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The benefits of biodiversity conservation through the Italian Marine Protected Areas: application of a Choice experiment in Portofino for the monetary valuation of three ecosystem services

Filippo Blasi

Tutor:

Prof. Marco Saroglia

Co-tutors:

Prof. Barbara Cavalletti

Prof. Giovanna Jona Lasinio

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Abstract

In Italy the funds allocated by the Government to the Marine Protected Areas (MPAs) were progressively reduced from 2008 to 2015. The question we can ask is whether Italian citizens confirm this point of view, or the view of Italian citizens is different. This study tries to answer this question. What emerges is that Italians attending the MPA of Portofino are willing to pay € 29.07 per family per year for an increase of the level of three ecosystem services provided by marine ecosystems protected by MPAs. This only affects the MPA of Portofino. In addition, the study has laid the foundation for future applications of Choice experiment for the economic valuation of ecosystem services in the specific context of the Italian MPAs: further research are needed to show if the Italian population as a whole is disposed to maintain and increase funding for the conservation of marine biodiversity through the Marine Protected Areas.

1. Introduction

The biodiversity of the seas and oceans is gradually declining due to the exploitation of resources, habitat destruction, pollution, the introduction of alien species, and climate change and related perturbations of ocean biogeochemistry. In this context, it has been necessary over time to establish areas of protected sea in order to conserve marine biodiversity and ecosystem services that it provides (Worm et al., 2006; Potts et al., 2014; Christie et al., 2015).

In Italy have been established, to date, 27 Marine Protected Areas (MPAs) and 2 Underwater Parks, with the aim to preserve and conserve endangered species, critical habitats, fish stocks, the landscape features, cultural biodiversity, and historical and archeological heritage (Cattaneo & Tunesi, 2007; Marino, 2011; Vallarola, 2011).

However, the funds allocated by the government to the Italian MPAs were progressively reduced from 2008 to 2015 [source: *Ministero dell'ambiente e della tutela del territorio e del mare* (Italian Ministry of the Environment, Land and Sea)].

The objective of this study is the economic valuation of three ecosystem services provided by some of the most important habitats and species protected by the Marine Protected Areas, with the aim of showing the benefits of marine biodiversity conservation through the Italian MPAs (Blasi, 2011). To do this, in our research we use the Choice experiment method, accompanied by an additional questionnaire designed to obtain information to make supplementary considerations on ecosystem services. Questionnaires were put to a sample of 150 people, interviewed face-to-face at the commune of Portofino (a municipality included in the Marine Protected Area of Portofino, Liguria, Italy) during the summer of 2014.

The paper is organized as follows.

- Introduction (**Section 1**), which is divided into the following parts:
  - in the *Section 1.1* we provide a discussion on the economic valuation of ecosystem services;
  - in the *Section 1.2* we provide basic information on the status and objectives of the Italian Marine Protected Areas essential to contextualize the application of Choice experiment in our work;
  - in the *Sections 1.3-1.5* we describe in detail the habitats and species protected by MPAs of which, in this study, we will value three ecosystem services (*Climate regulation* provided by *Posidonia oceanica* meadows, *Aesthetic benefits* provided by coralligenous, *Food* provided by Fish populations).

- Material and methods (**Section 2**), which is divided into the following parts:
  - in the *Section 2.1* the application of a Choice experiment, who is the method we used for the economic valuation of ecosystem services, is described in detail;
  - in the *Section 2.2* we describe the experimental design;
  - in the *Section 2.3* we show the composition of our sample according to gender, age, profession and location;
  - in the *Section 2.4* we present the statistical models we use in the study (chi-square tests and multinomial logit models);
  - the *Appendix* is a comparison between the sample size in our study and the sample size of other similar studies that used the Choice experiment method for the economic valuation of benefits from biodiversity conservation.
- Results, which is divided into the following parts:
  - the first part (**Section 3**) consists in the descriptive analysis of contingency tables and bar graphs, obtained by crossing the variables of the Choice experiment and the additional questionnaire. The aim of this section is to identify the points of consistency between the answers, and trends in the choices and decisions of the population interviewed.
  - the second part (**Section 4**) is an analysis of aggregate combinations obtained with the multinomial logit model, and the monetary value of ecosystem services is assessed;
- Discussion and Conclusions (**Section 5)** which is divided into the following parts:
  - in the *Section 5.1* "Discussion" we analyze the results of the economic valuation of ecosystem services, and examine the main results obtained from the contingency tables and with the multinomial logit models;
  - in the *Section 5.2* we provide the "Conclusions".

Table 1 is a summary frame of the present work.

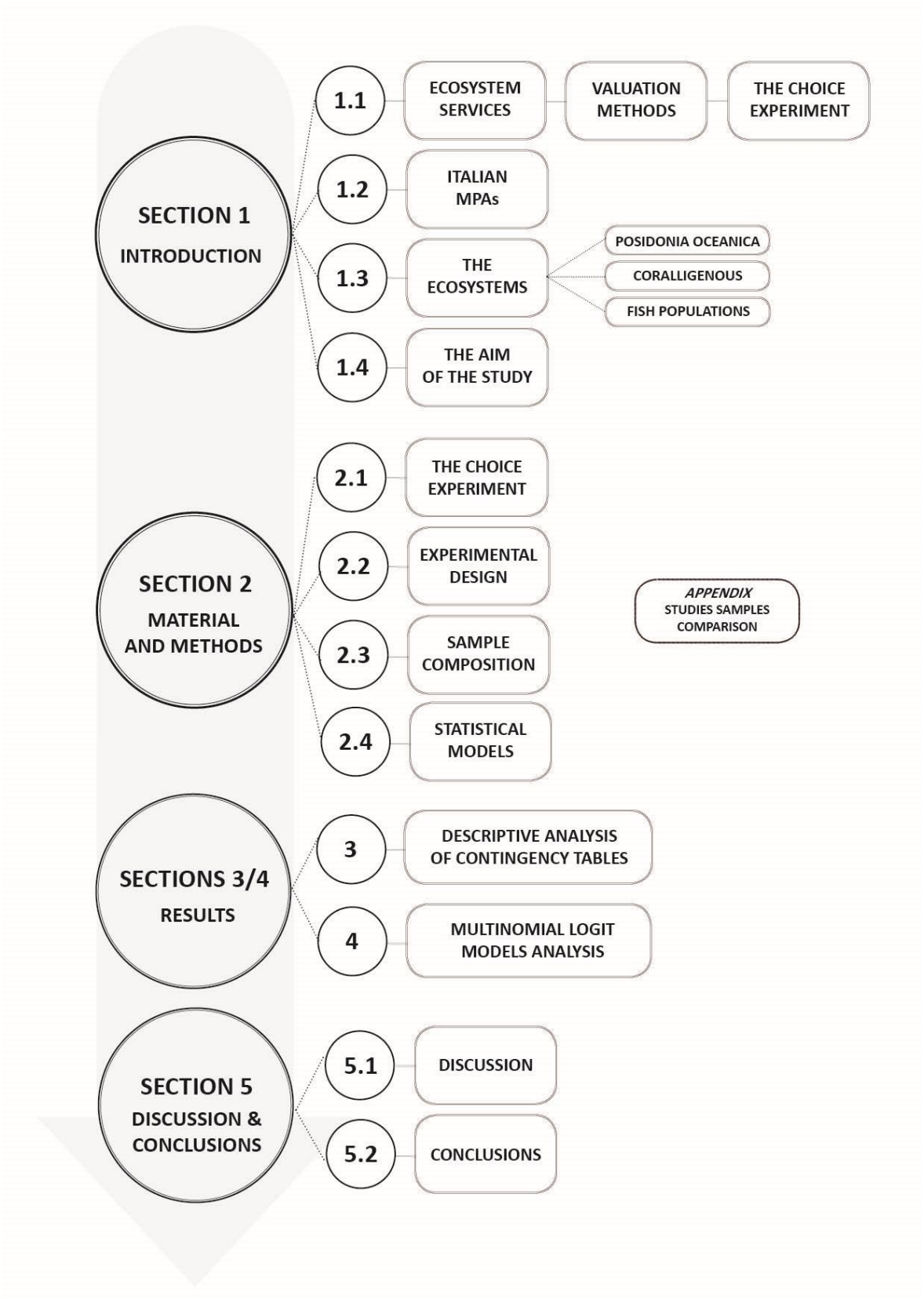


Table 1. Summary frame of the work.

1.1 Ecosystem services valuation and the Choice experiment method

Despite significant national and international efforts, the rate of biodiversity loss does not appear to be slowing (Butchart et al., 2010). One of the main reasons for the declining of biodiversity lies in the failure to recognize the value of ecosystem services for society.

Ecosystem services are defined as the benefits people obtain from ecosystems (MA, 2005; Fisher et al., 2009). The flow of ecosystem services used by society is produced by natural capital. This is defined as the stock of materials and information (biotic and abiotic components of ecosystems and information contained in an ecosystem) existing at a given point in time (Costanaza et al., 1997). The Millennium Ecosystem Assessment (MA, 2005) classifies ecosystem services into provisioning services (e.g., food, fibre, genetic resource, etc.), regulating services (climate regulation, water regulation, etc.), cultural services (aesthetic values, recreation and ecotourism, spiritual and religious values, etc.) and supporting services (e.g., nutrient cycling, soil formation, etc.).

The economic valuation of ecosystem services is an important and potentially determinant contribution to biodiversity conservation, providing society with a measure of ecosystem value and a new and more accurate tool for decision-makers.

Most ecosystem services are "out of the market"; this means that their monetary value is

not determined by the dynamics of economic systems and is therefore zero. To assign an economic value to these ecosystem services we can refer to the following main valuation methods (deGroot et al., 2002)[1]:

- *Avoided cost*: some ecosystem services allow society to avoid the costs that would be incurred in their absence.
- *Replacement cost*: this method evaluates the cost of technological systems required to provide the services that are currently fulfilled by ecosystems;
- *Factor income*: this method evaluates the incremental income derived from ecosystem services; for example, ecosystem services improving water quality increase the commercial catch of fish and by extension incomes in the fishing industry;
- *Travel cost*: the travel costs necessary to reach an ecologically precious area are considered a measure of its value.
- *Hedonic pricing*: service demand may bereflected in the prices people will pay for associated goods housing prices at beaches usually exceed prices of identical inland homes near less attractive scenery.
- *Stated preference methods* (*Contingent valuation* and *Choice experiment*): the ecosystem services are valuated through questionnaires which offer to the interviewees different hypothetical scenarios.

[1] Economic theory leads to two distinct and complementary notions of benefit. The first is the willingness to pay (WTP), which expresses the availability of individuals to pay for an environmental improvement, or to avoid damage. The other is the willingness to accept (WTA) compensation to forgo a gain or tolerate a cost. The valuation techniques for market valuation of ecosystem services can be used to establish the (revealed) WTP or WTA for the availability or loss of these services.

An important concept dealing with valuation of ecosystem services is the total economic value of natural resources (VET), which allows us to order, in a synthetic and coherent form, ecosystem services on the basis of their utility (Pearce & Moran, 1994; Pearce & Turner 1991; Casoni & Polidori, 2002). VET identifies two types of value of ecosystem services: the use value and the value of non-use.

Use value derives from the actual value of an ecosystem service; can be further divided into direct use value, indirect use value and option value. The direct use value arises from the "real" use (ie object of market exchange) of services. The indirect use refer to the benefits deriving from ecosystem functions (such as recycling nutrients, absorbing waste, the moderation of the force of the waves and climate stabilization). The option value expresses the willingness to pay to reserve a possibility to use the service for which there are no substitutes.

Non-use values are classified in the bequest value, reflecting the benefit from each individual from the knowledge that others can benefit from the same ecosystem service in the future, and the existence value (or intrinsic value), which refers to benefit to the individual that comes from knowing that biodiversity is protected.

In our work we use ***Choice experiment***. This method do not rely on existing markets; instead, respondents are asked for their willingness to pay for environmental goods in a number of hypothetical scenarios. For example, participants may be asked for their willingness to pay for conservation programmes which improve biodiversity or a number of ecosystem services (Kenter et al., 2011). Choice experiment method is based on the notion that any environmental good can be described in terms of its characteristics, or attributes, and the levels that these attributes take (Biron & Koundouri, 2008). In the Choice experiments estimated coefficients of the attributes maybe also used to estimate the economic value of different ways in which the attributes can be combined: choice experiment allows to calculate the welfare effects of alternative scenarios to illustrate the most and least preferred management options.

The Choice experiment has been used in the contexts of the evaluation of the benefits of biodiversity. Following we describe some of the main publications, selected for their affinity with our study.

Bergmann et al. (2006) attempted to estimate through a Choice experiment the magnitude of benefits and costs produced by renewable energy investments on environmental goods and services. The study shows a positive willingness to pay to change a slight increase in harm to wildlife from renewable projects to a level that has no harm, or to change a slight increase in harm to wildlife from renewable projects to a level that wildlife is improved from the current level. The authors also estimated welfare changes for different combinations of impacts (on wildilife, landscape quality, air quality, and employment) associated with different political strategies.

Christie and Rayment (2012) used Choice experiment to estimate the economic value of changes in biodiversity and associated ecosystem services provided by different habitats present inside the "Sites of Special Scientific Interest" (SSSI) present in England and Wales. The result of the research is that the public are willingness to pay to secure the levels of services currently delivered by SSSI conservation activities in England and Wales, and to secure the benefits that would be delivered if all SSSIs all in favorable condition. These values are greater than the annual public costs of SSSI sites management, proving that biodiversity conservation is cost effective.

Shumann et al. (2013) used a Choice experiment to estimate the economic value of marine biodiversity to recreational SCUBA divers in Barbados. The research - that indicates that willingness to pay for good coral cover, fish diversity and presence of sea turtles is significantly higher than prices paid for dives – demonstrate the economic value generated by the recreational SCUBA diving in the studied site.

Jobstvogt et al. (2014) used a Choice experiment to ask Scottish households for their willingness to pay for additional MPAs in the Scottish deep sea. The research shows an high willingness to pay for deep sea protection; this demonstrates that survey participants care for protection of these ocean areas despite their own luck of familiarity with these remote sites.

Christie et al. (2015) used a Choice experiment to estimate the values of ecosystem services provided by Marine Protected Areas in Caribbean. The work demonstrates that locals and tourists attending Marine Protected Areas in Caribbean have high values to protect against deterioration in current levels of ecosystem services provision and significantly value improvements in the level of ecosystem service provision.

In our study we use a Choice experiment in the specific context of Italian Marine Protected Areas. Specifically, we identified the ecosystem service attributes that relate to specific ecosystems of the Mediterranean Sea protected by the Italian MPAs (*Posidonia oceanica* meadows, coralligenous, fish populations); and the economic attribute is a specific national tax calculated for Italian MPAs. Our research differ from these studies because we added a questionnaire, designed to obtain information to make supplementary considerations on ecosystem service, with original questions compared to the practice in the literature. In our case, we decided to not consider different scenarios to calculate the welfare effects of alternative scenarios but to focus our work on the monetary estimates of ecosystem services.

In chapter 4 we report the results of the application of several multinomial logit (Bermann et al., 2006; Hanley & Barbier, 2009) to describe the probability to choose an alternative given each of the proposed options (level of services). The same models are adopted to evaluate, following (Christie & Rayment, 2012) the monetary values of ecosystem service.

1.2 Italian Marine Protected Areas

In this section we provide basic information on the status and objectives of the Italian Marine Protected Areas. In Italy have been established, to date, 27 Marine Protected Areas (MPAs) and 2 Underwater Parks (Cattaneo & Tunesi, 2007; Marino, 2011; Vallarola, 2011).

The first indications as to the realization of the MPAs in Italy date back to the late '60s,

with conventions that have had as its object, among others, the promontory of Portofino, the island of Pianosa, Castellabate, and Sicily. In 1965 the National Fisheries Law (Law 963/1965), providing for the establishment of "Zones of biological protection", guaranteed a kind of protection for certain habitats. However, it is only with the enactment of Law 979 of 1982 and 394 of 1991 (in which the following definition of marine reserve was present: "marine environment, inclusive of the waters, the bottoms, and stretches of coastline that have a significant interest for the natural, geomorphological, physical, biochemical, particularly with regard to the marine and coastal flora and fauna and for the cultural, educational and economic importance) that the terms of the protection have been defined (Cattaneo & Tunesi, 2007; Marino, 2011).

