

Isole Eolie (Aeolian Islands)

2025 Conservation Outlook Assessment

SITE INFORMATION

Country: Italy

Inscribed in: 2000

Criteria: (viii)



The Aeolian Islands provide an outstanding record of volcanic island-building and destruction, and ongoing volcanic phenomena. Studied since at least the 18th century, the islands have provided the science of volcanology with examples of two types of eruption (Vulcanian and Strombolian) and thus have featured prominently in the education of geologists for more than 200 years. The site continues to enrich the field of volcanology. © UNESCO

SUMMARY

2025 Conservation Outlook

Finalised on 11 Oct 2025

GOOD WITH SOME CONCERNS

Although the current state of the geological values for which the WH site was inscribed is good and their condition is stable; considering that the Aeolian Islands are listed for criterion viii, highlighting “active volcanic processes”, eruptions and natural processes are seen as adding to the geological value and associated scientific interest in the site. At the same time, the eruptions may cause significant damage to buildings and infrastructure. There are significant concerns regarding the deteriorating state of the site's other important biodiversity values. These concerns are all the more noteworthy in light of the major threat of mass tourism, which has been compromising the conservation of the site's natural heritage since its inscription and threatening the islands' notable endemic species. The absence of a functioning management system to implement conservation measures is a major issue, compromising the site's future capacity to conserve its values.

FULL ASSESSMENT

Description of values

Values

World Heritage values

► **Outstanding volcanic phenomena**

Criterion:(viii)

The Aeolian archipelago is one of the most outstanding examples of volcanic island-building and destruction, and ongoing volcanic phenomena in the world (World Heritage Committee, 2000).

► **Geological processes**

Criterion:(viii)

The islands represent a rich field for volcanological studies of on-going geological processes in the development of landforms (World Heritage Committee, 2000).

► **Contribution to volcanology and geology**

Criterion:(viii)

The islands have provided two of the types of eruptions (Vulcanian and Strombolian) to the fields of volcanology and geology, and have featured prominently in the education of geoscientists for over 200 years (World Heritage Committee, 2000).

Other important biodiversity values

► **Wetlands**

Although most of the archipelago's wetlands have disappeared, there are two very significant – albeit small – and fragile wetland areas left, offering a key habitat for bird conservation. The Stagno di Punta Lingua saltlake on Salina and the marshland on the Isthmus on the island of Vulcano are the two main environments that offer an important stopover for migratory birds. In addition, the Punta Lingua swamp is populated by various halophytes, such as *Salsola sola*, *Suaeda vera*, *Atriplex prostrata*, as well as by a number of interesting luto-halobius invertebrates that can only be found on this site, like *Tachys dimidiatus*, *Tachyura parvula*, and *Colotes obsoletus* (Ministero dell'Ambiente, 2010). Stagno di Punta Lingua and the lagoon of Vulcano Isthmus represent the only examples of “coastal lagoon” occurring in the whole archipelago. The coastal lagoons are listed as priority habitat in the Annex of 43/02 92 EU Directive. In particular, the Isthmus of Vulcano Island is considered the most important area for birds within the Natura 2000 Site ITA030044, which covers the whole archipelago. Most of the recorded species are listed in the Annex of 147/09 EU Directive (Regione Siciliana, Assessorato Territorio e Ambiente, 2009; Lo Cascio, 2012).

► **Rich seabed**

The Aeolian archipelago's seabed is one of the best conserved and richest in the Mediterranean Basin. Among the species found are Cnidarians such as *Attinia equina*, *Condylactis aurantiaca*, and *Anemone suolcata*, as well as a number of interesting echinoderms such as the five-point starfish (*Echinaster sepositus*), *Ophioderma longicauda*, various species of urchins, brightly coloured gorgonians (*Paramuricea clavata*, *Eunicella cavolinii*, *Eunicella singularis*) and the spirograph *Spirographis spallanzanii*. However, the most interesting species populating the Aeolian seabed are seahorses (*Hippocampus hippocampus*), *Pinna nobilis* mollusks (the largest bivalves in the Mediterranean) and exceptional corals, including the extremely rare red coral (*Corallium rubrum*), and *Parazoanthus axinellae*, a Cnidarian similar to that forming barrier reefs (Ministero dell'Ambiente, 2010).

► **Unique evolution of natural environment linked to the volcanic nature of the islands**

The particular interaction between the biotic and abiotic systems that has occurred throughout the archipelago's evolution has provided a landscape and environment that are unique, comprising a multitude of geological, biological and anthropological elements; as islands, the Aeolians are an “ideal laboratory” for “studying the evolution of the central Mediterranean region's ecosystems and communities” (Ministero dell'Ambiente, 2010). The islands are also noteworthy for their endemic species (IUCN, 2000), which are inextricably linked to the volcanic nature and evolution of the islands (Ministero dell'Ambiente, 2010). The active volcanoes of Stromboli and Vulcano island host plant communities dominated by the endemic *Genista tyrrhena*, that acts as pioneer species on sandy volcanic soils.

► **Mediterranean island biodiversity**

These islands make an important contribution towards the conservation of biodiversity in the Mediterranean basin (IUCN, 2000). This value also alludes to the presence of continental European species reaching their southern limit of distribution (State Party of Italy, 1999), of regional and rare endemics and to the significant endemism that has evolved on these islands.

► **Protected bird species**

All of the islands are International Bird Areas (UNESCO and IUCN, 2007). 47 species of nesting birds protected nationally and internationally have been recorded (Ministero dell'Ambiente, 2010) including 10 under the Sicilian Red List of threatened bird species (Lo Cascio, 1999). The islands are an important stopover for migratory or wintering birds, specifically for more than 260 species. Approximately 50% of the Italian ornithological fauna passes through this archipelago (Ministero dell'Ambiente, 2010; Regione Siciliana, Assessorato Territorio e Ambiente, 2009; an updated list is given by Massa et al., 2015). Recent surveys performed according to the European Marine Strategy Framework Directive (MSFD 2008/56/CE) allow to discover the occurrence of some breeding populations of Yelkouan and Scopoli's shearwater and of Mediterranean Storm petrel, especially on the pristine coastal rocky habitats and islets of the archipelago (IUCN Consultation, 2025).

► **Endemic and threatened flora**

900 plant species have been recorded in the Aeolian Islands, including many endemic species (Pasta, 1999). This accounts for almost 17% of all Italian flora despite that the archipelago only represents 0.038% of Italy's surface area. While there are fewer endemic plants than on other island ecosystems, the exclusive Aeolian endemics are extremely interesting from the ecological and biogeographical perspectives and many are included in the protected lists of international conventions, such as CITES, Berne Convention, and the EU Habitats Directive. The islands are home to unique endangered species, such as *Silene hicesiae*, considered by IUCN as one of the fifty most threatened species of Mediterranean flora and categorized as critically endangered (Ministero dell'Ambiente, 2010), or the palaeo-endemic *Cytisus aeolicus*, currently occurring on the islands Stromboli, Vulcano and Alicudi. The endemics of the Aeolian Islands also include the newly described (or taxonomically revalued) *Bituminaria basaltica*, *Erysimum brulloi*, *Anthemis aeolica* and *Genista tyrrhena*. *Bituminaria basaltica*, *Erysimum brulloi* and *Anthemis aeolica* are strictly endemic to one island only: Filicudi, Alicudi and Lisca Bianca islet (off Panarea island) respectively (Ferro, 2009; Minissale et al., 2013; Brullo et al., 2016).

► **Important mammals**

Mammals include one endemic subspecies of the extremely rare garden dormouse (*Eliomys quercinus liparensis*), however, it has not been observed since the 1990s and probably became extinct on the Island of Lipari. Seven species of bat have been reported (Lo Cascio, 1999), including one on the IUCN Red List (Ministero dell'Ambiente, 2010). Concerning non-cetacean marine mammals, recent records of Mediterranean Monk seal *Monachus monachus* suggest an increase of the frequentation of Aeolian seas from this species, that historically was known for some islands (Mo et al., 2023).