Marine Protected Areas can play an important role for the conservation of marine biodiversity. Even if Italian MPAs established in Italy are based on a list of areas in need of protection, the criterion of the legislature was especially to identify areas of high landscape value, rather than following ecological criteria. Yet within the Italian MPAs can be identified species and habitats of major ecological value (especially since most of the areas identified by legislators have rocky bottoms, characterized by a high biodiversity), which must be properly managed during design and the government of the MPAs.

The species is important to identify and protect are first the endangered species and endemic species, and the habitats in which they live. Among these, those that are to be given special protection are the seagrass *Posidonia oceanica*, large brown algae, coralline algae and many bioconstructing invertebrates (Cattaneo & Tunesi, 2007). Secondly, must be particularly protected species that have commercial value (especially juveniles) and their habitats, and species that have a symbolic value for Italian MPAs [like the Dusky Grouper (*Epinephelus marginatus*), the Mediterranean moray (*Muraena helena*), the seabream (*Diplodus spp.*) and the Common dentex (*Dentex dentex*)].

The conservation of marine ecosystems through Italian Marine Protected Areas is important for their ability to provide ecosystem services that support numerous human activities (such as fishing, aquaculture, tourism, cultural activities and scientific research). The structures and processes of coastal ecosystems, in fact, provide society with numerous ecosystem services of which benefit especially the inhabitants of the coasts, including pollution control, maintenance of fish species of commercial interest, protection of the coastline from erosion, and recreational services. The ability of ecosystems to provide ecosystem services is compromised because of the conflict between the different uses of ecosystems, as in MPAs insist many settlements (such as urban and industrial settlements and ports) and activities (such as fishing, aquaculture, agriculture, transport, industrial,

energy production, the exploitation of mineral resources, tourism and recreation). For this reason the management of the coasts can be successful if the exploitation of coastal ecosystems can be economically and socially optimal, such as to guarantee the ability of coastal ecosystems to provide ecosystem services over time and reduce conflicts among different stakeholders.

The economic valuation of biodiversity of Italian MPAs can be a useful aid in decisions about design and management of protected areas. In fact, the quantification of the value of ecosystem services allows us to achieve two objectives. First, allows to show the benefits to society from the preservation and conservation of ecosystems, both for the locals and national and international communities. Second, it allows to determine the importance of this value for different categories of users of ecosystem services, contributing to the prevention and resolution of conflicts. The economic benefits must be evaluated in the appropriate spatial and temporal scale; this should be taken into consideration: on the one hand, the dynamics of ecosystems and environmental benefits of conservation; on the other, the benefits of conservation at a scale greater than that of local economies affected by MPAs.

1.3 Posidonia oceanica *meadows*
(Ecosystem service 1)

Posidonia oceanica is an endemic marine Magnoliophyte of the Mediterranean, organized in roots, a steam termed rhizome, and leaves (Cinelli et al., 1995). The rhizomes develop horizontally and vertically; these two types of growth bring about the so called "matte"; the "matte" is the whole mass composed of rhizomes, sheaths, roots and the sediment that fills the interstices. *Posidonia oceanica* presents both sexual reproduction, with flower and fruits formation, and asexual reproduction by means of stolonisation. *Posidonia oceanica*, when encounters favourable environmental conditions, colonises vast areas of the sea bottom, forming extensive meadows, which extend from the surface to a depth of approximately 35-40 meters (Cinelli et al., 1995).

Posidonia oceanica meadows are the most important "hot spot" of biodiversity of the Mediterranean Sea (Relini, 2009; Boudouresque et al. 2006) and one of the most important target of biodiversity conservation through the Italian MPAs (progettoisea.it). During the 20th century, and certainly more especially since the 1950s, *Posidonia oceanica* meadows

has considerably regressed, particularly around major urban centres and ports (Boudoresque, 2008). For this reason, Posidonia has become one of the main objectives of protection and management of Mediterranean coastal marine areas. Human activities are the main factor in the regression of the *Posidonia oceanica* meadows (Relini, 2009, and Boudouresque et al. 2006 discuss the causes of regression of meadows in detail).

The economic importance of *Posidonia oceanica* comes from its crucial role in maintaining the ecological balance and physical coastal marine environment, and in ecosystem services provision (Relini, 2009; Boudoresque, 2008). Important ecosystem services provided by Posidonia meadows include: Disturbance regulation; Nutrient cycling; Waste treatment; Habitat/Refugia for commercial species; Protection from predators for young fish and young organisms (nurseries); Erosion control; Food production). Some studies assessed an economic value to *Posidonia oceanica* meadows. Blasi (2009), for example, estimated that economic value of Erosion control ecosystem service in € 309 m^{-2} $year^{-1}$. Vassallo et al. (2013) estimated, based on calculation of resources employed by nature to provide services, an economic value of *Posidonia oceanica* equal to 172 € m^{-2} a^{-1}.

For each habitat or species described in the *Sections 1.3-1.5* (*Posidonia oceanica* meadows, Coralligenous and Fish populations) we have identified for our study an ecosystem service. For the *Posidonia oceanica* meadows we have chosen the ecosystem service *Climate regulation* (see *Section 2.1*).

1.4 Coralligenous
(Ecosystem service 2)

Coralligenous is a coralline algal concretion that thrives exclusively in the Mediterranean deep waters, where develop in dim light conditions on almost vertical walls, in deep channels, or on overhangs (Ballesteros, 2006; Relini, 2009). International experts during the meeting of RAC/ SPA (Tabarka, Tunisia) in 2006 proposed the following definition for the Mediterranean coralligenous formations: "the coralligenous is a complex of biocoenoses rich in biodiversity, which forms a seascape of sciaphilic and perennial animal and plant organisms with a quite important concretion made of calcareous algae" (Casellato & Stefanon, 2008). All algae and animals thriving in coralligenous habitat are sciaphilic (that is, grow only in shady habitats).

Coralligenous communities constitute the second most important 'hot spot' of species diversity in the Mediterranean after the *Posidonia oceanica* meadows (Ballesteros, 2006; Relini, 2009) and one of the most important targets of biodiversity conservation through the Italian MPAs (progettoisea.it).

Five main causes of disturbance that affect coralligenous assemblages can be distinguished (Ballesteros, 2006). (1) Mass mortality of suspension feeders, that seem to be related to summer water column stability and high temperatures (Cerrano et al., 2005; Ballesteros, 2006). (2) Impact of waste water dumping. (3) Impact of trawling: trawling is especially destructive, for not only does it physically destroy the coralligenous structure, but it also increases turbidity and sedimentation rates, which negatively affects algal growth and suspension feeding (Ballesteros, 2006). (4) Diver activities; (5) Invasive species.

The economic importance of coralligenous is due to two main aspects: fishing and diving. Both traditional and recreational fishing are practiced on coralligenous habitats (Ballesteros, 2006), due to the diversity and abundance of fish species present (Guidetti, 2009). Coralligenous assemblages are also one of the preferred diving spots for tourists due to the great diversity of organisms. Divers are astonished by the high number of species belonging to taxonomic groups as diverse as sponges, gorgonians, molluscs, bryozoans, tunicates, crustaceans or fishes (Ballesteros, 2006).

For the economic valuation in our work, we have chosen the ecosystem service *Aesthetic benefits* provided by coralligenous habitat (see *Section 2.1*).

1.5 Fish populations
(Ecosystem service 3)

An important reason for which, globally, have been set up MPAs is the need to create protected areas for the targeted fish species. In fact, in the face of over-exploitation, the traditional tools of management of fish stocks have proved insufficient.

Only a limited number of Italian MPAs born with the specific purpose of protecting fish stocks. In fact, although some protected areas were born thanks to the Law on Marine Fisheries ("Zona di tutela biologica", Italian Law 963/1965), most have been established on the basis of a broader set of objectives. However, they can be designed and managed, keeping in mind the ecological characteristics specific to each MPA, with the aim of contributing to the conservation of fisheries resources of the Italian seas and retain the

traditional fishing. For example, the MPA of Portofino is engaged in the management of fishery resources and in the enhancement of traditional fishing characteristics of the Ligurian Sea (Cattaneo & Bava, 2004; Cappanera et al., 2011; AMP di Portofino: Piano di Gestione Standardizzato).

The experience and experimental research show a positive effect of MPAs on fish, especially on species of commercial interest. One positive consequence is found on increasing the size of the fish and their age (Roberts et al., 2001; Francour, 1994; Sanchirico et al. 2002; Pezzey et al., 2000; Sanchirico & Wilen, 2001; Francis et al ., 2002). In particular there is a "refuge effect" of protected areas: inside MPAs are present large individuals, which are the most sensitive to fishing pressure (both professional and sport) (Francour, 1994). Fishes of higher age are also more fertile individuals (Sanchirico et al., 2002; Bohnasack, 1993).

Another benefit of protection is manifested on the density. Some studies, which have used the technique of visual census show, after a decade since the establishment of MPA, an increase of individuals for all categories of fish (planktivorous, detritivores and ichthyophagous) that is attributable to the closure of the fish areas, and the recovery of structural complexity of the seabed previously altered by fishing gears (Alcala, 1988).

MPAs also allow an increase of the total number of fish species. In fact it was often observed in protected areas the return of species previously missing, also of commercial interest (Cattanneo & Tunesi, 2007; Francour, 1994; Garcia-Rubies & Zabala, 1990).

Two interesting benefits are the spillover effect (migration of fish species from the MPA to the outside) and the dispersion of the eggs and larvae.

The migration of fish varies depending on the mobility of the species and age of the individuals, in particular in relation to feeding and reproductive behavior (Polunin, 2002). Among the conditions that contribute to determining the number of individuals moving into new areas, there are the season and the presence of suitable habitats in areas more or less close to the protected area.

The spillover effect of fish may affect areas located far from a MPA (Cattaneo & Tunesi, 2007), up to tens or hundreds of kilometers (Polunin, 2002), although it decreases as a function of distance from the edge of the reserve (Francis et al., 2002).

Regarding the flow of larvae and planktonic eggs outside of the protected area, it depends on the characteristics of the life cycle of the individual species (especially by the longevity of the larvae) and on its relation with the oceanographic characteristics of the sea area (Sanchirico & Wilen, 2001; Polunin, 2002).

A research concucted in the MPA of Portofino had shown a moderate fish spillover of sea breams *Diplodus puntazzo*, *Diplodus sargus* and *Diplodus vulgaris* (La Mesa et al., 2011). However, only a part of the Italian MPAs enforcement is effective and allows fish populations to replenish and spillover of adult fish to occur (Guidetti et al., 2008).

In our study we refer to the provisioning service *Food*, to evaluate the benefits of the conservation of fish stocks through the Italian MPAs. The choice of this ecosystem service has been determined by three considerations. First, the fact that food provisioning in the form of fisheries catch is one of the most important services derived from marine and coastal ecosystems (UNEP, 2006). Second, that the protection of fish populations through the Italian MPAs, and their social benefits, is a much debated topic. Third, on this issue there is an adequate scientific literature which concerns the MPA of Portofino and, more generally, the Italian MPAs.

1.6 Aim of the study

In this study, we aim to estimate the economic value of changes in ecosystem services from the political scenario in which the annual funding from the State for the conservation of marine biodiversity through the Italian MPAs remains current, to the political scenario in which the funds are increased to allow for more conservation. To meet this aim, we implemented a Choice experiment at the Portofino Marine Protected Area.

We carried out the research at the Portofino MPA, which is one of the 27 Italian Marine Protected Areas, because the director gave us the availability to perform the study in the territory and provided us with information about the management of the MPA.

2. Material and methods

2.1 The choice experiment

In this study we use a Choice experiment for the economic estimate of three ecosystem services provided by three habitats and species protected through the Italian Marine Protected Areas.

In a Choice experiment is asked participants to answer a questionnaire in which they have to choice between alternatives with different levels of particular attributes. The different alternatives are arranged in pairs, and the respondents are asked to choose between them and a status quo alternative. This is known as "choice set", which is composed of three options: Option A, Option B, *Status quo*.

In our case, we have identified four attributes. Three attributes are represented by three ecosystem services provided by some habitats and species protected through the Italian Marine protected areas. A fourth attribute, *Cost* attribute, has been included in order to measure the economic value of ecosystem services.

The habitats and species that were selected for the study are the *Posidonia oceanica* meadows, the coralligenous and fish species. *Posidonia oceanica* is an endemic seagrass of the Mediterranean Sea. During the 20th century, and certainly more especially since the 1950s, posidonia meadows has considerably regressed, especially due to human activities (Boudouresque et al. 2006; Bianchi et al., 2008). Mediterranean coralligenous, which is affected by many causes of anthropic disturbances (Ballesteros, 2006; Relini, 2009), is a complex of biotic communities rich in biodiversity that form a landscape of sciaphilic animals and plants with concretions composed of calcareous algae (Relini, 2009). We have selected the posidonia meadows and coralligenous because they are the two most important "hot spots" of biodiversity of the Mediterranean Sea (Boudouresque et al. 2006; Ballesteros, 2006) and some of the most important targets of biodiversity conservation through the Italian MPAs (progettoisea.it).

The protection of fish populations through the Marine protected areas contributes to the conservation of the resources of the Italian seas and preserve the artisanal fishing (Cattaneo & Tunesi, 2007), and is one of the main targets of biodiversity conservation through the Italian MPAs (progettoisea.it).

For each habitat or species we have identified an ecosystem service. For the *Posidonia oceanica* meadows we have chosen the ecosystem service *Climate regulation*. This

ecosystem service has been selected for its importance in environmental policy, with particular reference to the conservation of the Magnoliophytes to reduce greenhouse emissions and increase Corg stores (Fourqurean et al., 2012). For coralligenous we have identified the *Aesthetic benefits* ecosystem service; in fact, for this service it is interesting to make a monetary evaluation through the use of Stated Preference Methods which allow the evaluation of the cultural ecosystem services (Potts et al., 2013) and the existence value (Pearce & Turner, 1991). In our study, in particular, we refer to the area of seabed occupied by the gorgonian *Paramuricea clavata*, because the *facies* characterized by this species represents the climax of the exposed cliffs of coralligenous (Bavestrello et al., 1997). For fish populations, it has been identified the Provisioning service *Food*. In fact, if well managed Marine Protected Areas allow fish populations to replenish and spillover (migration of fish species from the MPA to the outside) of adult fish to occur (La Mesa et al., 2011; Guidetti et al., 2008).

For each ecosystem service, we have identified two levels of provision, *Present* and *Growth*, based on two political scenarios: the scenario in which the current funding from the State to the Italian MPAs is maintained, and the hypothetical scenario where funding from the State to the Italian MPAs are increased. The *Present* level expresses the flow of each ecosystem service provided by the habitats or the species with the present share of funding for the Marine protected areas. The level *Growth* expresses the change in the flow of each ecosystem service provided by the habitats and the species in the political scenario in which funding for MPAs would increase over the present political scenario, allowing for greater conservation of ecosystems[1]

The *Cost* attribute in our study is represented by an annual increase in taxation for the 24.6 million households in Italy - Source: censimentopopolazione.istat.it - (Christie & Rayment, 2012; Jobstvogt et al., 2014), the incomes of which would be used for the conservation of posidonia meadows, coralligenous and fish populations by the Italian MPAs. To determine the increase in annual taxation we did four assumptions: increase of 25%, 50%, 75%, 100% over the monetary share transfer to the Italian MPAs in 2014 (4 992 906 €, source: *Ministero dell'ambiente e della tutela del territorio e del mare* (Italian Ministry of the Environment, Land and Sea)). We have chosen the hypothesis of 50%. This hypothesis has been chosen on the basis of two considerations. (1) The assumption of 50% is the recovery of transfers to the level of 2008, from which there has been a gradual decrease in the ordinary transfers from the Ministry of the Environment for the Italian MPA. (2) We rejected the assumption of 25% because it has led to a basic value of the

[1] In the case of *Climate regulation* ecosystem service, a hypothesis of our study is that *Posidonia oceanica* meadows can recover through the adoption of conservation policies. However, it is important to take into account that natural recolonization of posidonia meadows is complex and varies with the geographical area (Blasi & Cavalletti, 2009; Meinesz & Lefevre, 1984, Boudoresque et al., 2006). In particular, it should not always be assumed that the meadows will recover from the disturbance, as they can undergo phase shifts: the meadow disappears and is replaced by other seagrass or by algae which tend to replace the *Posidonia oceanica* on the dead matte (Bianchi & Buia, 2008), and return to the original state may be lengthy and difficult (Hughes et al., 2005).

In the case of the MPA of Portofino, the assessment of the state of conservation of the meadows is made complicated by the different characteristics of the substrate in different areas, and the difficulty in comparing the most recent studies with those prior to the establishment of the MPA (Montefalcone et al., 2009 ; Lasagna et al., 2008; Montefalcone et al., 2006). However it is possible make some observations. In particular, it is observed an increase of the area of the meadow of the western side of the C zone, compared to previous data (despite signs of regression of the lower limit), while the more recent anthropized eastern side shows signs of regression of the upper and lower limits (Lasagna et al., 2008).

attribute Cost that we judged to be too low to determine a choice of respondents different from the *status quo*; we rejected the hypothesis of 75% because we judged unlikely. To determine the levels of the attribute, we have multiplied the value obtained (€ 0.10) to a factor of 10, as many times as the levels of the attribute *Cost* established during the *Experimental design*. In our study, the attribute *Cost* assumes one of three levels: € 0.10, € 1, € 10 per year.

Fig. 1 shows an example of a *choice set* that has been put to the respondents (see Fig. 3 for the English translation).

In addition to the choice set, each participant had to fill a questionnaire in order to get additional information about the choices of respondents and socio-demographic information (for a detailed description, see the section on the elaborate on the *Experimental design, Section 2.2*). In Fig. 2 the questionnaire is shown (see Fig. 4 for the English translation).

We have chosen to interview the general public who attended in summer the MPA of Portofino. This choice was dictated by several reasons. First, we felt that, considered the ecosystem services treated in the study, to interview specific stakeholders could lead to the risk of generating unidirectional answers. For example, the willingness to pay for the *Aesthetic benefits* ecosystem service provided by coralligenous could lead to a distortion in the responses of divers. The service *Food* could lead to distortions in the responses by fishermen (professional or sports). Second, the issue of preserving the environment and funding to MPAs has acquired public importance; it is therefore scientifically important to know the opinion of the general public.

Before administer the Choice experiment, each interviewed were presented species and ecosystems considered (posidonia meadows, coralligenous and fish populations) showing plasticized enlarged photographs of habitats and species (*Posidonia oceanica*; an area of seabed occupied by the gorgonian *Paramuricea clavata*; and the fish *Diplodus vulgaris*) and answering any questions of ecological nature.

To analyze the choices we used the statistical model known as multinomial logit model. For estimating the implicit price of ecosystem services we used a model where the dependent variable is represented by the choice of respondents (Option A, Option B or Status quo), and the independent variables are the ecosystem services and the attribute *Cost* of Choice experiment; the willingness to pay was estimated by dividing the coefficients of the attributes of the services with the coefficient of the attribute *Cost*. We have also developed additional multinomial logit models, with the aim to evaluate the relationships between the different variables taken from the choice set and the supplementary

questionnaire. In addition, we created contingency tables and bar graphs, in order to identify the points of consistency between the answers and trends in the choices and decisions of the respondents. Statistical analysis was performed using SPSS software.

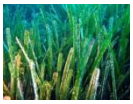
	Opzione A	**Opzione B**	**Opzione C** ***Status quo***
Regolazione del clima (*Praterie di Posidonia*) **NOTA:** ***La Posidonia assorbe la CO_2, aiutando a ridurre il <u>riscaldamento globale</u>***	**ATTUALE** 	**ATTUALE** 	**ATTUALE** 
Benefici estetici (*Coralligeno*)	**ATTUALE** 	**CRESCITA** 	**ATTUALE** 
Approvvigionamento di cibo dal mare (*Pesci*)	**ATTUALE** 	**CRESCITA** 	**ATTUALE** 
Costo per famiglia per anno	**0,10 €**	**1 €**	**0 €**
Io preferisco	☐	☐	☐

Fig. 1. Choice set example. See Fig. 3 for the English translation.

1. Attribuisca, per piacere, un punteggio di importanza da 1 a 4 a ciascun attributo:	
Regolazione del clima (Posidonia)	
Benefici estetici (Coralligeno)	
Approvvigionamento di cibo dal mare (Pesci)	
Costo (Tasse aggiuntive)	

2. Se Lei avesse 100 € in più rispetto al suo budget attuale, quanto sarebbe disposto a spenderne per le Aree marine protette?

_____ **€**

4. Dove risiede?

☐ Nei comuni presenti all'interno dell'Area marina protetta

☐ Altrimenti per piacere specifichi _____

5. Quanti anni ha?

☐ < 18 ☐ 18-25 ☐ 26-35 ☐ 36-45

☐ 46-55 ☐ 56-65 ☐ 66-75 ☐ 76+

6. Quale è la sua professione?

_____

Fig. 2. Supplementary questionnaire. See Fig. 4 for the English translation.

	Option A	Option B	Option C *Status quo*
Climate regulation (*Posidonia meadows*) **NOTE:** ***Posidonia absorbs CO_2, helping to reduce global warming***	**PRESENT** 	**PRESENT** 	**PRESENT** 
Aesthetic benefits (*Coralligenous*)	**PRESENT** 	**GROWTH** 	**PRESENT** 
Food (*Fishes*)	**PRESENT** 	**GROWTH** 	**PRESENT** 
Cost per household per year	**0,10 €**	**1 €**	**0 €**
I prefer	☐	☐	☐

Fig. 3. Choice set example. English translation.

1. Assign, for pleasure, a score of importance from 1(minimum) to 4 (maximum) to each attribute:	
Climate regulation (Posidonia)	
Aesthetic benefits (Coralligenous)	
Food (Fishes)	
Cost (Additional taxes)	

2. If you had € 100 more than in your current budget, how much you would be willing to expend for Marine Protected Areas?

_____ **€**

4. Where do you live?

☐ In the towns present within the Marine protected area

☐ Otherwise please specify _____

5. How old are you?

☐ < 18 ☐ 18-25 ☐ 26-35 ☐ 36-45

☐ 46-55 ☐ 56-65 ☐ 66-75 ☐ 76+

6. Your current type of occupation/ employment?

_____

Fig. 4. Supplementary questionnaire. English translation.

2.2 Experimental design

The experimental design was divided into the following steps.

STEP 1: the number of attributes and the number of levels for each attribute have been identified. This step has been made taking into account:

a. The ability of the attribute levels to respond to the capacity of the aspects and ecological components considered to provide ecosystem services. The starting conditions must be consistent and compatible with the considerations that were previously made about the ecosystems selected and which had been thorough operation, and related ecosystem services provided by them.

b. The number of people who wanted to interview, and the time available to collect data on the territory. The number of persons to be interviewed should be compatible with the way in which interviews are carried out and the funds available to carry out the data collection. From this point of view, the following considerations were made. It has chosen to do the interviews with people on the street stops at the commune of Portofino. This would have led to interview a number of people compatible with the difficulties inherent in this type of interviews: people's willingness to stop and willingness to respond to the questionnaires, risk of verbal or physical abuse. In addition, the data collection should be compatible with the time in which the interviewer would be present in the territory to collect data (so it was necessary to consider the costs of accommodation, food and travel. These costs have been supported by the author in person).

c. The economic attribute and the economic attribute levels that could be identified in accordance with the directions of the working group economist Professor Barbara Cavalletti.

STEP 2: identifying the number of combinations of the levels of the attributes, with the aim of identifying all possible profiles can be generated for the choice tasks. If the number of attributes and the number of levels is high, then the number of combinations is so high as to imply a very high number of interviews order to be able to consider all. Therefore, it was decided to refer to 4 attributes, and 2 levels for each attribute. All the possible

combinations are therefore calculated (using the R software). The number of possible combinations was found to be 28. It was therefore decided to try to interview at least 5 people for each combination of choice task. In this way the maximum number of respondents would have been 140, in the case where all combinations of attribute levels had had sense.

STEP 3: Once combinations have been identified, were selected combinations that had a clear logical sense.

In a first stage, it was excluded one of two combinations for which the level of the attributes in option A of a combination resulted the same in option B of another combination; and the level of attributes in option B of the first combination was equal to the attribute level in option A of the second combination. Here below is an example (Tables 1 and 2):

Table 1

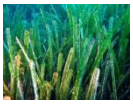
	Option A	**Option B**
Climate regulation (*Posidonia meadows*)	**PRESENT**	**GROWTH**
Aesthetic benefits (*Coralligenous*)	**PRESENT**	**PRESENT**
Food (*Fishes*)	**PRESENT**	**PRESENT**
Cost per household per year	**0,10 €**	**1 €**

Table 2

	Option A	**Option B**
Climate regulation (*Posidonia meadows*)	**GROWTH**	**PRESENT**
Aesthetic benefits (*Coralligenous*)	**PRESENT**	**PRESENT**
Food (*Fishes*)	**PRESENT**	**PRESENT**
Cost per household per year	**1 €**	**0,10 €**

Subsequently a small pilot study was made, in which the remaining questionnaires of the choice experiment were subjected to a total sample of 20 people. In two phases: in Rome, before leaving for Portofino to collect data, to people who regularly attend the Italian Marine Protected Areas, and later in Portofino. In this way, it was possible to exclude the combinations that generated questionnaires for which respondents answered: "answer for me does not make sense", and gave as a reason the undecidability of the propositions created with the proposed combinations. Such combinations are those in which:

a) The level of environmental attributes in option A or option B were equal to those of the status quo; for example:

	Option A	**Option B**	**Option C** ***Status quo***
Climate regulation (*Posidonia meadows*) **NOTE:** ***Posidonia absorbs CO_2, helping to <u>reduce global warming</u>***	**PRESENT** 	**GROWTH**  	**PRESENT** 
Aesthetic benefits (*Coralligenous*)	**PRESENT** 	**GROWTH**  	**PRESENT** 
Food (*Fishes*)	**PRESENT** 	**GROWTH**  	**PRESENT** 
Cost per household per year	**0,10 €**	**1 €**	**0 €**
I prefer	☐	☐	☐

b) The level of the attribute cost for options A and B is the same with combinations of different ecological attributes; for example:

	Option A	**Option B**	**Option C** ***Status quo***
Climate regulation (*Posidonia meadows*) **NOTE:** ***Posidonia absorbs CO_2, helping to reduce global warming***	**PRESENT** 	**GROWTH**  	**PRESENT** 
Aesthetic benefits (*Coralligenous*)	**PRESENT** 	**GROWTH**  	**PRESENT** 
Food (*Fishes*)	**GROWTH**  	**GROWTH**  	**PRESENT** 
Cost per household per year	**1 €**	**1 €**	**0 €**
I prefer	☐	☐	☐

c) At the same level of environmental attributes in options A and B, corresponded a different level of the cost attribute; for example:

	Option A	**Option B**	**Option C** ***Status quo***
Climate regulation (*Posidonia meadows*) **NOTE:** ***Posidonia absorbs CO_2, helping to reduce global warming***	**PRESENT** 	**PRESENT** 	**PRESENT** 
Aesthetic benefits (*Coralligenous*)	**PRESENT** 	**PRESENT** 	**PRESENT** 
Food (*Fishes*)	**GROWTH** 	**GROWTH** 	**PRESENT** 
Cost per household per year	**0,10 €**	**1 €**	**0 €**
I prefer	☐	☐	☐

At the end of the selection process the number of questionnaires that was found to have sense was 9.

STEP 4: The number of questionnaires made it possible to add a third level of the attribute cost consistent with the times and thus the costs of self-financing of the data collection. The final number of questionnaires so obtained is found to be 27. Thus, a minimum number of 5 interviews for combination have been collected, and then continue until funds are exhausted, proceeding with interviews in which the questionnaires were chosen randomly until reaching 150 interviews in the two weeks collecting data set.

In *Appendix B* we report a comparison between the number of participants in our study and the number of participants in other studies on the economic valuation of benefits from biodiversity conservation using the Choice experiment method.

In addition to the Choice task it was decided to add to the Choice experiment questionnaire the following questions:

- *Score of importance*. In order to have additional information about the relative value assigned to each attribute, it was decided to ask respondents to assign a rating of importance 4 to 1 to the 4 attributes of the Choice task.

- *If you had € 100 more than in your current budget, how much you would be willing to expend for Marine Protected Areas?*

With this question it wanted to have additional information about the *Cost* attribute with the aim to learn about the willingness to pay for the Italian AMPs. The purpose is to evaluate, during data processing, if integrate it with other information of Choice experiment and to have an estimate usable for the evaluation of the *Cost* attribute for future studies.

- *Residence.* It was decided to ask the respondent (1) if he/she reside in the towns inside the MPA Portofino (or in another Italian MPA), (2) the commune or the region in which it resides.
- *Age.* the respondent was asked to choose between 8 age classes.
- *Profession.*
- *Gender* (M / F).

2.3 Sample composition

The onsite face-to-face survey was conducted during the summer season 2014 (month of August) at the municipality of Portofino (Liguria, Italy). Our sample is mainly composed by tourists (144 persons), while 6 people were resident in the municipalities present in the territory of the Portofino MPA. Table 3 shows the composition of our sample according to gender, age, profession and location.

Table 3. Sample composition (percentage values).

	Sample (n=150)
Gender	
Male	50.7%
Female	49.3%
Age	
< 18	4.0%
18-25	22.0%
26-35	30.0%
36-45	19.3%
46-55	12.0%
56-65	8.0 %
> 65	4.7%
Profession	
Manager	2.0%
Employee	40.7%
Self-employed	27.3%
Pensioner or Unemployed	5.3%
Student	23.3%
Unknown	1.3%
Location	
Northern Italy	64%
Center of Italy	8%
Southern Italy	8%
Unknown	20%

2.4 Statistical models we use in the study

In our study, to analyze data we refer to the use of contingency tables (*Section 3*) and multinomial logit models (*Section 4*)

Contingency tables

Given a set of observed data, they can be arranged in a contingency table. What is a contingency table? A contingency table is a type of table in a matrix format that displays the frequency distribution of the variables. In the simplest case, two dichotomous variables are involved; table rows represent the results of a variable, and the results of the other columns. The numbers in the table are the frequencies that correspond to a particular combination of categories. A contingency table allows us to organize the data in a tabular format. The contingency table can be used not only to organize the observed values, but also to organize the expected values.

Below is an example of a contingency table A x B, made up of two variables (Gnisci & Pedon, 2011; Pagano & Gauvreau, 2003).

		B				
		b_1	b_2	…	b_j	TOTAL
A	a_1	x_{11}	x_{12}	…	x_{1j}	x_{1+}
	a_2	x_{12}	x_{22}	…	x_{2j}	x_{2+}
	…					…
	a_i	x_{i1}	x_{i2}	…	x_{ij}	x_{i+}
	TOTAL	x_{+1}	x_{+2}	…	x_{+j}	$N = x_{++} = \sum_{i=1}^{i} \sum_{j=1}^{j} x_{ij}$

In each cell of the contingency table appear the observed frequencies (x) in which the two events occur simultaneously, for example the number of people with blue eyes (the first level of the variable A) with a science degree (first level of the variable B). So, x_{11} indicates how many times an event occurred that has the characteristic of the first level of the first variable, and the first level of the second variable; x_{12} indicates how many times there has been an event that is part of the first level of the first variable; and so on.

The first number in subscript indicates the line (i), the second number the column (j), together (ij) they indicate the corresponding cell at the intersection of the i-th row and j-th column. The total number of the frequencies of the table (N), which is the sum of all the cells of the table, is also indicated by the expression x_{++}, where the + sign refers to the sum of all the rows in the first case and all the columns in the second case. The sums of each line or each column, called "marginal values" row or column, are in this symbolism indicated, respectively, and with x_{i+} and x_{+j}.