► **Newly discovered and endemic reptiles**

Seven species of reptiles are present in the archipelago, including the threatened endemic Aeolian wall lizard (*Podarcis raffonei*) (UNESCO and IUCN, 2007).

► **Endemic invertebrates**

Invertebrate fauna seems relatively well known, with many endemic species described (Lo Cascio, 1999), some of them discovered just recently (for an updated list see Muscarella and Baragona, 2017 and Lo Cascio et al., 2022), although it is quite likely that there are still endemic insects to be identified (Ministero dell'Ambiente, 2010). Especially among beetles there are also several species of biogeographic interest (Lo Cascio et al., 2022).

► Seagrass beds

The limited sandy seabed found in this volcanic archipelago is populated by large meadows of *Posidonia oceanica* seagrass, serving as nursing grounds for numerous marine species (Ministero dell'Ambiente, 2010).

► Important fish species

The specific conditions of the Aeolian marine environment allow for the extensive growth of both pelagic microalgae and underwater vegetation, thereby ensuring the settlement of a large amount of plankton and benthic species while providing nurseries for numerous fish including those of commercial value. For example, there are 37 species of teleostei, the coastal fish group which includes the Dusky Grouper (*Epinephelus marginatus*), a rare species. Moving away from the coast, where the waters are deeper, there are a large number of fish that are rare in other areas such as amberjacks (*Seriola dumerili*), mackerels (*Lichia amia*), mahi-mahi (*Coyphaena hippurus*), tuna fish (*Thunnus thynnus*), and sword fish (*Xiphias gladius*) (Ministero dell'Ambiente, 2010).

► Important and rare cetaceans

Five species of cetaceans have been recorded in Aeolian waters, including common whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), as well as bottlenose dolphin (*Tursiops truncatus*), and striped dolphin (*Stenella coeruleoalba*). In addition, there have been a few sightings of the common dolphin (*Delphinus delphis*) which, despite its name is actually considered very rare, and Risso's dolphin (*Grampus griseus*) (Ministero dell'Ambiente, 2010).

Assessment information

Threats

Current Threats

High Threat

From the narrow view of the geological values for which the site was inscribed there are no high threats, except indirectly by mass tourism, infrastructure development and possibly landslides. However, since the Aeolian Islands World Heritage site is listed for criterion viii, highlighting “active volcanic processes”, eruptions and natural processes are seen as adding to the geological value and associated scientific interest in the site. At the same time, the eruptions may cause significant damage to buildings and infrastructure. In contrast, the other important biodiversity values of the site, although not part of the site's Outstanding Universal Value, are being seriously affected by a number of threats, namely mass tourism, air and maritime traffic, unsustainable fishing, pollution, invasive species, fires and erosion. These threats are all the more significant considering the evolution of several endemic species on these isolated volcanic islands. This isolation also makes the site highly vulnerable to any anthropogenic changes.

► Fishing, Harvesting & Controlling Aquatic Species

High Threat

(Fishing and trawling)

Outside site

Other targeted species names

Red coral (*Corallium rubrum*), bottlenose dolphin (*Tursiops truncatus*), sperm whale (*Physeter macrocephalus*), loggerhead sea turtle (*Caretta caretta*), Mediterranean shearwater (*Puffinus yelkouan*)

Fishing is mostly small-scale and artisanal, however, some illegal practices are being implemented by using fishing aggregating devices (FAD). These devices are a threat to cetaceans and sea turtles, which

are often caught in them as well as in fishing nets and hooks (Blasi and Mattei, 2017; Leone et al., 2019; Sechi et al., 2023). During the last years, the cases of cetaceans killed by illegal nets in the Aeolian sea have increased. Two sperm whales (*Physeter microcephalus*) were found trapped in these nets only during July 2020 (IUCN Consultation, 2020a; Sea Shepherd Global, 2020). Fishing is also significantly reducing the population of the protected deep-sea coral *Corallium rubrum*. Trawling activities affect numerous benthic species such as the protected bivalve *Pinna nobilis*. There is a certain risk of overfishing (which is a threat not only for target species, but also for their predators, such as cetaceans and shearwaters), mainly due to an absence of a marine protected areas, which does not allow defining the restocking areas needed to compensate for fishing pressure (Ministero dell'Ambiente, 2010; IUCN Consultation, 2014; Ruta, 2017). Although the Law 244/2007 designated all the islands and the marine area as a National Park (terrestrial and marine), it is not known why this protected area has not been effectively established (IUCN Consultation, 2020a). Research has been conducted to support the designation of a Marine Protected Area at the Aeolian Islands (Álvarez et al., 2019), which would in part respond to this threat, but the process for its establishment still seems in pause (Notiziario Eolie, 2024). According to local news, following a participatory process started in 2021, the three local municipalities of the Island of Salina approved the resolution to establish a Marine Protected Area of Salina (Giornale di Sicilia, 2024a; Il Corriere, 2024; Altreconomia, 2024). The process of its establishment is ongoing and local stakeholders hope it will lead to the extension to the rest of the archipelago.

► **Shipping Lanes**

(Maritime traffic)

High Threat

Outside site

There is significant (although heavily seasonal) maritime traffic which, despite being outside the World Heritage site, negatively impacts some bird species, such as the European storm petrel (*Hydrobates pelagicus*), the Scopoli's shearwater (*Calonectris diomedea*) and the Eleonora's falcon (*Falco eleonora*). Boat and vessel traffic reach the maximum intensity during the breeding season in the proximity of the only two reproductive sites of *Hydrobates pelagicus* so far detected in the Aeolian Islands, and especially one of them seems to be seriously threatened by direct and indirect human disturbance (Ministero dell'Ambiente, 2010; Lo Cascio, 2016). Maritime traffic also directly affect several species of cetaceans and the loggerhead sea turtle (*Caretta caretta*) by collision with vessels (Blasi and Mattei, 2017, Leone et al., 2019).

► **Roads, Trails & Railroads**

(Road infrastructure)

Low Threat

Inside site, scattered(5-15%)

Habitat fragmentation by roads occurs mainly on the islands of Salina, Vulcano and Lipari, where these infrastructures overlap with ecologically sensitive areas. The consequent habitat loss and associated disturbances (sound, light and chemical pollution) are adversely affecting numerous protected species, including endemic invertebrates and plants (Ministero dell'Ambiente, 2010). Recent studies have shown that infrastructure such as roads facilitate the spreading of the invasive Italian wall lizard (*Podarcis siculus*), which is already common on Vulcano Island, successfully outcompeting and hybridizing with the Aeolian wall lizard (D'Amico et al., 2018).

► **Fire & Fire Management**

(Fires)

High Threat

Inside site, scattered(5-15%)

The incidence of fires during the last years in Lipari has reached worrying proportions: just in July 2017, more than 15% of the island surface was destroyed by arsons (Il Giornale di Lipari, 2017b; Notiziario Eolie, 2017). In 2019, a fire destroyed most part of the northern slope of Lipari Island, including the old landfill that was closed in 2007, but never reclaimed. That produced significant pollution in a wide area (Monte Pilato, Monte Chirica) inside the World Heritage site boundaries, with the risk of dioxin contamination (IUCN Consultation, 2020a). On the other hand, fires on Stromboli are mostly due to volcanic activity (Ministero dell'Ambiente, 2010), such as Stromboli eruption in 2019 which caused a fire damaging up to 39% of the total area of the island (Turchi et al., 2020). However, in May 2022, due to recklessness during the filming of a television drama, the island of Stromboli suffered a severe arson that burned almost half of the vegetated area of Stromboli. The fire partly damaged the local natural reserve "Riserva Naturale Orientata Isola di Stromboli e Strombolicchio", which lies within WH site boundaries and Natura 2000 site

(ITA030026) boundaries (Copernicus, 2022; Guarino et al., 2024). Fires are threatening bird species such as the protected Dartford's warbler (*Sylvia undata*), Cetti's warbler (*Cettia cetti*), the tortoise *Testudo hermanni*, and the extremely rare garden dormouse (*Eliomys quercinus liparensis*) (nowadays considered extinct, see Lo Cascio, 2017), but also a not measurable number of endemic invertebrates and many other species of fauna. Fires are also threatening the few island forests and the xeric grasslands that are identified as priority habitat (6220) in the Habitat Directive 43/92/EU (Ministero dell'Ambiente, 2010). Fires also accelerate the erosion of the slopes and the instability of the terraces, determining a strong impact on the structure of the semi-natural landscapes.