The tables A and B always have a number ab (or ij) of cells and can be composed of variables in two or more dimensions. The easiest table is 2x2; more complex tables are 2x3, 2x4, 3x3, 5x7, and so on.

The first stage in the process to make a statistic decision is to define an hypothesis problem, where a null hypothesis (H_0) and an alternative (H_1) one are compared. Usually the null hypothesis is formulated with the intention of rejecting it, i.e., it is the negation of the hypothesis that we try to verify. If we reject the null hypothesis, we support the alternative hypothesis.

In the study of contingency tables it is of interest to asses if the two characteristic there related are statistically associated or not. Then the hypothesis problem is such that

H_0: the two variables are independent

H_1: the two variables are not independent

To verify the given problem we start from the table, with the same marginal totals, corresponding to the independence case. We know how to obtain such table, in each cell the expected frequency is

$E_{ij}=x_{i+}x_{+j}$

We then carry on our test by computing the “average distance” between the observed and the expected table:

$$\chi^2 = \sum_{ij=1}^{r,c} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

The probability distribution describing the behavior of this sum under the null hypothesis is a chi-square (χ^2) with (r - 1) (c - 1) degrees of freedom.

Now given a significance level α if the probability (p) of observing a value equal or more extreme of the computed statistics is smaller than the significance level ($p < \alpha$), we reject the null hypothesis and accept the hypothesis H_1 of association between the two variables.

Multinomial logit model specification

The term "multinomial logit regression" includes, in a broad sense, a variety of models. Conditional logit models are used to model consumer choices (for further reading, on conditional models, see Hoffman & Duncan, 1988). Below we report a specification of the multinomial (sometimes called conditional, see Bermann et al., 2006, and Kenter et al., 2011) logit models we used in our study.

Choice experiment is based on two concepts: the Lancaster's characteristics theory of value (Lancaster, 1966) and Random utility theory (Mc Fadden, 1974; Manski, 1977). The Lancaster theory states that when an alternative is chosen, it is not preferred per se but for the attributes that compose it (Kenter et al., 2011; Lancaster, 1966). In valuing ecosystem services, these alternatives consist of environmental scenarios, composed of a number of ecosystem services as attributes (Kenter et al., 2011).

Random utility theory says that not all of the determinants of utility derived by individuals from their choices is directly observable to the researcher, but that an indirect determination of preferences is possible (Bermann et al., 2006; McFadden, 1974).

The utility function for a representative consumer can be decomposed into observable and stochastic sections:

$$U_{An} = V_{An} + e_{An}$$

where U_{An} is the utility held by an individual n from a particular alternative A, V_{An} is the systemic or observable portion of utility that individual n has for alternative A, and e_{An} is the random or unobservable portion of the utility that individual n has for an alternative A.

The probability function (defined over the alternatives which an individual faces assuming that the individual will try to maximize their utility) is expressed as:

$$P(A|C_n) = P[(V_{An} + e_{An}) > (V_{jn} + e_{jn})] = P[(V_{An} - V_{jn}) > (e_{jn} - e_{An})] \quad \forall A \neq j$$

for all j options in choice set C_n

We can use multinomial logit models to determine the probability to choose A over j options (Bermann et al., 2006; Hanley & Barbier, 2009):

$$P(U_{An} > U_{jn}) = \frac{\exp(\mu V_A)}{\sum j \exp(\mu V_j)} \qquad \forall A \neq j$$

where μ is a scale parameter which relates to the variance of the error component of the random utility model; and j are all the other options the individual could have chosen instead of A. The multinomial logit model is structured such that the probability of choosing alternative A depends on the utility of that alternative relative to the utility of all other alternatives (Christie & Rayment, 2012).

To model the information collected from the questionnaire, each choice set has three lines of code that combines the attribute levels, ASCs and socio-economic variables (Bermann et al., 2006).

The data matrix appeared in the form:

Option A:

$V_A = ASC_A + \beta_{attributes} X$

Option B:

$V_B = ASC_B + \beta_{attributes} X$

Status quo:

$V_C = \beta_{attributes} X$

Where: V is the conditional indirect utility, $ASC_{A,B}$ are the alternative specific constants for each choice option, $\beta_{attributes}$ is a vector of coefficients associated with the attributes X and levels.

If one of the attribute is a reflection of cost, we can calculate tradeoffs as implicit prices:

$$\text{Implicit price} = -\frac{\beta \text{ non-market attribute}}{\beta \text{ monetary attribute}}$$

Appendix. Comparison of the sample (Number of participants) in studies on the economic valuation of benefits from biodiversity conservation using the Choice experiment method

To determine the number of respondents to which put the interviews we proceeded as follows.

(1) We have identified the number of combinations of the levels of the attributes, with the aim of identifying all possible profiles can be generated for the choice sets; then we have selected combinations that had a clear logical sense. The final number of questionnaires so obtained is found to be 27.

(2) A minimum number of 5 interviews for combination have been collected and then proceeded with interviews in which the questionnaires were chosen randomly.

(3) The data collection continued until funds are exhausted, compatibly with the time in which the interviewer would be present in the territory to collect data (so it was necessary to consider the costs of accommodation, food and travel. These costs have been supported by the author in person). The final number of interviews obtained was 150. The number of 150 interviews is similar to other works on the valuation of economic benefits of biodiversity conservation through the Choice experiment method (Tab. 4). More details on the sampling plan and the number of interviews are presented in the paragraph Experimental Design (Paragraph 2.2).

Table 4. Comparison of the sample (Number of participants) in studies on the economic valuation of benefits from biodiversity conservation using the Choice experiment method

Authors (*Journal*)	Geographic area	Aim of the study	Number of participants
Bergmann et al., 2006 *Energy Policy*	Scotland	*To estimate the magnitude of external costs and benefits, produced by renewable energy investments, on wildlife, landscape quality and air quality*	**211**
Christie & Rayment, 2012 *Ecosystem services*	England and Wales	*To demonstrate the potential ecosystem services benefits that can be derived from biodiversity conservation policies in England and Wales*	**153**
Schuhmann et al., 2013 *Journal of Environmental Management*	Caribbean island of Barbados	*To estimate the economic value of marine biodiversity to recreational SCUBA divers in Barbados*	**165**
Blasi et al., 2015 *PhD Thesis*	Portofino, Italy	*The monetary valuation of some ecosystem services provided by some of the most important habitats and species protected by the Italian Marine Protected Areas, with the aim of showing the benefits of marine biodiversity conservation through the Italian MPAs*	**150**

3. Descriptive analysis of contingency tables

We created contingency tables and bar graphs by crossing the variables of Choice experiment and of the additional questionnaire.

Below are presented the contingency tables and for each of them is accomplished a deep descriptive analysis. The comments that follow each contingency table, and to its bar graph, are aimed at make a preliminary survey about the choices made by the respondents in relation to the various questionnaires that were them places: Choice experiment; Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas; Age; and Score of importance attributed to the attributes. We will identify the points of consistency between the answers, and trends in the choices and decisions of the population interviewed. This phase of the data processing is also aimed at assessing the next choices and decisions in the application of the following statistical models.

Below we report the joint distributions of the variables in the following order:

- Contingency tables with numerosity of cell that allow the calculation of statistical indexes in a reliable manner (Tables 1-3).

- Joint distributions of the variables for which the Chi – square test indicates that there is association between the variables, but it is not very reliable because of the sample size.

- Joint distributions for which it was not possible to do an inferential analysis. In this case, we decided not to present the contingency tables but only the bar graphs, and we have made a qualitative analysis.

Table 1. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas and Level of Climate regulation ecosystem service (provided by the Posidonia oceanica meadows) in the Choice experiment (Present/Growth). Absolute and percentage values as regards the ecosystem service (columns), it also includes the result of the chi-square test.

			Level of *Climate regulation* ecosystem service		Total
			PRESENT	GROWTH	
Level of willingness to spend more	HIGH	No. of answers	13	18	31
		Percentage per column	22,4%	22,2%	22,3%
	MEDIUM	No. of answers	20	39	59
		Percentage per column	34,5%	48,1%	42,4%
	LOW	No. of answers	9	23	32
		Percentage per column	15,5%	28,4%	23,0%
	NONE	No. of answers	16	1	17
		Percentage per column	27,6%	1,2%	12,2%
Total		No. of answers	58	81	139
		Percentage per column	100,0%	100,0%	100,0%

Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23,112	3	,000

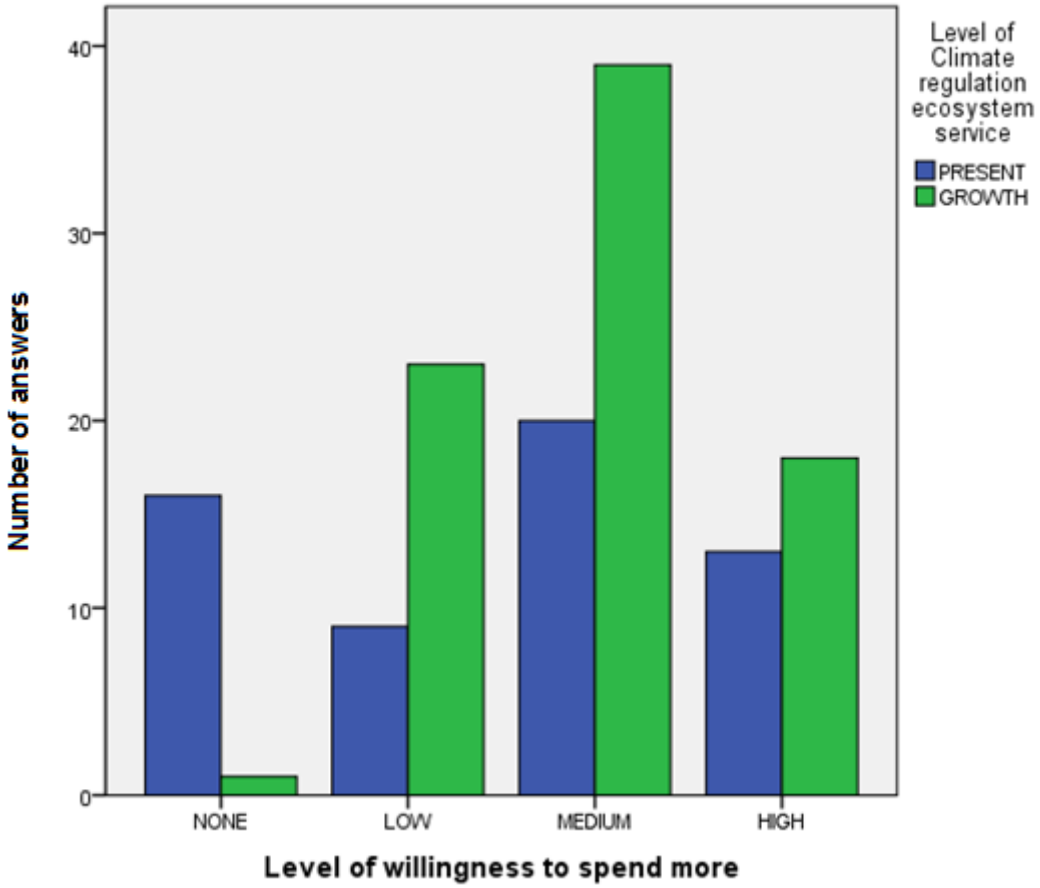


Figure 1. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the ecosystem service *Climate regulation*. Number of answers.

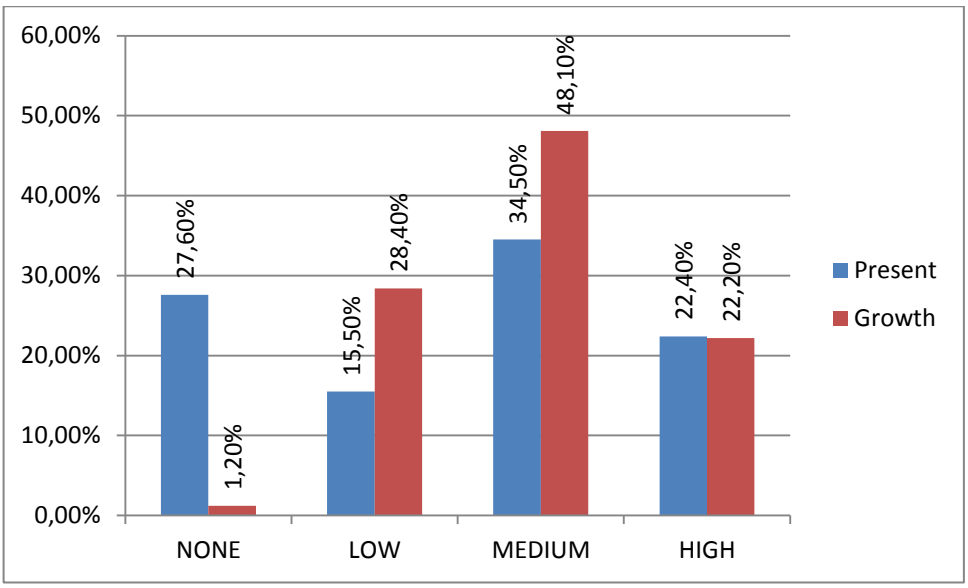


Figure 2. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the ecosystem service *Climate regulation*. Percentages as regards ecosystem service.

Comment. The analysis of the contingency table (Table 1) and the observation of bar graphs (Figure 1, Figure 2) of the joint distribution of *Payment per year* and the *Level of the ecosystem service Climate regulation* (considered without distinction gender) shows that the increase of the willingness to pay an additional tax to enhance the flow of ecosystem services by the 3 ecosystem aspects or components considered (posidonia meadows, coralligenous and fish populations), corresponds to a growth of the element of *choice set* that refers to the service of *Climate regulation*.

We observed that the higher relative number of people who have chosen an option of Choice experiment with the value "Growth" correspond to the level of *Payment per year* "Medium" (48.1%), followed by the “Low” and “High" levels that have similar values (respectively 28.4% and 22.2%). Instead, almost all of the respondents who are not willing to pay additional taxes (16 of 17) chose combinations of attributes in which the level of service *Climate regulation* remains "Present".

The Chi-square test shows that there is association between the variables, with a p-value very low.

Table 2. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas and Level of Aesthetic benefits ecosystem service (provided by coraligenous) in the Choice experiment (Present/Growth). Absolute and percentage values as regards the ecosystem service (columns), it also includes the result of the chi-square test.

			Level of *Aesthetic benefits* ecosystem service		Total
			PRESENT	GROWTH	
Level of willingness to spend more	HIGH	No. of answers	7	24	31
		Percentage per column	16,3%	25,0%	22,3%
	MEDIUM	No. of answers	8	51	59
		Percentage per column	18,6%	53,1%	42,4%
	LOW	No. of answers	12	20	32
		Percentage per column	27,9%	20,8%	23,0%
	NONE	No. of answers	16	1	17
		Percentage per column	37,2%	1,0%	12,2%
Total		No. of answers	43	96	139
		Percentage per column	100,0%	100,0%	100,0%

Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41,759	3	,000

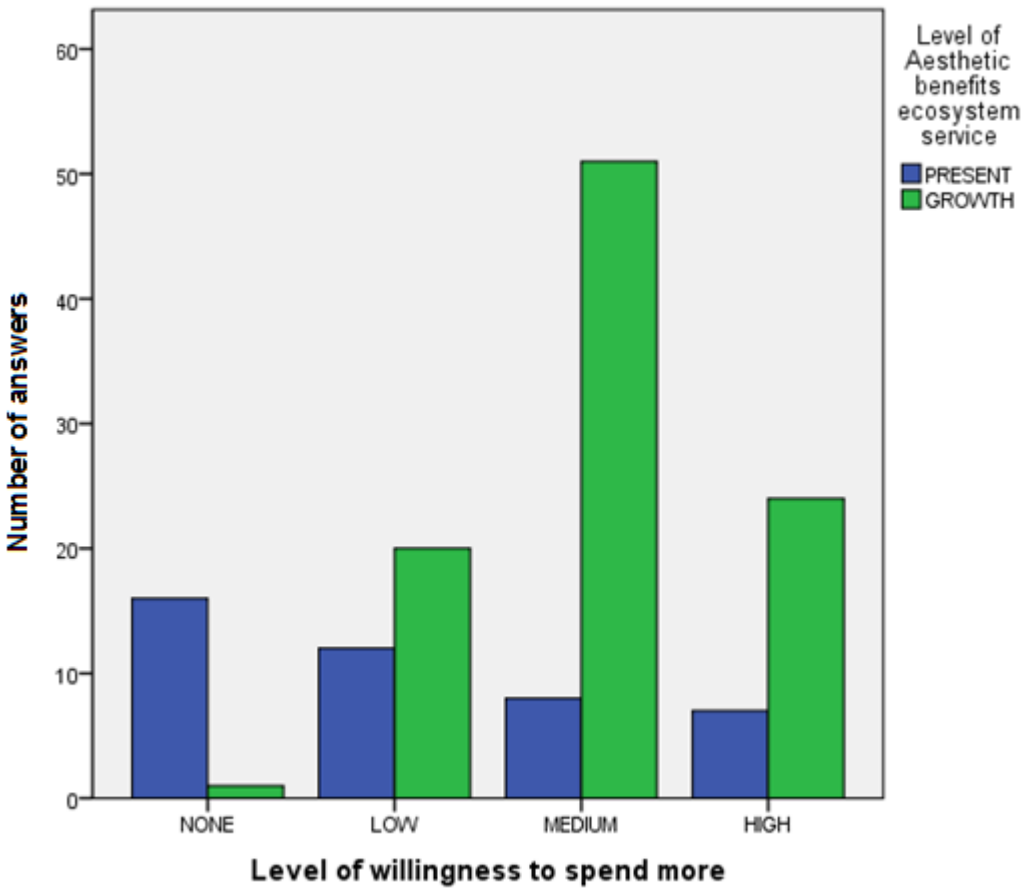


Figure 3. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the ecosystem service *Aesthetic benefits*. Number of answers.