These impacts were detectable in Stromboli's fire in May 2022. The fire considerably damaged the native plant communities, hosting many species of high biogeographic interest, such as *Cytisus aeolicus*, one of the rarest and most emblematic endemic plant species of the Aeolian archipelago (Vettore et al., 2024; Zaia et al., 2020), in favour of perennial grass of alien origin (*Saccharum biflorum*) that instead showed a very high vegetative performance after burning (Guarino et al., 2024). This event had also devastating consequences for the inhabitants and infrastructures on the island. Furthermore, in August 2022 due to the reduced hydro-geological stability caused by the fire, the occurrence of an extreme rainfall event induced extensive sliding and debris flow also affecting the island's villages (Vettore et al. 2024).

The Regional Forestry Police, responsible for surveillance, is only present on Lipari during summer, and is lacking for most part of the year (IUCN Consultation, 2020a). It is therefore difficult to contain the phenomenon of intentional fires, in most part of the cases presumably caused by illegal hunters (IUCN Consultation, 2017).

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| <p>► Invasive / Other Problematic Species, Genes & Pathogens,
 Invasive Non-Native/ Alien Species
 <i>(Introduction of non-native species)</i>
 Invasive/problematic species
 Paraserianthes lophantha
 Podarcis siculus
 Other invasive species names
 Acacia sp., Eucalyptus sp., Hottentot fig (Carpobrotus edulis), western whip snake (Hierophis viridiflavus), domestic dogs and cats</p> | <p>High Threat
 Inside site, throughout(>50%)
 Outside site</p> |
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Quite a few of the reforestation projects on the islands have made use of non-native species, such as acacia and eucalyptus, negatively affecting the growth of autochthonous populations. In addition, some invasive species such as eucalyptus make an already acidic soil even more acidic, preventing the growth of native species. Another problem concerns the invasive plant *Carpobrotus edulis*, which recently seems to have extended its distribution on coastal habitats (for instance, on Vulcano Island). Recently, the expansion of other invasive plants, such as the Cape wattle (*Paraserianthes lophantha*) has been observed (Lo Cascio, 2017). Especially exposed to exotic invasive species are the endemic species living on islands which, due to their geographical isolation, have no escape routes when a non-native species appears in their territory taking over their ecological niche. This is the well-known case of the Italian wall lizard (*Podarcis siculus*) that, once settled on the Aeolian Archipelago, caused the almost total extinction of the endemic Aeolian wall lizard (*Podarcis raffoneae*) (D'Amico et al., 2018). The last populations of Aeolian wall lizards survive, paradoxically, precisely because of their extreme isolation, entrenched in some rocks and stacks that have not yet been reached by its competitor, but suffer a severely impoverished genetic diversity (Ministero dell'Ambiente, 2010; Salvi, 2023). The last population on Vulcano Island (the only main island still inhabited by the species) has perhaps recently been extinct and now Aeolian wall lizards occurs only on three tiny islets and a promontory of Vulcano Island (Lo Cascio and Ficetola, 2016; D'Amico et al., 2018; Salvi 2023). Some introduced predators probably contributed to the extinction of the Aeolian wall lizard on the main islands of this archipelago, still having potential impacts on the last individuals on Vulcano Islands. For example, the western whip snake (*Hierophis viridiflavus*) is an introduced snake on the Aeolian Islands (Avella et al., 2017), and domestic/feral cats and dogs are common on the main islands (additionally establishing a reservoir for some parasite species potentially affecting humans: Brianti et al., 2017; Greco et al., 2019; Otranto et al., 2017).

► **Water-borne & other effluent Pollution**

Low Threat

(Marine pollution, heavy metals and groundwater pollution)

Outside site

Marine pollution and, in particular, oil slicks and micro-plastic particles, are threatening the Storm-petrel (*Hydrobates pelagicus*), the rare Mediterranean shearwater (*Puffinus yelkouan*), the Scopoli's Shearwater (*Calonectris diomedea*) and several marine organisms, such as the fan mussel (*Pinna nobilis*) and the loggerhead sea turtle (*Caretta caretta*). The quality of subterranean waters throughout the islands is also jeopardized by the uncontrolled use of herbicides in agriculture as well as by organic pollution from sites used for the dumping of solid urban waste. Although these sites are no longer used, they have not witnessed any restoration projects. This, coupled with the high permeability of the volcanic terrain, which permits extensive percolation and leaching, has led to groundwater pollution (Ministero dell'Ambiente, 2010; Renzi et al., 2018, 2020).

For most of the Aeolian islands there seems to be no wastewater treatment system, and it is therefore assumed that the discharges are poured directly into the sea. Sewage treatment systems exist for the islands of Lipari and Vulcano but information about them remain mostly incomplete (Isole sostenibili, 2020). Concerns remain regarding the condition of the sewage treatment on Lipari Island, as the previous infrastructure was considered dated and replaced with a new plant (2012) that, however, has not yet been taken into operation. It remains uncertain whether the sewage of Lipari is adequately treated or released into the sea without any, or only after partial, treatment. It has not been possible to obtain documentation or reliable information from the public offices of the Municipality in order to verify the situation. This has significant implications for the marine fauna and flora, but also for the level of quality of the seawater. It should also be noted that the uncertainty regarding the effectiveness of sewage treatment does not allow to establish whether this should be considered a Low or High Threat (IUCN Consultation, 2020a).

► **Recreational Activities**

Very High Threat

(Mass tourism in high season)

Inside site, extent of threat not known

Mass tourism has been the answer for local communities seeking economic growth (Ministero dell'Ambiente, 2010), and it still seems to be the only type of tourism encouraged by local tourist operators (IUCN Consultation, 2013a). Tourism is highly seasonal (Ministero dell'Ambiente, 2010), notwithstanding the promising push in 2007 in support of de-seasonalizing of the industry, which was supported by many local stakeholders (UNESCO and IUCN, 2007). In fact, everything is geared towards a summer seaside tourism comprised of brief visits, intensive consumption and exploitation of resources with a high environmental impact (IUCN Consultation, 2013a). Except for Salina, where the walks within the Natural Reserve are already easily accessible and well indicated, a better management of several old trails existing in the islands and promotion of a new local identity through the National Park proposed in 2007 may instead help de-seasonalize tourism. The increasing number of tourists and their lack of environmental sensitivity is a high threat to the delicate ecological balance of the islands, as well as to specific species such as Eleonora's Falcon (*Falco eleonora*) (Ministero dell'Ambiente, 2010), as revealed by the recent decline of the colony on Salina Island. Also, the occurrence of excessive nautical tourism (for instance, in the Pollara Bay, Salina Island) represents the main threat that affects the reproductive success of the local population of Mediterranean storm petrel (*Hydrobates pelagicus*) (Lo Cascio, 2016). Uncontrolled tourism has led to the re-settlement of people on some islands, such as Vulcano and, in some areas, the population doubles in the summer, such as in the Malfa municipality on the island of Salina (Ministero dell'Ambiente, 2010; Corso et al., 2009). Smaller islands lack the necessary regulations to manage the daily influx of tourists (IUCN Consultation, 2013b). In other cases, legislation exists but is not enforced. For example, the protected Strombolicchio Reserve receives daily visits from unauthorized tourists who are unaware of the fragility of the islet's ecosystems and who consequently threaten its endemic species (IUCN Consultation, 2013a; Ministero dell'Ambiente, 2010). Additionally, the large seagrass meadows of *Posidonia oceanica*, which are already limited to a few areas of sandy seabed, have been severely impoverished over the last few decades due to excessive and uncontrolled anchoring by tourist boats (Ministero dell'Ambiente, 2010).

► **Water-borne & other effluent Pollution**

High Threat

(Sewage treatment plant)

Inside site, localised(<5%)

A new sewage treatment plant for Vulcano Island was built on the slopes of the active La Fossa crater in 2012, and despite it should come into operation in 2020 (Isole Sostenibili, 2020), it is still inactive. The new plant dramatically disrupts the natural geometry and morphology of the valley formed by pyroclastic and sand deposits at the base of the crater. Also, a water pump belonging to this plant was built a short distance from the coastal lagoon of the Isthmus (priority habitat of 43/92/EU directive, code 1150). The Isthmus pump represents a remarkable threat for several bird species included in 147/09/EU directive and for the whole integrity of the Natura 2000 Site ITA030044 (IUCN Consultation, 2014). The sewage treatment infrastructure is very close to the last population of Aeolian wall lizard (*Podarcis raffonei*) inhabiting Vulcano Island (on Capo Grosso Promontory), and recent studies have shown that human activities facilitate the spreading of the Italian wall lizard (*Podarcis siculus*), which is already common in the area, successfully outcompeting with the Aeolian wall lizard (D'Amico et al., 2018; Ficetola et al., 2021).

► **Geological Events**

Low Threat

(Landslides)

Inside site, scattered(5-15%)

Outside site

Landslides on the Aeolian Islands can occur due to volcanic activity (Baena et al., 2019; Di Traglia et al., 2018; Gamberi et al., 2024), and they can cause tsunamis (Fornaciai et al., 2019; Macias et al., 2018; Gamberi et al., 2024). These events can be a threat for endemic plants and invertebrates inhabiting the islands' slopes, to protected seabirds and raptors nesting on cliffs and islets, and for the Critically Endangered Aeolian wall lizard, which nowadays is inhabiting mostly small islets (D'Amico et al., 2018). On Vulcano, landslides can also threaten specific slopes of the volcanic structure (Ministero dell'Ambiente, 2010).

► **Water-borne & other effluent Pollution**

Low Threat

(Algal blooms during periods of peak tourism)

Outside site

Non-toxic algal blooms are common in the summer months when the pressures of tourism are highest, breaking the ecological balance of marine ecosystems (Ministero dell'Ambiente, 2010).

► **Garbage & Solid Waste**

Low Threat

(Illegal dumping of waste and open landfills)

Inside site, widespread(15-50%)

Waste (from building materials, abandoned cars and construction machinery) is filling up a vast volcanic beach on Stromboli (IUCN Consultation, 2013a). On Lipari, the Vallone fiume Bianco riverbed is still used as an illegal dumping ground for old cars, refuse from an olive oil press and other garbage (Ministero dell'Ambiente, 2010). Open landfills are also a threat to local bird species, although decreasingly so due to the closure and decommissioning of public landfills (Ministero dell'Ambiente, 2010). Illegal landfills continue playing a role as sources for the dispersal of several nitrophilous and/or ruderal alien and invasive plants, such as *Paraserianthes lophanta* and *Carpobrotus* sp. (Lo Cascio, 2017; Giornale di Sicilia, 2024b).

► **Water-borne & other effluent Pollution, Air-borne Pollutants**

Low Threat

(Use of pesticides and herbicides)

Inside site, scattered(5-15%)

Outside site

Numerous protected species living on the Aeolian Islands are threatened by the use of pesticides and herbicides, such as the Eleonora's Falcon (*Falco eleonora*) and many other protected bird species. Of particular concern are chlorine-based pesticides, which are particularly dangerous to the Aeolian birds of prey as they are the most susceptible to the negative effects of bio-accumulation (Ministero dell'Ambiente, 2010). During recent years, a gradual decline was also detected for many invertebrate species within the surrounding areas near to vineyards and cultivated fields, that could be due to the widespread use of pesticides and herbicides in local agriculture (IUCN Consultation, 2025).

► **Earth & Sediment Management, Removing/Reducing Human Management**

High Threat

(Significant erosion, especially at the abandoned quarry mine)

Inside site, scattered(5-15%)

In recent decades, most of the islands have suffered the consequences of agricultural abandonment, which have increased erosion and caused geological instability. The cessation of cultivation activities has led to the progressive deterioration of slopes, which had been previously modified through water channelling, furrowing, terracing, and the construction of dry stone walls. In some islands, such as Filicudi, Alicudi, Panarea, Salina, terraced landscapes cover between 50% and 70% of the island surface (Barbera et al., 2009). In the terraces, vegetation structure may differ in relation to the age of abandonment of the agricultural use, and often there is interesting shrub formations (with *Erica arborea*, *Arbutus unedo* and other woody species). The progressive erosion of dry stonewalls may determine strong changes in the whole landscape structure with dramatic consequences for the local biodiversity, but this issue has not yet claimed the attention from local municipalities and/or protected area managers. These uncultivated areas only have thin vegetation coverage, leading to widespread runoff and a consequent increase in the loss of useful surface soil (Ministero dell'Ambiente, 2010). Another case concerns the northeastern part of Lipari, where the progressive stripping of land has been aggravated by extensive pumice stone extraction (Ministero dell'Ambiente, 2010). Illegal pumice stone extraction activities have still occurred, namely in the Vallone bianco locality of Lipari where activities falling in an area subject to landscape and environmental constraints have been documented from 2019 until July 2023 (Tempostretto, 2024). Currently, Lipari's abandoned quarry and its old mining spoil banks are suffering serious erosion problems, threatening the area's hydrogeological balance (IUCN Consultation, 2013b). This hydrogeological instability is creating serious safety hazards, especially given that even basic security measures have not yet been employed (Legambiente, 2011). The integrity of the geological values that merited inscription on the World Heritage list does not seem to be threatened (IUCN Consultation, 2013b), although it would be interesting to understand whether there is a risk of crater instability in Monte Pelato as alluded to by the State of Conservation report in 2006 (UNESCO, 2006). There are considerations of a pumice geomineral park (Municipality of Lipari, 2018). Between 2015 and 2017, the Municipality of Lipari involved the University of Milan (Politecnico) in a session of preliminary projects to design a future for the area of pumice quarries (PGP, 2017; Il Giornale di Lipari, 2017a). However, after the presentation of results in 2018, nothing seems to have happened (IUCN Consultation, 2020a). Although the plan is only conceptual, it may pose a pathway towards improving conditions at other abandoned mines. The bankruptcy trustee of Pumex S.p.A. is selling ferrous material from the quarries to cover the company's debt. In 2021, the Sicilian regional administration took steps forward for the redevelopment of Campo Bianco - Porticello area as a geosite and "Museum of the pumice", as previously suggested by IUCN. However, the proposal of the Sicilian region to acquire the area did not materialize and the historical and ethno-anthropological constraint was judged lawless in 2022 by the Sicilian Administrative Court (TAR) (Vettore et al., 2024). In 2024, procedures for the purchase of the former Pumice quarries of Pumex by the private company "Mt Project srl" have been initiated (QdS, 2024). That risks nullifying the possibility of using the existent structures in view of a future geo-mineral park. At the same time, part of the coastal belt of pumice quarries are now used as summer "lido" for local entertainment during the tourist season (IUCN Consultation, 2020a). Another old abandoned quarry, that of caolino (on the northwestern side of Lipari Island), was purchased in 2018 by the winery Tenuta di Castellaro. The new ownership organizes a private (but freely accessible) geomineral park without public financial support.