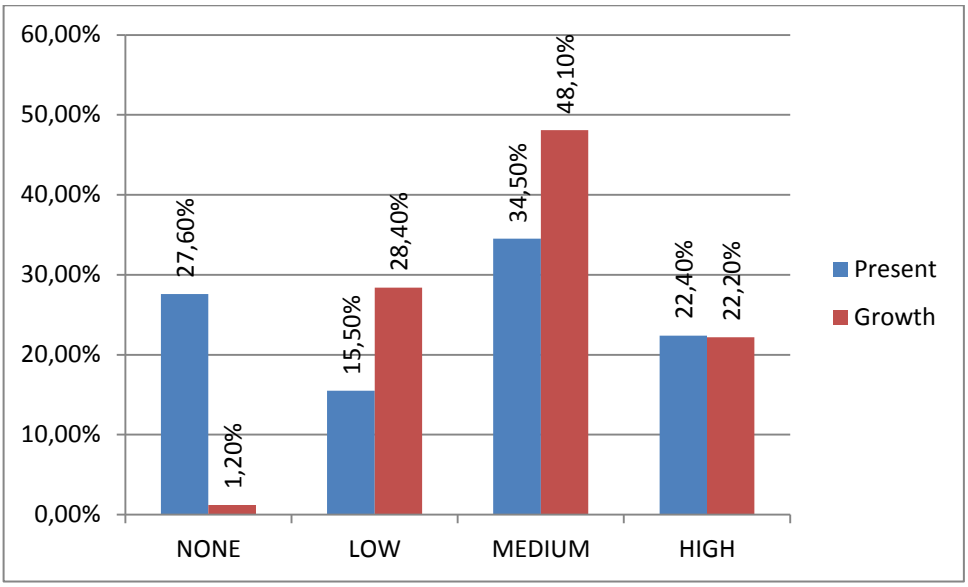


Figure 4. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the ecosystem service *Aesthetic benefits*. Percentages as regards ecosystem service.

Comment. Similarly to the case of the ecosystem service of *Climate regulation*, the contingency table (Table 2) and bar graphs (Figure 3 and Figure 4), regardless of gender, show an association between classes "High", "Medium" and "Low" of the Payment for the year and the level of ecosystem service *Aesthetic benefits* provided by coralligenous. In particular, it results that for the respondents that are willing to pay an annual additional tax of "Medium" level corresponds a value of the ecosystem service "Growth" much higher than the level "Present" (52 versus 7). An association, albeit less pronounced, also results considering the "High" level and the "Growth" (25 compared to 6), and the "Low" level and the "Growth" (20 compared to 12). Instead, those who said they would not be willing to pay additional taxes chose combinations of attributes in which the provision of ecosystem service by the coralligenous is "Current" (16 of 17).

The Chi-square test shows that there is association between variables, giving a p-value very low.

Table 3. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas and Level of Food ecosystem service (fishes) in the Choice experiment (Present/Growth). Absolute and percentage values as regards the ecosystem service (columns), it also includes the result of the chi-square test.

			Level of *Food* ecosystem service		Total
			PRESENT	GROWTH	
Level of willingness to spend more	HIGH	No. of answers	11	20	31
		Percentage per column	19,0%	24,7%	22,3%
	MEDIUM	No. of answers	13	46	59
		Percentage per column	22,4%	56,8%	42,4%
	LOW	No. of answers	18	14	32
		Percentage per column	31,0%	17,3%	23,0%
	NONE	No. of answers	16	1	17
		Percentage per column	27,6%	1,2%	12,2%
Total		No. of answers	58	81	139
		Percentage per column	100,0%	100,0%	100,0%

Chi-Square			
	Value	df	Asymp. Sig. (2-sided)
Chi-quadrato di Pearson	31,873	3	,000

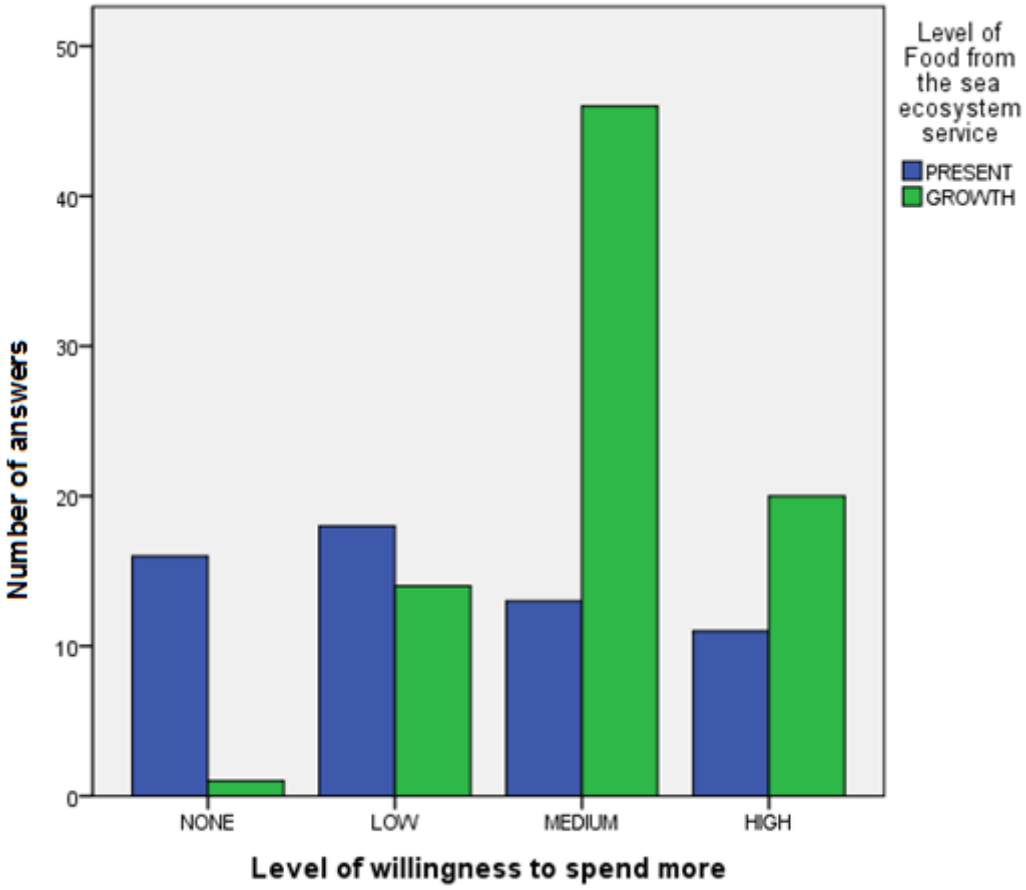


Figure 5. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the ecosystem service *Food*. Number of answers.

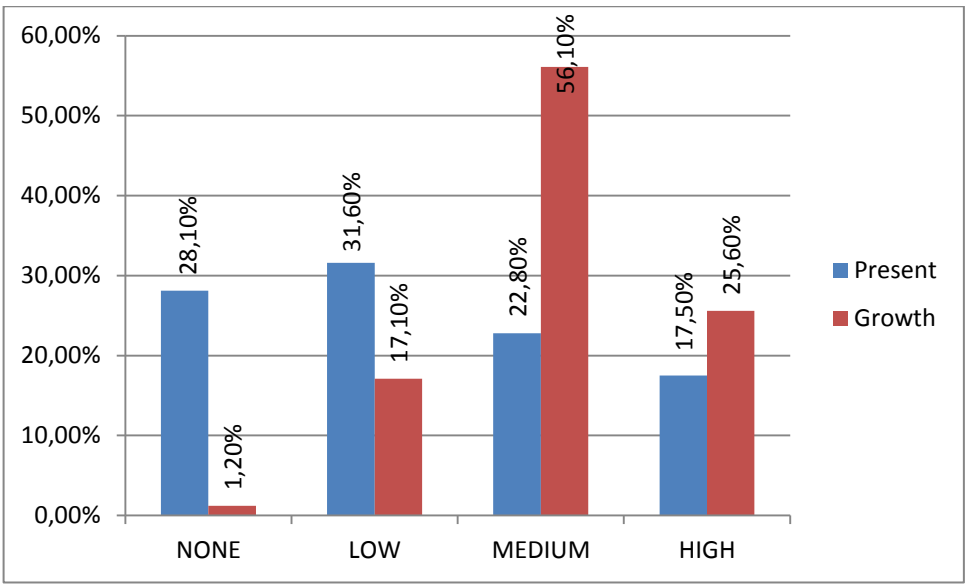


Figure 6. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the ecosystem service *Food*. Percentages as regards ecosystem service.

Comment. The contingency table (Table. 3) and bar graphs (Figure 5, Figure 6), considered regardless of gender, show an association between the "High" level of *Payment per year* and the "Growth" level of the ecosystem service *Food*; the same trend is observed for the "Medium" level. Instead, between the "Low" level of payment and the ecosystem service, a greater number of respondents chose options of *choice set* in which the level of *Food* remains "Present" compared to "Growth" (18 responses compared to 14). This datum is in countertendency with what was observed for ecosystem services *Climate regulation* and *Aesthetic benefits*.

Also in this case almost all of the respondents who are not willing to pay additional taxes chose combinations of attributes in which the level of ecosystem service remains "Present" (16 of 17).

The Chi-square test shows that there is association between variables, giving a p-value very low.

Considerations on contingency tables. Considering the marginal totals of contingency tables, it emerges that the additional tax that respondents are willing to pay that has the highest percentage value (42%) belongs to the class "Medium", which includes values ranging between 10 and 24 €. To this we can add the observation that 22.3% of

respondents are willing to pay an additional tax of the class "High" (€ 25-100). This indicates that the greater relative amount of respondents who attended the Marine Protected Area of Portofino is willing to pay an additional tax equal to, or greater than, that provided for in the Choice experiment (10 €) to increase the conservation of coastal marine ecosystems that provide the ecosystem services *Climate regulation*, *Aesthetic benefits* of Coralligenous and *Food*.

The comparison between the contingency tables relating to three ecosystem services show similar trends with regard to the classes "High", "Low" and "None" for the *Level of the willingness to spend more*. There is, however, a difference of class "Medium" of the *Level of willingness to spend more for year* of services *Climate regulation* and *Aesthetic benefits* compared to the service *Food*, which has a number of choices of the level "Present" greater than the level "Growth ".

- *Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas and Level of e the attribute "Cost" in the Choice experiment.* Graphics and comment.

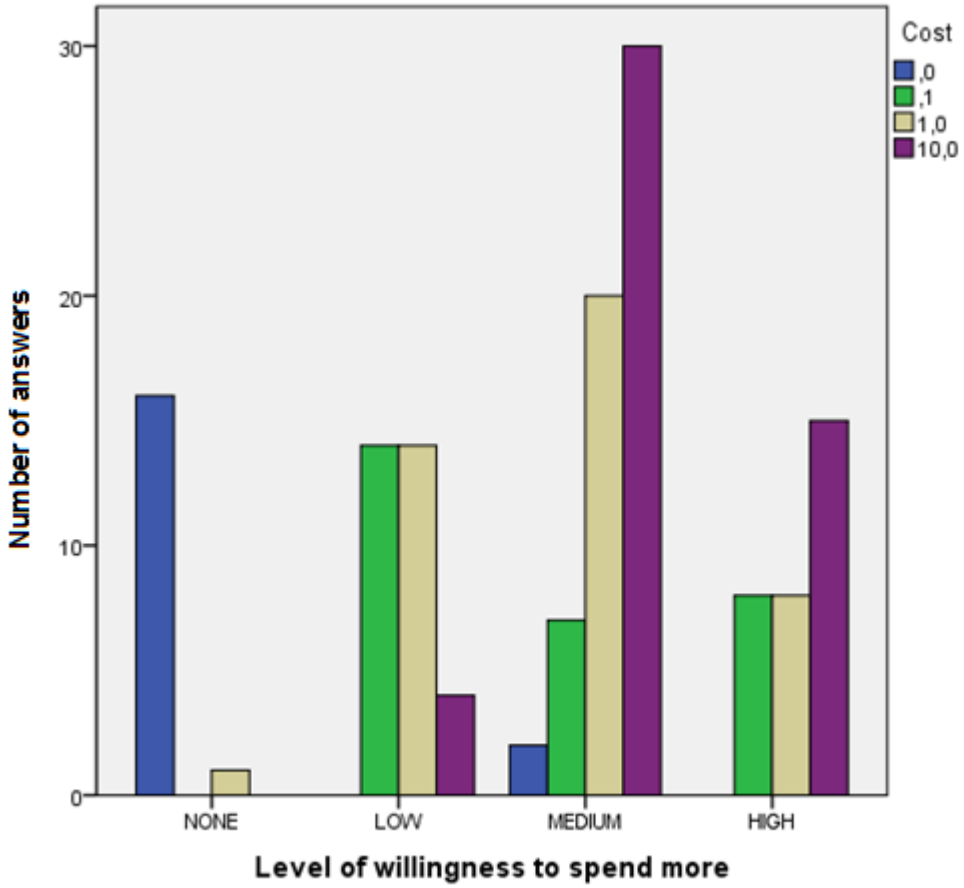


Figure 7. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by level of variation of the *Cost* attribute. Number of answers.

Comment. The Chi-square test indicates also in this case an association between the variables, while being not very reliable because of the sample size. A qualitative analysis of the bar graph (Figure 7) shows that respondents who chose options of Choice experiment in which the level of the attribute Cost was the highest (10 Euros) subsequently indicated a willingness to pay an additional tax for average level (10-24 Euros) or high level (25 to 100 Euros). Who has chosen options of Choice experiment in which the level of the tax is 1 Euro, subsequently indicated a willingness to pay a tax that is (in the order of

the number of answers): medium (25 to 100 Euros), low (0.1 - 9 Euros) or high (25 to 100 Euros). Finally, there is a clear match between the choice by the respondents of the option status quo of the Choice experiment and the subsequent unwillingness to pay any additional tax.

- *Chosen combination of the Choice experiment and Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* Graphics and comment.