► **Atmospheric & Space Activities**

(Air traffic)

High Threat

Inside site, scattered(5-15%)

Outside site

Despite the ban on helicopter flying over the Natura 2000 sites of the Aeolian Islands, in force under the regulations of the Natural Reserves (RNO) of Alicudi, Filicudi, Panarea, Salina and Stromboli (D.A. n° 484 of 25/07/1997, D.A. n° 485 of 25/07/1997, D.A. n° 483 of 25/07/1997, D.A. n° 87 of 14/03/1987 and D.A. n° 819 of 20/11/1997) and reiterated by the Regional Council of Territory and Environment (Assessorato regionale Territorio e Ambiente) with the note n° 64408 of 28/08/2009, helicopter flights continue in absence of any effective control. The local company "Air Panarea" has now increased the flights by using more than one helicopter. A pragmatic solution, in absence of any control, could be to design special flight corridors that allow to approach the island from the other side (east) instead of the current approach (from the uninhabited cliffs of the western slopes), in order to minimize the impact on bird colonies (IUCN Consultation, 2020a). The reproductive season of the Eleonora's falcon (*Falco eleonora*) coincides with the peak of flights (summer). A decline of the Panarea population of this species and a

strong reduction of the number of breeding pairs has been documented during the last decade (Corso and Gustin, 2009; Massa et al., 2015; Lo Cascio, 2016; Il Giornale di Lipari, 2015; Mount City, 2015; Gruppo d'Intervento Giuridico onlus, 2011), and confirmed from more recent data (IUCN Consultation, 2020a). Some pairs, probably belonging to this population, have been observed to use the adjacent islet of Basiluzzo as nesting site (IUCN Consultation, 2020a). The same concerns other islets where nesting pairs have been found during recent years (Lo Cascio & Massa, 2023)

Potential Threats

Low Threat

The overall assessment of potential threats is seen as low, as there are currently no potential threats affecting the geological values for which the site was inscribed. The Lipari touristic port enlargement project, suspended in 2010 but with a revision of the project announced in 2016, currently seems to have been abandoned. Instead, an enlargement of the commercial port of Lipari with uncertain environmental impacts is ongoing. Also, the project for the enlargement of Rinella port on Salina Island has been approved despite the new environmental constraints. There are indications that this could affect important biodiversity values and cause destruction of marine habitats including one of the most representative example of Posidonia seagrass beds of the archipelago. Both biodiversity and cultural values of the site are potentially threatened by climate change due to the rising sea level and associated flooding and erosion events. Another potential threat to the biodiversity of this site comes from the increase in microplastic pollution in the marine environment, also affecting beaches and terrestrial environments.

► Shipping Lanes

Data Deficient

(Proposed enlargement of the Lipari port)

Outside site

The Lipari port enlargement continues to be a highly controversial topic, notwithstanding the Regional government's suspension of the proposed project in 2010 (Legambiente, 2011). In fact, it seems to still be a very real possibility with a potentially large environmental impact on the island (IUCN Consultation, 2013b). The private company, Società Condotte d'Acqua, which would carry out the port enlargement has huge economic interests in the port's enlargement and has lobbied to obtain the local government's backing (Legambiente, 2011). Although the World Heritage Committee (2007) recommended an Environmental Impact Assessment for the Lipari port enlargement, this was never provided by the State Party. In 2008, it was recognized that the port enlargement would have a significant impact and would be more than what is necessary on the island (State Party of Italy, 2008). According to Section 3.9 of the joint UNESCO-IUCN reactive monitoring mission report, port development was also not regulated by the Landscape Territorial Plan or by any other regulatory framework (UNESCO and IUCN, 2007). Therefore, the same concerns expressed during the reactive monitoring mission are valid today: is the intention still to bring in large cruise ships, and what are the indirect effects of port enlargement on the World Heritage site, such as a significant increase in tourists.

Currently the project of enlargement of the Lipari port through a private intervention seem to have been abandoned by the local Municipality (IUCN Consultation, 2020a). Instead, there is a definitive project for the enlargement of Rinella port on Salina Island, with possibly significant destruction of marine habitats including one of the most representative example of Posidonia seagrass beds of the archipelago (Legambiente Sicilia, 2019; Il Mattino di Sicilia, 2019). The project obtained a positive assessment by the Regional Environmental commission claiming the public need to ensure territorial mobility. Despite the Natura 2000 site ITA030041 extension also to the port area (in 2020), the implementation works of the project received a positive assessment by the Ministry for Environment in 2021 (Decree No. 527; Ministero dell'Ambiente e della Transizione Energetica, 2021).

In 2023, in Lipari a project to enlarge the dock of the commercial Port of Lipari "Sottomonastero" with the aim of promoting small-scale fisheries, with uncertain potential environmental impacts (GIOSA SRL, 2022), has been also approved and the works should be concluded by the end of 2024 (Regione Siciliana, 2023; Giornale di Sicilia, 2024c)

► Garbage & Solid Waste

Low Threat

(Microplastics polluting beaches)

Inside site, scattered(5-15%)

Outside site

Micro-plastic pollution is increasingly pervasive in the marine environment, and has adversely affected beaches in the Mediterranean, including sandy beaches on Lipari, Vulcano, Salina, Panarea, and Stromboli (Sabatino et al., 2024)

► **Changes in Precipitation & Hydrological Regime**

(Rising Sea Level)

High Threat

Inside site, extent of threat not known

Outside site

The combination of phenomena such as sea level rise induced by global warming and subsidence related to the intense seismic and volcanic activity has as its ultimate consequence the gradual but continuous shoreline retreat of the archipelago's coastline (Romagnoli et al., 2022; Anzidei et al., 2018). Clear signs of the phenomenon of coastal retreat are evidenced by the current and potential disappearance of beaches (e.g. the beach of Baia Portinenti in Lipari), and the progressive submergence of important archaeological and cultural heritage sites located along the coasts of Liparia, such as maritime works from the Roman period Sottomonastero port of Lipari and the Basiluzzo landing quay, now submerged at depths of about 9 and 3 meters, respectively. In Lipari the sea level increase expected by the end of the century may reach as much as 1.6 meters (UIPA, 2019). This suggests including Lipari at risk from coastal hazard due to sea level rise and points to the need for proper future management (Romagnoli et al., 2022).

Overall assessment of threats

Low Threat

From the narrow view of the geological values for which the site was inscribed there are no major threats to the property. However, other important biodiversity values of the site are being seriously affected by a number of threats, namely mass tourism, air and maritime traffic, unsustainable fishing, pollution, invasive species, fires, erosion and climate change. These threats are all the more significant considering the many threatened endemic species inhabiting this archipelago of isolated volcanic islands. This isolation also makes the site highly vulnerable to any anthropogenic changes. Although the Lipari port enlargement project currently seems to have been abandoned, other proposals for ports have been carried forward. The environmental long-term impacts of the project to enlarge the commercial port of Lipari are unclear and the ongoing project to enlarge the Rinella port on Salina Island could cause destruction of marine habitats including one of the most representative example of Posidonia seagrass beds of the archipelago.

Protection and management

Assessing Protection and Management

► **Involvement of stakeholders and rightsholders, including indigenous peoples and local communities, in decision-making processes**

Some Concern

Given the absence of a management entity and the lack of awareness within the local population relative to the World Heritage site [refer to section on "Education and interpretation programs"], participatory approaches are very limited if not non-existent. In fact, there seems to be a general lack of communication with local stakeholders, and local sustainable initiatives are not encouraged (IUCN Consultation, 2013b). There are also direct references to the difficult relations between local populations and the organizations managing protected areas. For example, local stakeholders have appealed the creation of a new Regional Nature Reserve on the island of Vulcano (Ministero dell'Ambiente, 2010). Similarly, the creation of a NP for the Aeolian archipelago was opposed locally partly due to a lack of stakeholder involvement (Legambiente, 2011; IUCN Consultation, 2013b). In addition, although the management plan for the site is thorough and comprehensive, it is not clear how involved local stakeholders were in its creation. Furthermore, traditional knowledge regarding the use of natural resources (local craftwork, medicinal plants) is disappearing across the islands (Ministero dell'Ambiente,

2010), making it all the more important to tap into this know-how before it is lost. However, there are also positive examples of participatory approach, such as in the establishment of a MPA in Salina: following a participatory process started in 2021, the three local municipalities of the Island of Salina approved the resolution to establish a MPA of Salina (Giornale di Sicilia, 2024; Il Corriere, 2024; Altreconomia, 2024).

► **Legal framework**

Some Concern

From a legal perspective, a significant portion of the Aeolian archipelago's terrestrial surface is protected, enough to guarantee appropriate protection from anthropogenic pressures. All of the islands are partially or totally included in the World Heritage site, and have a portion of their surface area designated as a Site of Community Interest (SCI) under the European Union's (EU) Habitats Directive. In addition, the entire archipelago (both land and sea) is protected as a Special Protection Area (SPA) under the EU Birds Directive (Ministero dell'Ambiente, 2010). Although the World Heritage site lacks a coordinated management system and entity (see "Management System"), the legal constraints imposed by the Natura 2000 network (SCI and SPA) seem to be granting the area sufficient protection (IUCN Consultation, 2013b). Nevertheless, there are several ecologically important areas that lack protection. For example, the Scoglio Faraglione, located on the island of Salina in the middle of one of the most popular bays in the area (Pollara), does not have any protection status notwithstanding the fact that it hosts several species protected by European regulations (Ministero dell'Ambiente, 2010). There is also serious concern regarding the smaller islets, which lack regulations to manage the daily access of tourists (IUCN Consultation, 2013a). On the other hand, some areas have an adequate legal framework but lack implementation measures, resources or the necessary monitoring activities to ensure appropriate protection. The whole Natural Reserve of Strombolicchio also lacks any form of control and protection due to its geographical isolation and to the inadequate resources of its management authority. The islet is in a state of semi-abandonment, which is a significant threat given the extreme ecological fragility of the site and its very high naturalistic and biological value (Ministero dell'Ambiente, 2010). Regulations actually prohibit access to the islet (except for scientific reasons) due to its status as an "integral reserve", but there are no active measures in place to enforce this (IUCN Consultation, 2013a). In fact, concerns regarding the non-implementation of protection measures on some islands were already expressed in the 2007 joint UNESCO-IUCN reactive monitoring mission report (UNESCO and IUCN, 2007).

► **Governance arrangements**

Serious Concern

Given the absence of an effective management of the World Heritage site, the governance arrangements for the site remain unclear, as well as the roles and responsibilities for implementation. Supposedly, the municipality of Lipari reported to the Ministry of the Environment and Energy Security, but the wanted steering committee composed by mayors of the municipalities of the islands and the nomination of a technical-scientific committee has not been formalized yet (Vettore et al. 2024). The governance and decision-making mechanisms remain therefore unclear and opportunities for stakeholders and rightsholders to participate in the planning process very limited.

► **Integration into local, regional and national planning systems (including sea/landscape connectivity)**

Some Concern

In 2007, the Landscape Territorial Plan for the Aeolian Islands (Piano Territoriale Paesistico delle Isole Eolie) was the main guidance mechanism for the protection of all the archipelago and had been effectively implemented since 2004 (UNESCO and IUCN, 2007; UNESCO, 2007). At the time, the two responsible agencies (the Regional Authority for Cultural Heritage and the Regional Authority for Territory and Environment) were well-coordinated, even though this had not always been the case (UNESCO and IUCN, 2007). More information is needed regarding its current application and effectiveness, as well as whether or not it has been improved or weakened given that it was due for revision in 2007 (UNESCO and IUCN, 2007). At the regional level, there is also a Master Plan Agreement for the Minor Islands (Isole Minori), which in theory plays a coordination role on all issues affecting Sicily's islands (Ministero dell'Ambiente, 2010; UNESCO and IUCN, 2007), but the actual implications of this plan on the World Heritage site are not apparent. In 2013, the Regional Government approved the

Management Plan for the Natura 2000 sites of the Aeolian Islands (Piano di Gestione dei Siti Natura 2000 delle Isole Eolie), that includes an updated and detailed analysis of the biological and natural context and provides a list of conservation measures and actions in order to improve the natural values of the islands (D.D.G. n° 120 of 08/03/2013). Similarly, it is unclear how well-integrated national, regional and local policies are in Sicily, as the National Park for the Aeolian Islands was opposed locally (Legambiente, 2011; IUCN Consultation, 2013b). After a convention held in Panarea in August 2016, with the participation of the Italian Ministry of Environment, the Municipality of Lipari expressed the intention to evaluate the feasibility of establishing a Marine Protected Area (MPA) and to restart its institution process, which was provided by the Laws n° 979/1982 and n° 394/1991, but was suspended in the late 1990s and unaccomplished during the last 30 years. In September 2016, the Regional Authority for Territory and Environment declared that the MPA zonation would be ready after two months (November). However, no further actions and/or proposals have been submitted and the process seems to have stopped again (Il Giornale di Lipari, 2016). According to local news, following a participatory process started in 2021, the three local municipalities of the Island of Salina approved the resolution to establish a MPA of Salina (Giornale di Sicilia, 2024; Il Corriere, 2024; Altreconomia, 2024). The process of its establishment is ongoing and local stakeholders hope it will lead to the extension to the rest of the archipelago.

► **Boundaries**

Serious Concern

Fragmented protected areas, jagged borders, and weak buffer zones seem to be placing unnecessary pressures on the protected habitats that fall within the World Heritage site. Another factor limiting the effectiveness of the protected areas is their low perimeter/area ratio (Ministero dell'Ambiente, 2010).

► **Overlapping international designations**

Serious Concern

The World Heritage site fully overlaps with NATURA 2000 sites “Arcipelago delle Eolie” (ITA030044) and partially overlaps with NATURA 2000 sites “Isola di Filicudi” (ITA030024), Isole di Stromboli e Strombolicchio (ITA030026), “Isola di Vulcano” (ITA030027), “Isola di Salina (Monte Fossa delle Felci e dei Porri)” (ITA030028), “Isola di Salina (Stagno di Lingua)” (ITA030029) and “Isola di Lipari” (ITA030030). However, due to the lack of an effective management of the World Heritage site, no coordination appears between the overlapping internationally designated areas. To be noted that, in addition to NATURA 2000 overlap, the World Heritage site falls entirely within the boundaries of the Key Biodiversity Area and Important Bird and Biodiversity Area “Eolie islands” (site ID 2827), as it is also an important area for breeding *Calonectris diomedea* and falcons *Falco* sp.

► **Implementation of World Heritage Committee decisions and recommendations**

Serious Concern

The State Party has implemented only one out of nine recommendations issued by the World Heritage Committee in 2007 in its Decision 31COM 7B.24, which were based on the joint UNESCO-IUCN reactive monitoring mission of that same year. In 2010, the State Party confirmed that the quarries on the island of Lipari had been permanently closed on 31 August 2007 (UNESCO, 2010). In November 2008 the Catania Mining District inspected the area and confirmed the closure of the problematic PUMEX mine (State Party of Italy, 2009) and in 2010, this point was considered “comprehensively addressed” (UNESCO, 2010). The key limitations to fully implementing other recommendations are mainly related to the absence of a coherent and well-coordinated governance and to a lack of the necessary management instruments, including specifically earmarked funds (Ministero dell'Ambiente, 2010). It is worth noting that unclear management has always been an issue, as the initial nomination was deferred in 1999 on the basis that management issues had to be clarified (UNESCO and IUCN, 2007). In 2016, the Municipality of Lipari promoted collaborations with some Italian universities (especially with the Architecture Faculty of the Politecnico of Milan) in order to develop projects concerning the future of the whole former quarries area and its eventual rehabilitation (PGP, 2017; Il Giornale di Lipari, 2017a), but the project seems to have been abandoned. In 2024, a proposal to purchase the area of the former Porticello quarry was made by private individuals, with unclear purposes but likely aimed at creating a new hotel complex; negotiations are still ongoing. The purchase would definitively compromise the possibility of transforming the area into a geo-mining park, which is instead consistent with the

indications of the Management Plan of the Unesco Site. Also in 2024, the former Acquacalda quarry went to auction and was purchased by a private individual, who also obtained a permit to build a residential area. Construction work is expected to begin soon (IUCN Consultation, 2025).

► **Climate action**

Some Concern

The management plan lacks any climate action plan (Ministero dell'Ambiente, 2010). While no specific provisions seem to exist to monitor the effects of climate change and protect the site from negative impacts, the six islands municipalities have taken initiatives to start a clean energy transition. Since 2019 Salina island has been one of the six European islands designated “Eu Pilot Island,” and since 2023, along with the six islands in the municipality of Lipari, all of the Aeolian Islands have joined the “100% Renewable Energy Islands for 2030.” programme committing to drafting the Energy Transition Agenda, with the goal of achieving 100 percent renewable energy by 2030.