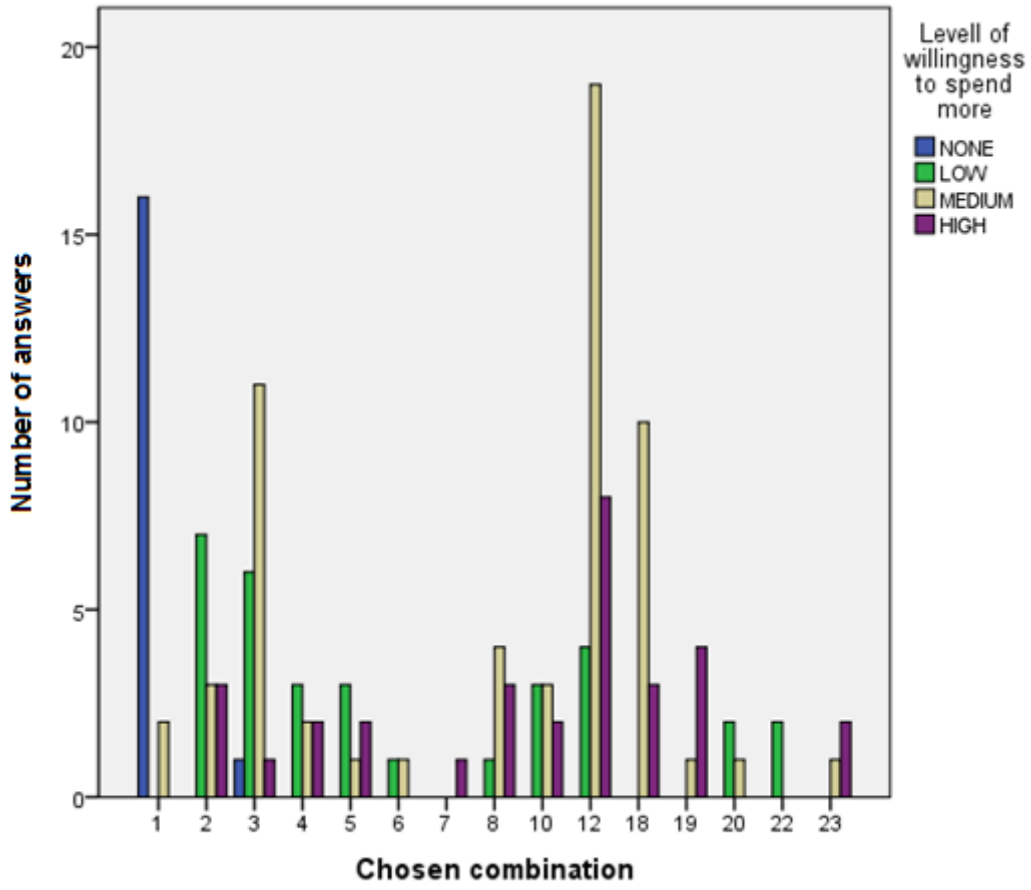


Figure 8. Chosen combination of the Choice experiment distinguished by Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas. Number of answers.

Comment. The Chi-square test indicates also in this case an association between the variables *Chosen combination* (the corresponding names of the combinations of attributes are shown in Table 4) and *Willingness to spend more*, while being not very reliable because of the sample size.

The bar graph (Figure 8) shows that between the different chosen combination corresponding to an overall high level of attribute values (12, 3, 18) and the *Willingness to spend more* there is an association. In particular, it is interesting that the most chosen level

of *Willingness to spend more* by these respondents is still Medium (10-24), then equal or superior to the higher level of taxation in the Choice experiment.

We also observe an association between the status quo option (1) and the level of Willingness to spend more "None", indicating a substantial consistency in the responses of who in the Choice experiment has chosen the option in which the level of the attribute Cost is zero and subsequently stated that, although he/she had at disposal an additional money compared to its current budget, would not be willing to dedicate it to additional taxation.

- *Frequency of the combination of the chosen attributes of the Choice experiment.*

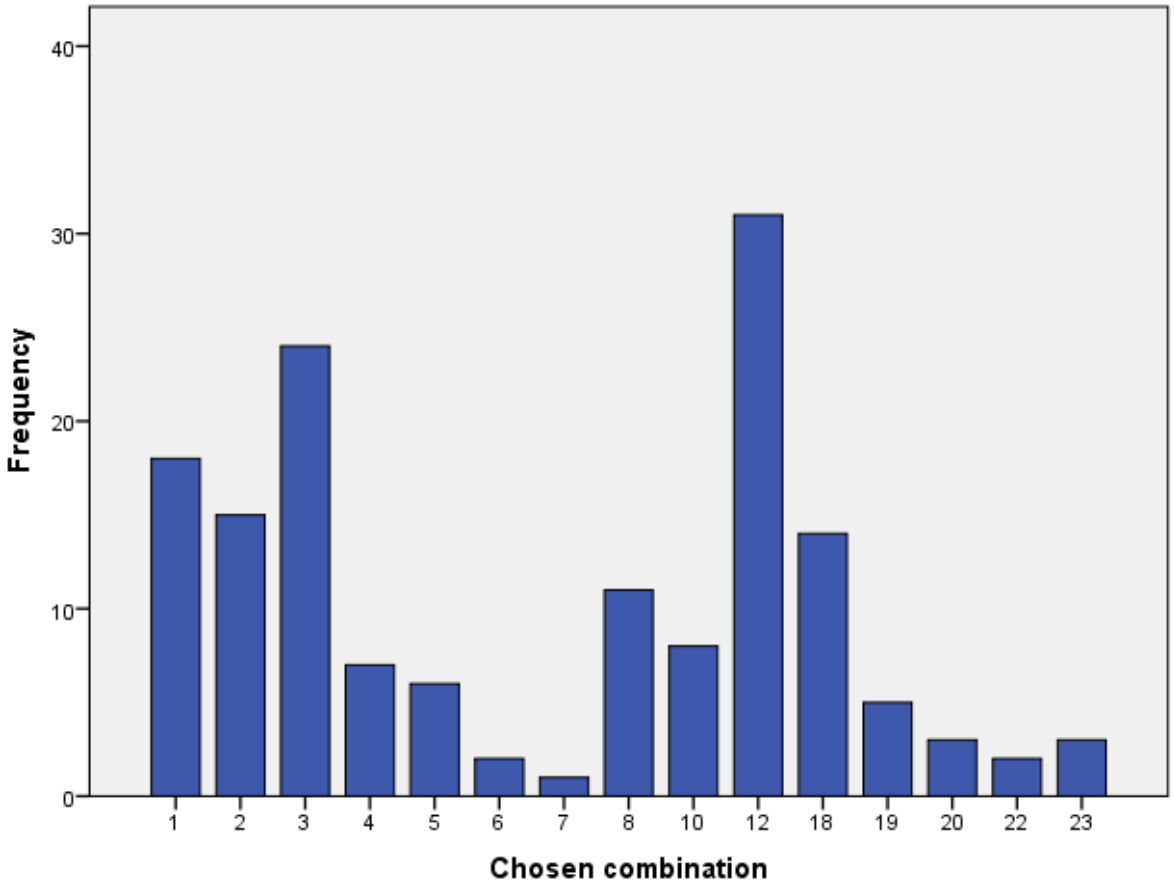


Figure 9. Frequency of the combination of the chosen attributes of the Choice experiment.

NAME of the combination	1	2	3	4	5	6	7	8	10	12	18	19	20	22	23
Climate regulation	X	XX	XX	X	X	XX	X	X	XX	XX	X	XX	XX	X	X
Aresthetic benefits	X	X	XX	XX	X	XX	XX	XX	XX	XX	XX	XX	X	XX	X
Food	X	X	XX	X	XX	X	XX	XX	X	XX	XX	X	X	X	XX
Cost	0	0,1	1	0,1	0,1	0,1	0,1	1	1	10	10	10	1	1	1

X = Present
XX = Growth

Table 4. Names of the combinations of attributes of the Choice experiment.

Comment. Figure 9 shows the frequencies for each of the combinations of attributes of the Choice experiment (the corresponding names of the combinations of attributes are shown in Table 4). The combination of attributes chosen by the relative greater number of respondents is the 12 (20.7%), for which is maximum the value of all 4 attributes. The combination 3 was chosen by 16.0% of respondents; it corresponds to the combination in which the level of all 3 ecological attributes is maximum and the level of the economic attribute is 1 €. The third combination that has been more selected is the 1 (12.0%), in which the level of all 4 attributes is minimum. The option 2 was chosen by 10% of respondents; in this case the level of ecosystem service *Climate regulation* is "High", while the level of the other 2 ecological attributes and the *Cost* attribute is minimum. The combination 18 was chosen by 9.3% of respondents; the value of the service *Climate regulation* is minimum, but the value of the other two attributes (*Aesthetic benefits* and *Food*) is maximum and is maximum also the value of the economic attribute. The less chosen combinations (that have a value below a 2%) were: the 7 (0.7%), for which the service of *Climate regulation* and the *Cost* are minimum; the 22 (1.3%), for which there is a minimum level of ecosystem services *Climate regulation* and *Food*; the 6 (1.3%), for which there is the minimum value to the service *Food* and of the *Cost*.

Overall, the data indicate the two poles of answers.

- A willingness to pay an additional tax for greater conservation of marine ecosystems. Ecosystem services *Climate regulation* and *Food* seem to be more important than the ecosystem service *Aesthertic benefits* provided by coralligenous.
- Data show a second pole of answers in which a significant proportion of respondents are not willing to pay additional taxes for the conservation of marine biodiversity (Option 1), but seem to show interest to pay a minimum tax (0.10 €) for service *Climate regulation* provided by the *Posidonia oceanica* meadows (Option 2).

It may be noted that the observations made are consistent with the dialogue and discussion with the respondents during the data collection, in which was found a special interest for the *Climate regulation* ecosystem service.

- *Combination of attriutes of the Choice experiment and Sex.* We reproduce the bar graph.

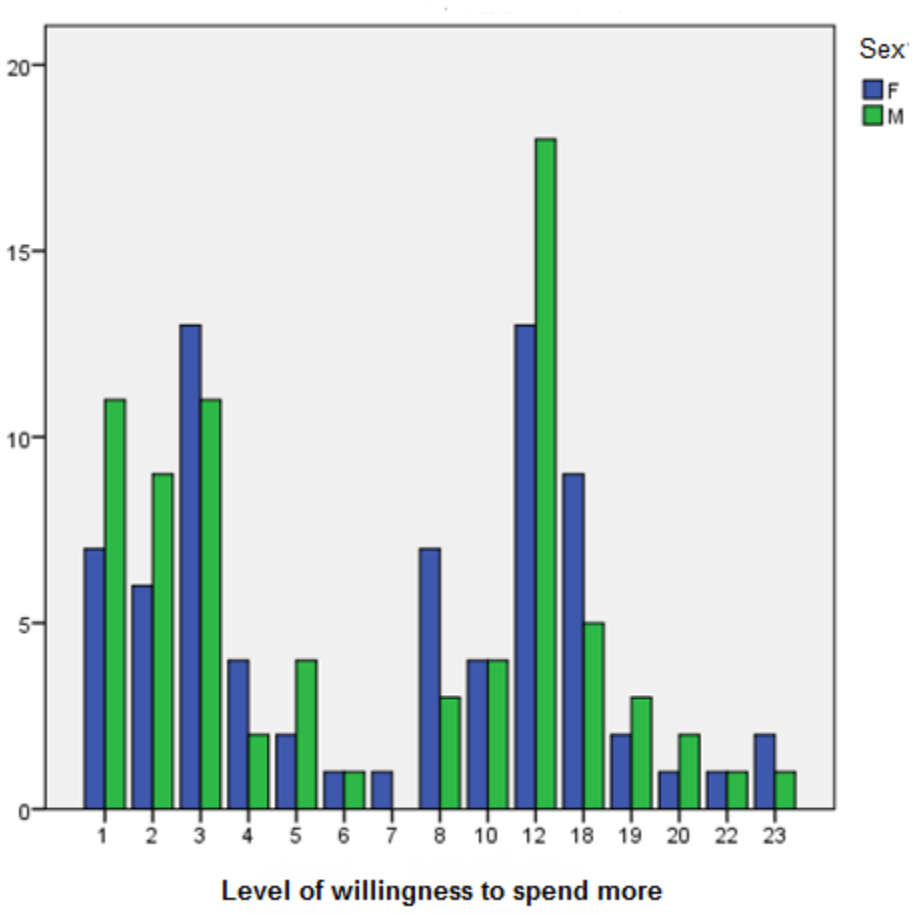


Figure 10. Chosen combination in the Choice experiment distinguished by Sex of the respondent.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph (Fig.10), with the aim of making a qualitative analysis of the data. From the bar chart we can take the following considerations.

The number of female gender respondents is 73, the number of the male gender respondents is 75.

The options more chosen by the female respondents are the 3 and 12 (both chosen by 13 respondents). The number 3 is the option in which the level of ecological attributes is the higher and the economic attribute has a value of 1 €. The option 12 represents the combination in which the level of the ecological attributes and the economic attribute is the highest (10 €).

Option 1 is the status quo. It has been chosen by 8 female respondents.

The option most chosen by the male respondents i s the 12 (18 preferences); followed by the option 1 (status quo) and 3, both with 11 preferences.

Comparing the answers of the female respondents with the male respondents, we observed that for the option in which the level of ecological attributes and economic attribute is higher (option 12), the number of respondents of the male gender (18) is greater than the number of female gender (13). We can interpret this difference as a greater propensity of male respondents to pay for a high level of provision of ecosystem services.

- *Level of the ecosystem service Climate regulation (provided by* Posidonia oceanica*) of the Choice experiment (Present /Growth) and Relative score attributed to the ecosystem service Climate regulation.* We reproduce the bar graph.

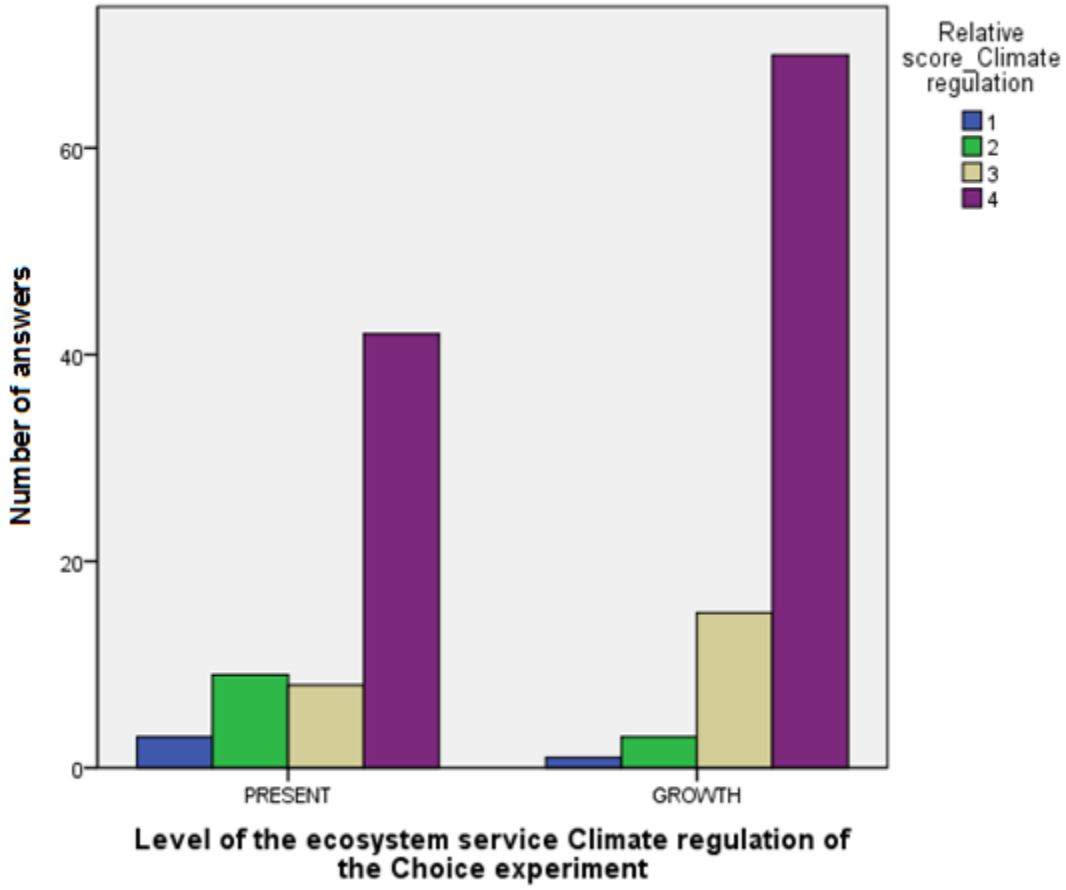


Figure 11. Level of the ecosystem service *Climate regulation* (provided by *Posidonia oceanica*) of the Choice experiment (Present/Growth) distinguished by *Relative score* attributed to the same ecosystem service. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Figure 11) shows two important aspects.