► **Management plan and overall management system**

Serious Concern

A detailed and comprehensive management plan was commissioned by the Regional Government and drafted in 2008 (IUCN Consultation, 2013b). It was deemed satisfactory by IUCN (UNESCO, 2007; World Heritage Committee, 2010; UNESCO, 2010) and a subsequent review, as per this assessment, came to a similar conclusion: the plan identifies the site's values, threats and objectives and goes into thorough detail on many aspects. However, concerns exist about whether this plan has been implemented at any level (IUCN Consultation, 2013b). In fact, the plan relies on a management structure that does not exist. It mentions that “the National Park of the Aeolian Islands [was] established through Law 244 dated 24 December 2007...[and] is responsible for safeguarding, valorising and promoting the Aeolian Islands and implementing [the management plan].” (Ministero dell'Ambiente, 2010). Various sources assert that the National Park (NP) has not been instituted (Legambiente, 2011; IUCN Consultation, 2013b) and it is not listed officially as an Italian NP (Federparchi, 2013). Throughout the years, the State Party's reports on the management structure have been confusing and contradictory, referring to three different management entities (State Party of Italy, 2008, 2009), which never seem to have translated into an effective and coordinated management system (IUCN Consultation, 2013b; UNESCO and IUCN, 2007). In 2015, the Aeolian municipalities of Lipari, S. Marina, Leni and Malfa approved a resolution for the establishment of the Lead Committee (Comitato Guida) that, according to the management plan of the World Heritage site, is composed by the four mayors of the archipelago (Comune di Lipari, 2015). Supposedly, after years of inactivity, in 2023 the municipality of Lipari updated the information given in the periodic reports sent to the Ministry of the Environment and Energy Security, as well as the maps of the Site. Furthermore, in agreement with the other municipalities of the archipelago, it would like to formalize the steering committee (composed by mayors, following the indications of the Management Plan) and the nomination of a technical-scientific committee (Vettore et al. 2024).

► **Law enforcement**

Serious Concern

Due to the lack of an effective management of the World Heritage site, the enforcement of relevant laws and regulations is undertaken by local or regional authorities (Superintendence, Municipality) with particular focus on the control of building activities.

► **Sustainable finance**

Some Concern

Even though an appropriate funding scheme has been designed by the Italian government with the law 77/2006, which aims at providing financial support, on an annual basis, to activities for the promotion, protection, and enhancement of Italian World Heritage sites and their organizational structure, there is no indication that any funds have been allocated to manage the Aeolian islands site, probably due to the absence of a coordinating body that could present the request. Supposedly, in March 2008 the UNESCO Sicily Foundation, which at one point was designated as the management entity received €70,000 (State Party of Italy, 2009) but no further information is available. Similarly, in December 2008 the national government allocated €500,000 to Sicily to raise awareness on World Heritage sites. Additionally, in the event that the National Park proposal goes ahead, there are concerns that the budget cuts to Italy's NP system could compromise the creation of this much-needed protected area (Legambiente, 2011).

► **Staff capacity, training and development**

Data Deficient

Data deficient

► **Education and interpretation programmes**

Some Concern

Despite assurances by the State Party that resources had been committed to “educational/interpretive actions” (IUCN, 2000), more than a decade after the site’s designation there is still no collective understanding amongst the Aeolian residents regarding the significance of having WH status (Legambiente, 2011; IUCN Consultation 2, 2013).

► **Tourism and visitation management**

Serious Concern

Given the lack of any management system, there are no awareness-raising programs related to the World Heritage site. Neither do the existing Nature Reserves promote the natural values nor have visitor centers (Ministero dell'Ambiente, 2010). For example, tourists on Stromboli are completely unaware of the richness of the area, and nothing is done to value the site or to attract quality tourism capable of appreciating it (IUCN Consultation, 2013a). On the other hand, there are various well-prepared brochures on the nature trails of most islands but, unfortunately, these are not well-distributed (Ministero dell'Ambiente, 2010). In addition, the ecotourism potential – the development of which was included as an unofficial recommendation in the 2007 joint UNESCO-IUCN reactive monitoring mission report (UNESCO and IUCN, 2007) – has not been leveraged and remains generally untapped. The potential geo-tourism (i.e. linked to the geological and volcanic values of the site), which could help de-seasonalize tourism, also remains undeveloped, as demonstrated by the fact that (apart from Stromboli volcano) the major sites for geological relevance are not yet established or well promoted (Ministero dell'Ambiente, 2010; Vettore et al., 2024). On the contrary, the added value of daily tourism from neighbouring islands and mainland to the islands’ economy is questioned, as it puts too much pressure on their facilities (Vettore et al., 2024). In 2023, the Municipality of Lipari seems to have commissioned Fondazione Santagata with the drafting of a strategic plan for sustainable tourism in the Aeolian Islands (Fondazione Santagata, 2023), but no plan has been published yet. Some positive developments have been carried out by a private publisher and local associations of guides, who have developed activities in order to improve the eco-tourism opportunities for visitors, such as publishing maps of the walks of the islands and books dedicated to the knowledge of the natural heritage etc. (Filicudi Wildlife Conservation, 2013; Nesos 2013).

Typical eruptive activities recorded at Stromboli by INGV during March-June 2019 was similar to the activity of the past few years; two major explosions occurred in July and August with a fatality during the 3 July event (Global Volcanism Program, 2019). Communication on the ongoing volcanic risk to visitors, contingency measures and the results of ongoing monitoring seemed to improve in the last years. For example, in 2021–2022 on the island of Vulcano the alert level of the La Fossa’ volcanic system was raised due to increased degassing and deformation and contingency measure, such as the partial evacuation and the subsequent interdiction of the crater summit path and the main beach below, were taken, despite complaints by the local stakeholders for the restriction of the two main “touristic sites” of the island (Vettore et al., 2024).

► **Sustainable use**

Some Concern

It seems like the Landscape Territorial Plan of the Aeolian Islands is still the main guidance mechanism for the protection of the archipelago, including as a mechanism to restrict natural resource use especially through mining activities (UNESCO and IUCN, 2007). In general, natural resource use seems to be mostly traditional both on land and at sea (Ministero dell'Ambiente, 2010). On the other hand, some of these traditional uses are not sustainable, such as for example the use of fishing aggregating devices (FAD) (IUCN Consultation, 2020b).

► **Monitoring**

Some Concern

Whilst there seems to be no specific monitoring programme for the World Heritage values of the site in place, there are numerous volcanic monitoring programs ongoing at Stromboli Volcano and other Aeolian Islands, which encompass the many of the values for which the site was inscribed. The frequency of

eruptions makes these sites ideal for testing new monitoring approaches (INGV, 2020). On the other hand, there is almost no monitoring on island biodiversity, including endemic and endangered species listed as other important biodiversity values (IUCN Consultation, 2020b), although some monitoring activities were performed in the framework of the Life Project "SeedForce" by University of Catania (concerning some endemic plant species) and of MSFD Directive by the local NGO Nesos (concerning the marine birds listed in 147/09 EU Directive).

► **Research**

Mostly Effective

The management plan makes reference to numerous and varied scientific sources (Ministero dell'Ambiente, 2010) and indeed, there is a large and active research effort on the volcanoes of the Aeolian Islands (INGV, 2020). On the other hand, research efforts on island biodiversity are still poor (IUCN Consultation, 2020b).

► **Effectiveness of management system and governance in addressing threats outside the site**

Some Concern

The geological values for which the site was inscribed do not appear to be seriously impacted by any outside threats, while, on the contrary, other important biodiversity values are seriously affected by several threats also from outside. The absence of an effective and coordinated management system and entity is of serious concern. There is no information available regarding staff capacity and the integration of national, regional and local policies remain unclear. These deficiencies also mean that law enforcement is of serious concern and threats to other biodiversity values of the site are not effectively dealt with. Several ecologically important areas lack a protection status and implementation of protection measures. There is also serious concern regarding the lack of regulations to manage the large number of seasonal tourists, especially on the smaller islets. The National Park has not yet been instituted. The process of establishing a Marine Protected Area in the entire archipelago still seems in pause, while the establishment of a MPA of Salina seems ongoing.

► **Effectiveness of management system and governance in addressing threats inside the site**

Serious Concern

Absence of an effective and coordinated management system is of serious concern.

Overall assessment of protection and management

Serious Concern

The fact that no management entity has been effectively in place to manage the site since its inscription in 2000 is of serious concern. Also of concern is that the site's management plan, which although detailed and comprehensive, was only prepared a decade after the site's inscription and relies on a management structure that does not exist: the National Park that the State Party claimed was created in 2007 but that has not been instituted. Although the protected area legal framework is relatively solid, it is fragmented and has various loopholes that threaten the conservation of ecologically important areas. Some of the protected areas lack the necessary resources and implementation tools to guarantee effective conservation measures. The complex, weakly coordinated and multi-layered governance system in Sicily seems to be one of the main obstacles to the implementation of the nine World Heritage Committee recommendations issued in 2007, only one of which has been implemented. The lack of a coordinated management system also explains the significant void that exists when it comes to stakeholder involvement and awareness-raising activities related to the World Heritage site and its values. The lack of a consistent program for communicating to visitors the ongoing volcanic risk, contingency measures, and the results of ongoing monitoring is a serious concern.

State and trend of values

Assessing the current state and trend of values

World Heritage values

► Outstanding volcanic phenomena

Good
Trend: Stable

There is no evidence to suggest that this value is threatened (IUCN Consultation, 2017), however, the absence of an effective and coordinated management system and entity needs to be addressed.

► Geological processes

Good
Trend: Stable

Geological processes remain undisturbed (IUCN Consultation, 2017), however, the absence of an effective and coordinated management system and entity needs to be addressed.

► Contribution to volcanology and geology

Good
Trend: Stable

There is no evidence to suggest that this value is threatened (IUCN Consultation, 2017). On the contrary, there is a continuous, large and active research effort on the volcanoes of the Aeolian Islands (INGV, 2020), although not coordinated through any World Heritage management system, as this is lacking.

Summary of the Values

► Assessment of the current state and trend of World Heritage values

Good
Trend: Stable

The geological values of the site are in good condition and well preserved. However, the absence of an effective and coordinated management system and entity needs to be addressed.

► Assessment of the current state and trend of other important biodiversity values

High Concern
Trend: Deteriorating

Most of the site's important biodiversity values are being adversely impacted by a number of threats and their conservation status is deteriorating over time.

Additional information

Benefits

Understanding Benefits

► Traditional agriculture

Although the predominance of tourism has led to the decline of traditional agricultural practices, and a consequent loss of economic value on all islands except for Salina, there is an untapped potential linked to sustainable development. In fact, not only is the primary function of agriculture on the islands to preserve the landscape, but the integration of agricultural and touristic activities could be a good opportunity to promote tourism-related quality products produced locally. For example, there are several Aeolian specialties such as capers, raisins and Malvasia wine, which are appreciated and sold nationally and internationally (Ministero dell'Ambiente, 2010).

► History and tradition

The archipelago boasts several archaeological sites of great interest, as well historic areas of high cultural value. Its main island, Lipari, has an archaeological museum, which has the potential to be amongst the most important in the Mediterranean basin, if properly promoted. This benefit could be further developed through the creation of the long called-for scientific or eco-museum related to the old pumice mining industry on Lipari. This "regional Pumice museum" proposal is detailed in the WH site's

management plan and consists of an exceptional testimony of industrial archaeology, which once formed the basis of the island's economy. The creation of this new museum, as well as the promotion of the existing archaeological one, could contribute significantly to the island economy by increasing jobs and creating an appeal for cultural tourism, thereby helping to de-seasonalize current tourism patterns (Ministero dell'Ambiente, 2010).

► Outdoor recreation and tourism

Tourism is the main economic driver, but is limited to seasonal mass tourism focusing on brief seaside visits. There is significant potential to tap into the favorable climate, widespread tourism facilities, well-established service sector, and local hospitality to promote a year-round quality tourism based on the islands' rich cultural, historical and natural heritage (IUCN Consultation, 2013a; Ministero dell'Ambiente, 2010).

Factors negatively affecting provision of this benefit :

- Overexploitation Impact level - High, Trend - Continuing

The over-exploitation and massive occurrence of visitors that characterizes especially the summer season seems to reduce the perception of natural and cultural values of archipelago.

► Importance for research

The values for which this site was inscribed demonstrate how the Aeolian Islands are an invaluable resource in the study of volcanic island-building and destruction, as well as other volcanological phenomena (World Heritage Committee, 2000). In addition, the particular geographical position of the archipelago makes it a potential research laboratory (biogeography, ecology, geology, volcanology, sustainable development) contributing significantly to the conservation of biodiversity in the Mediterranean bioregion (Ministero dell'Ambiente, 2010).

Factors related to anthropogenic disturbance, including invasive species and habitat disruption, affected the maintenance of the local biodiversity.

► Contribution to education

The site was inscribed for its priceless contribution to the fields of volcanology and geology, providing two types of volcanic eruptions, which have featured prominently in the education of geoscientists for over two centuries. Once an effective management entity is created, it could use awareness-raising and educational activities to share this knowledge outside expert circles and bring it down to the local level.

Summary of benefits

This site's benefits revolve around the tourist industry, which is already extensively developed but needs to be diversified and de-seasonalized, shifting its focus to attracting quality tourists. The potential to develop a tourist industry based on sustainable development and year-round economic returns is significant due to the unique resources the Aeolian Islands can tap into. For example, it can promote local quality products produced by traditional agricultural practices. It could also foment alternative types of year-round tourism based on existing and potential cultural, archaeological, geological and environmental attractions.

Projects

Compilation of active conservation projects

Nº	Organization	Brief description of Active Projects	Website
1	Associazione pro Stromboli per la difesa del sito (Pro-Stromboli Association)	Created in 1994, this association of Stromboli's local residents and regular visitors works to protect the island's natural and historical heritage while promoting sustainable development initiatives. They are involved in a variety of projects, from beach cleanups to environmental education and awareness-raising activities with local residents, as well as setting up a voluntary fire brigade for the island.	https://www.prolocoamostromboli.it/en/

Nº	Organization	Brief description of Active Projects	Website
2	Associazione Nesos – Island Biodiversity Research	The work of this NGO founded in 2011 focuses on the production of nature guides, ecotourism activities (trekking, nature walks for schools, etc.), and scientific research to obtain updated data on the biodiversity of the Aeolian and other Mediterranean islands. Together with other local associations Kurma, and Condotta Isole Slow Siciliane, and supported by the Blue Marine Foundation and the Sicily Environment Fund, Nesos launched the “Salina Blue Island” project. The project aims to involve the local community and visitors in the process of establishing the Salina Marine Protected Area (MPA) through a program of information and awareness about sea conservation.	http://www.nesos.org https://sicilyenvironment.org/it/grants/salina-blue-island/
3	Filicudi Wildlife Conservation	Filicudi Wildlife Conservation is a non-profit association based in Filicudi Island aimed at the study and conservation of the marine resources of the Aeolian Archipelago through an integrated approach and concrete actions throughout the area. Ongoing activities include research and monitoring of marine vertebrates, mainly cetaceans (common bottlenose dolphin, striped dolphin and sperm whale) and sea turtles (loggerhead sea turtle <i>Caretta caretta</i>).	https://www.filicudiconservation.com/
4	Associazione Nesos with the support of Sicily Environment Fund and Blue Marine Foundation	Save the Aeolian Lizard is a conservation project launched in 2021 and managed by the local NGO Nesos, that since 2001 promotes ecotourism, researches on and conservation of islands' biodiversity. The aim of this project is to create new populations of the threatened endemic Aeolian wall lizard <i>Podarcis raffonei</i> after the reintroduction of the species on some selected islets not inhabited by other lizards and where no competitors and predators occur. The introduced lizards are obtained through a captive breeding program, from few reproductive individuals previously sampled on Strombolicchio and Scoglio Faraglione islets. STAL is a low-budget project, mainly based on volunteering, entirely managed and carried out by local researchers and collaborators.	www.nesos.org

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