First, there is an association between the choice of the options of Choice experiment which corresponds to a "Growth" of the ecosystem service *Climate regulation* and the highest rating of importance assigned later by the respondents to the same ecosystem service.

Second, even when respondents have chosen the option of choice experiment for which the service *Climate regulation* remained "Current", and therefore that is not expected to increase financial resources in order to better conservation of *Posidonia oceanica* through

additional taxation, in the next part of the questionnaire the relative greater part of respondents considered the *Climate regulation* the most important attribute of the four attributes considered in the study.

These observations are consistent with the interest and sensitivity shown by the interviewees for this ecosystem service and the *Posidonia oceanica* meadows during the presentation of ecosystems (also occurred through photographs) and the related ecosystem services that was performed before the interviews.

- *Level of the ecosystem service Aesthetic benefits (provided by coralligenous) of the Choice experiment (Present /Growth) and Relative score attributed to the ecosystem service Aesthetic benefits.* We reproduce the bar graph.

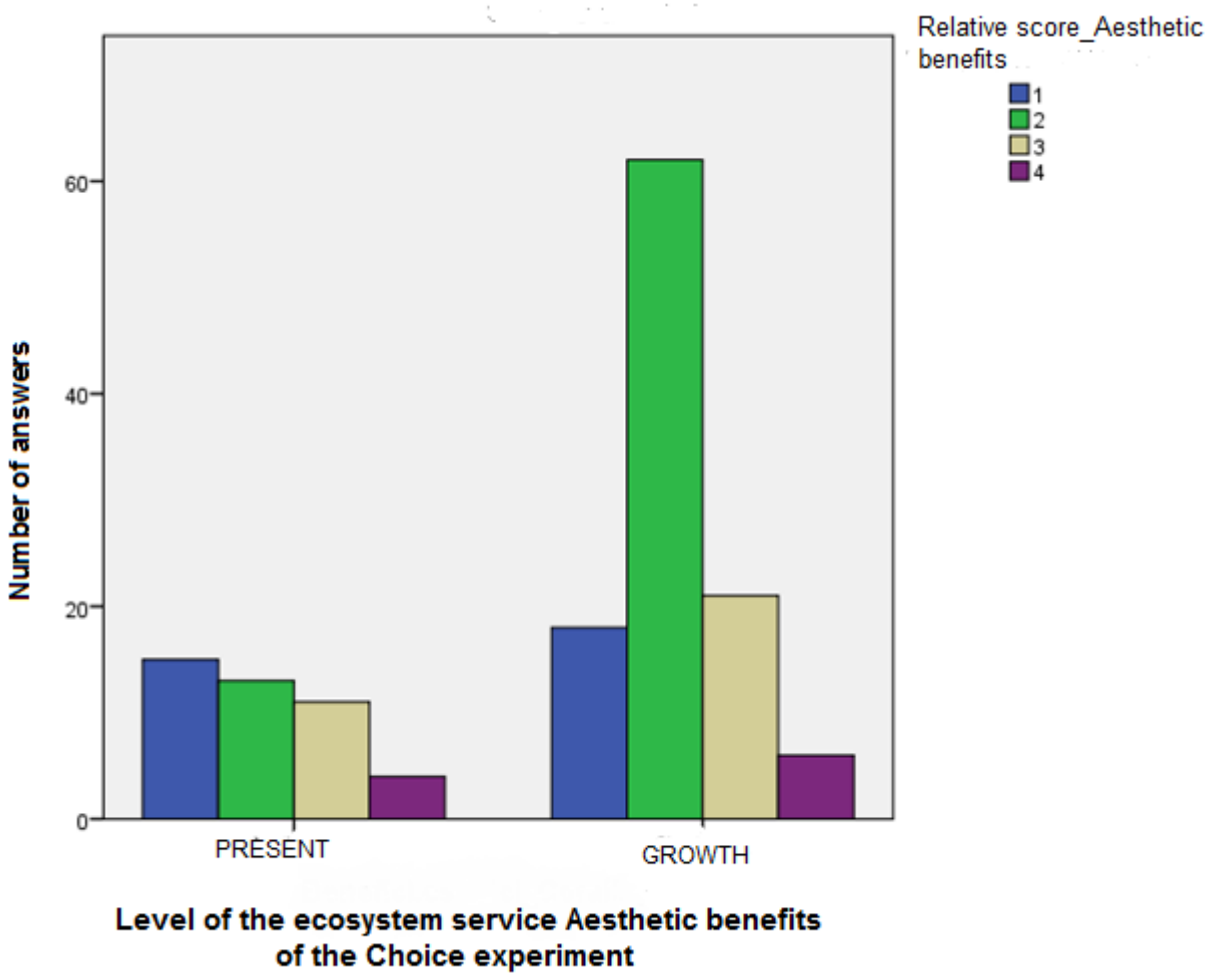


Figure 12. Level of the ecosystem service *Aesthetic benefits* (provided by coralligenous) of the Choice experiment (Present/Growth) distinguished by *Relative score* attributed to the same ecosystem service. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Figure 12) shows that for the combination of the attributes of the choice set in which the ecosystem service *Aesthetic benefits* is "Growth", corresponds a score dominant value "2". At the level of ecosystem service "Present", seems instead a substantial homogeneity of the score later attributed to the service, with a decreasing value to the score. These observations seem to indicate that respondents have

attributed little value to this ecosystem service in the decision that they made in the Choice experiment.

- *Level of the ecosystem service Food (fishes) of the Choice experiment (Present /Growth) and Relative score attributed to the ecosystem service Food.* We reproduce the bar graph.

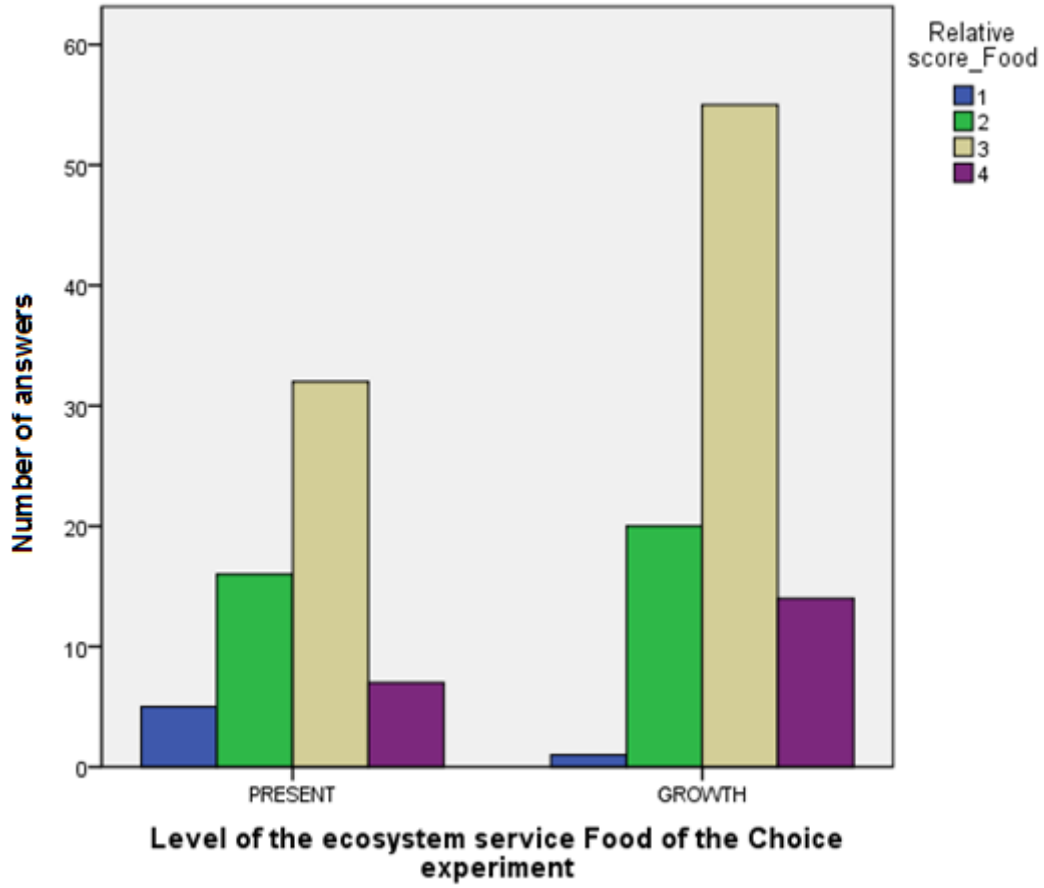


Figure 13. Level of the ecosystem service *Food* (fishes) of the Choice experiment (Present/Growth) distinguished by *Relative score* attributed to the same ecosystem service. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Figure 13) shows two important aspects which have similarities with contingency table *Climate regulation of the Choice experiment (Present/Growth) * Relative score attributed to the ecosystem service Climate regulation*. It results an association between the choice of the options of Choice experiment which corresponds to a "Growth" of the ecosystem service *Food* and the score of importance assigned later by the respondents to the same ecosystem service.

In this case, however, the dominant score is the value “3”. Also in the case in which has been chosen an option of Choice experiment for which the provision of the ecosystem service *Food* is "Present", in the next questionnaire the greater part of respondents has considered the ecosystem service in question significant, attributing it the value “3”.

- *Level of the Cost attribute in the Choice experiment and Relative score attributed to the Cost.* We reproduce the bar graph.

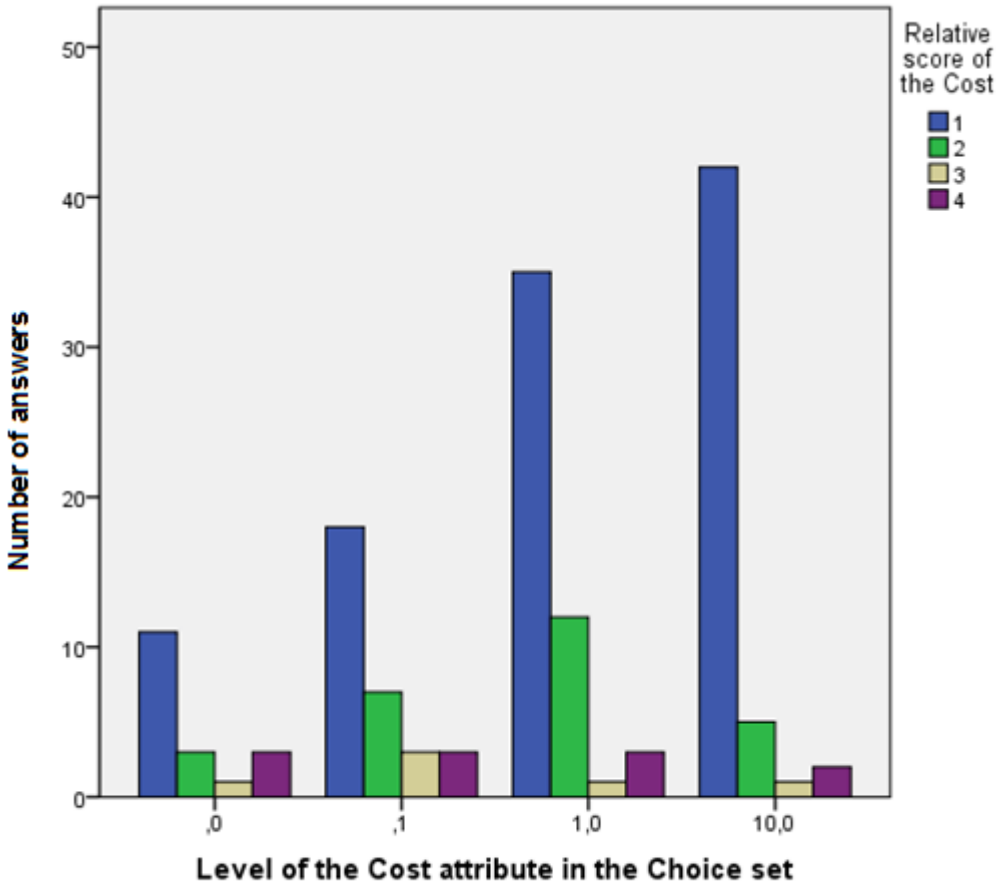


Figure 14. Level of the *Cost* attribute in the Choice experiment (Present/Growth) distinguished by *Relative score* attributed to the attribute. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Fig. 15) shows the following aspect. To the attribute *Cost* is assigned the lowest value relative to other attributes. In fact, of 150 respondents 106 have attributed to the *Cost* lower relative value (value 1 of 4); also, 27 people have attributed to the *Cost* the second value of importance (value 2 of 4).

Comparison of bar graphs of the 4 attributes. The comparison of the bar graphs of the 4 attributes shows a dominance in the choice of the score of the ecosystem service *Climate*

regulation provided by the Posidonia meadows (111 attributions of 150 interviews of "4" score, compared to 21 to *Food*, 11 attributions to the *Cost*, 10 for the *Aesthetic benefits*). Equally clearly, the respondents assign great importance to the service *Food* (87 of 150 interviews of "3", compared to 32 to *Aesthetic benefits*, and 6 to the *Cost*). For both ecosystem services there is a high score even if the respondents have chosen options of the Choice experiment in which the respective service level remained "Present". These results seem to indicate a particular attention to certain ecosystem services provided by marine biodiversity, which are perceived as necessary for the welfare of present and future of the public interviewed and society. Instead, from a comparison of the previous two ecosystem services with the *Aesthetic benefits*, it results that this ecosystem service is considered less relevant. To the *Cost* attribute has been assigned the lowest score by 106 respondents of 150, compared with only 4 respondents to the *Climate regulation*, 6 to *Food*, 33 to *Aesthetic benefits*.

- *Profession of interviewees and Relative score attributed to the ecosystem service Climate regulation.* We reproduce the bar graph.

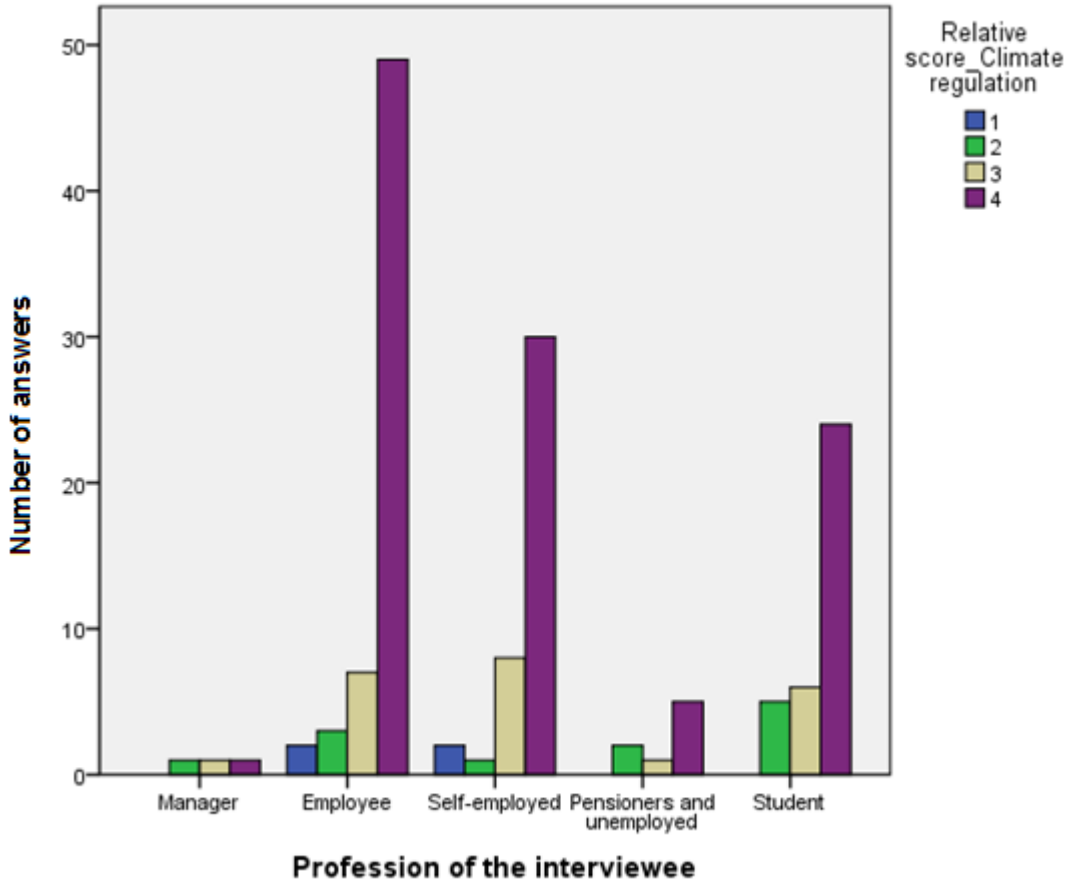


Fig.15. Profession of interviewees distinguished by Relative score attributed to the ecosystem service *Climate regulation*. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Figure 15) shows a prevalence of the maximum score attributed to the ecosystem service *Climate regulation* by all classes of workers, with the exception of Managers who express their choice equal to the scores "4", "3" and "2"; no Manager interviewed attributed the lower value to the ecosystem service (score "1").
The Chi-square test is not reliable.

- *Profession of interviewees and Relative score attributed to the ecosystem service Aesthetic benefits.* We reproduce the bar graph.

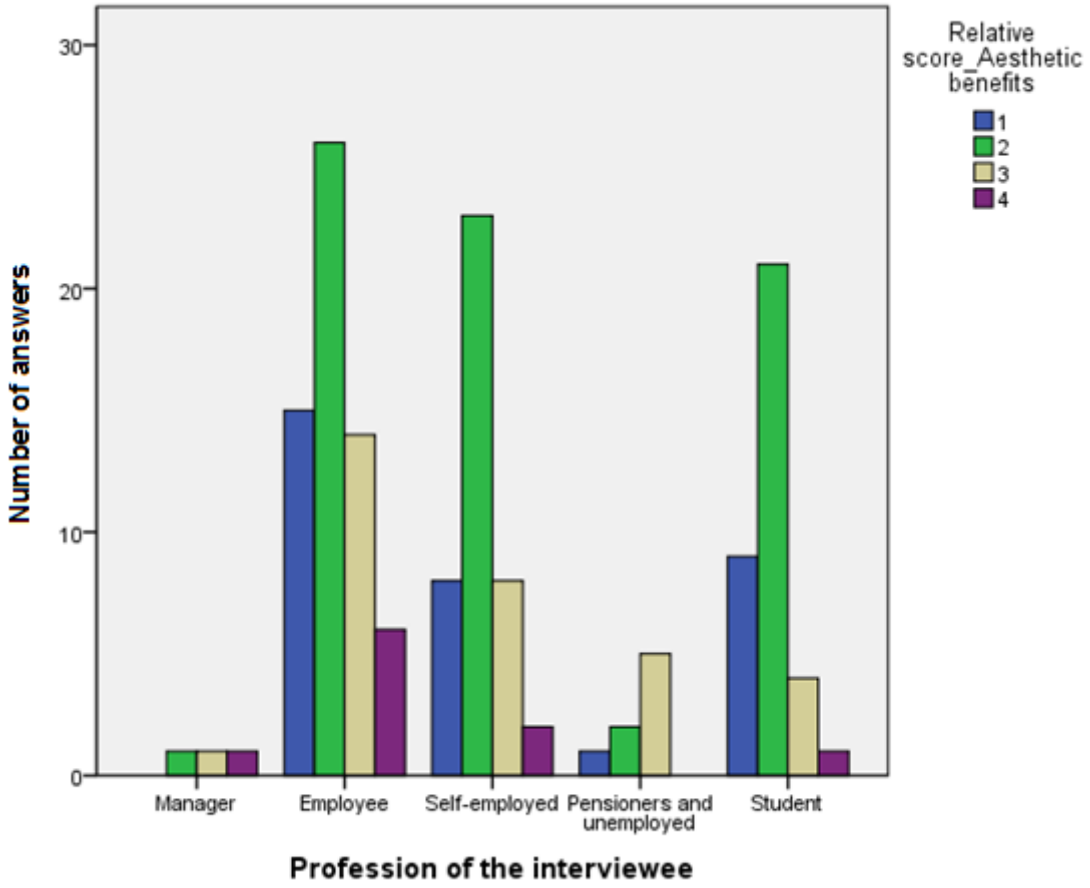


Fig.16. Profession of interviewees distinguished by Relative score attributed to the ecosystem service *Aesthetic benefits*. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Figure 16) of the ecosystem service *Aesthetic benefits* shows a dominance of the score "3" of the ecosystem service for Employees, Self-employed and Students. Managers express an equal choice for the scores "4", "3" and "2", and no one has given a minimum value ("1") to the service. For Pensioners and the Unemployed the dominant score is "3", indicating that for this class of workers the *Aesthetic benefits* provided by Coralligenous are more important compared to the other classes. A comparison of contingency tables indicate that the ecosystem service *Aesthetic benefits* has a greater homogeneity in the responses for the classes of the profession respect to the other attributes. This could be explained by the fact that, unlike the other ecosystem

services the benefits of which are felt indispensable to society, the *Aesthetic benefits* are an ecosystem service whose benefits are more subjective.

The Chi-square test is not reliable.

- *Profession of interviewees and Relative score attributed to the ecosystem service Food.*

We reproduce the bar graph.

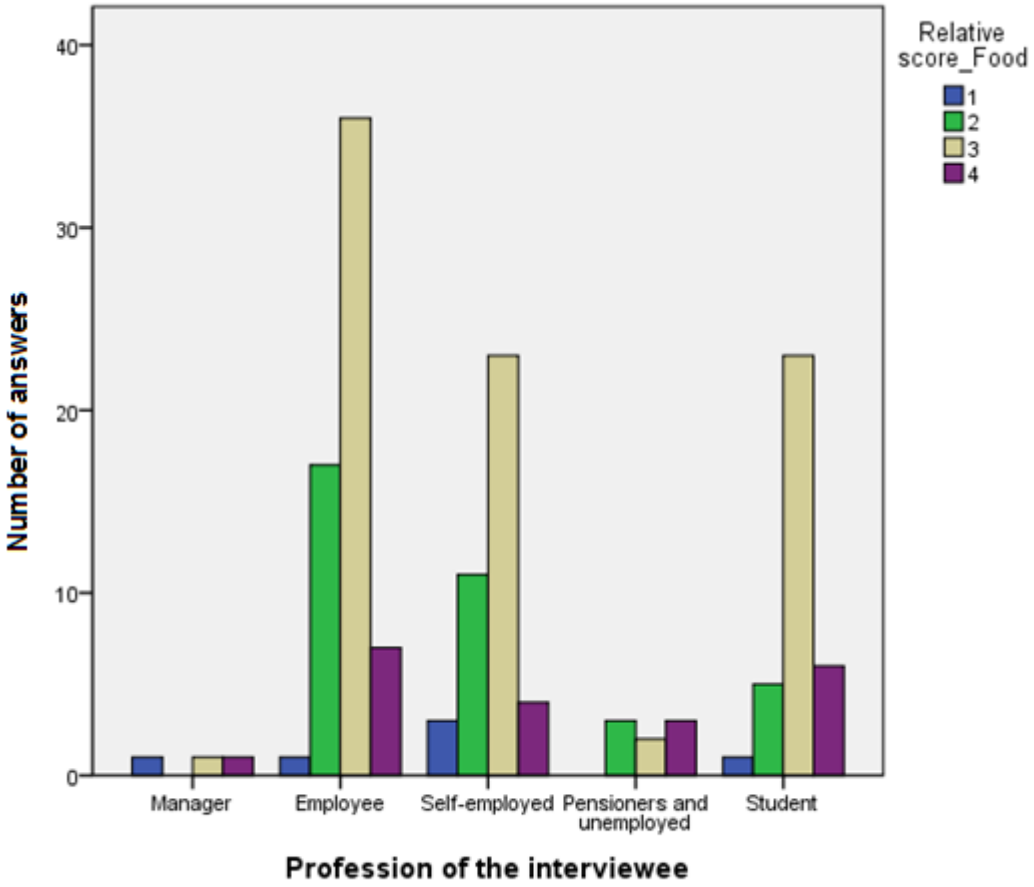


Fig.17. Profession of interviewees distinguished by Relative score attributed to the ecosystem service *Food.* Number of answers.

Comment. The bar graph for the ecosystem service *Food* (Fig. 17) indicates that the value "3" is the largest allocation from the Employees, Self-employed and Students. Pensioners and unemployed declared values similar for the scores "4", "3" and "2", and no one has attributed the minimum value ("1"). The Managers did not express a dominant choice for any of the scores, and excluded the score "2". The Chi-square test is not reliable.

- *Profession of interviewees and Relative score attributed to the Cost attribute*. We reproduce the bar graph.

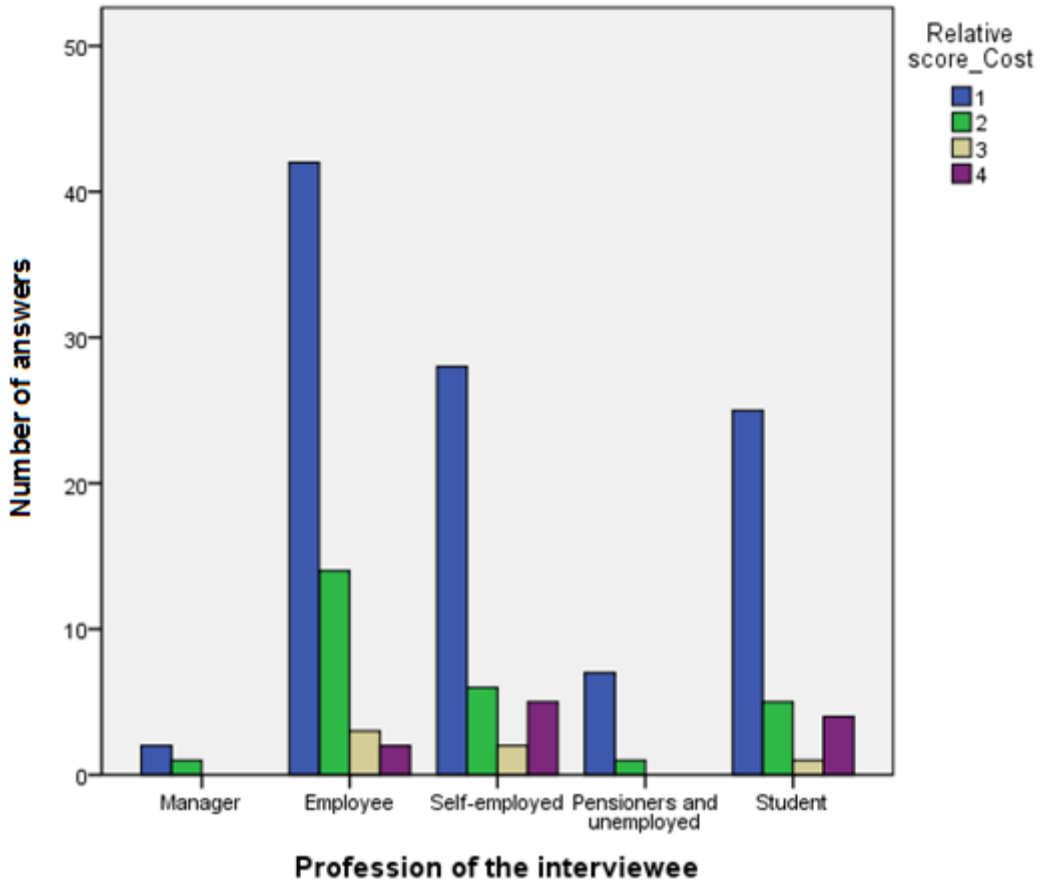


Fig.18. Profession of interviewees distinguished by Relative score attributed to the attribute *Cost.* Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Fig. 18) shows the dominance of the lowest scores for all classes of workers. The value "2" appears to be the second-more numerous for all classes.

- *Profession of interviewees and Level of the ecosystem service Climate regulation.* We reproduce the bar graph.

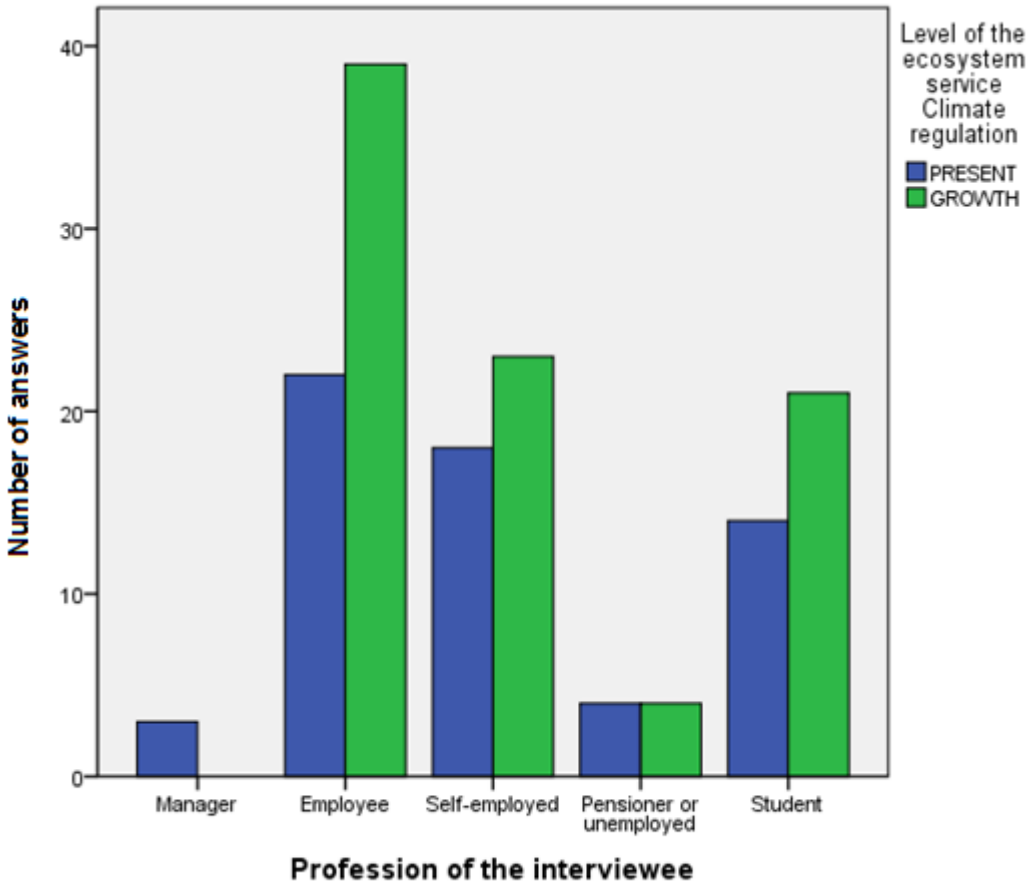


Fig. 19. Profession of interviewees distinguished by the Level of the ecosystem service *Climate regulation*. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. Bar graph (Figure 19) indicates that the Employees, the Self-employed and Students show a greater propensity to choose combinations of attributes of the Choice experiment in which the ecosystem service *Climate regulation* grows through enhanced conservation of Posidonia meadows. Managers, on the contrary, have chosen unanimously combinations in which the flow of the service provided by the Posidonia meadows remains "Present". Pensioners and unemployed have made choices for which the values for the two levels of the attribute are equal.

- *Profession of interviewees (in which it was made a* ***unification of groups of workers****) and Level of the ecosystem service Climate regulation in the Choice experiment.* We reproduce the bar graph.

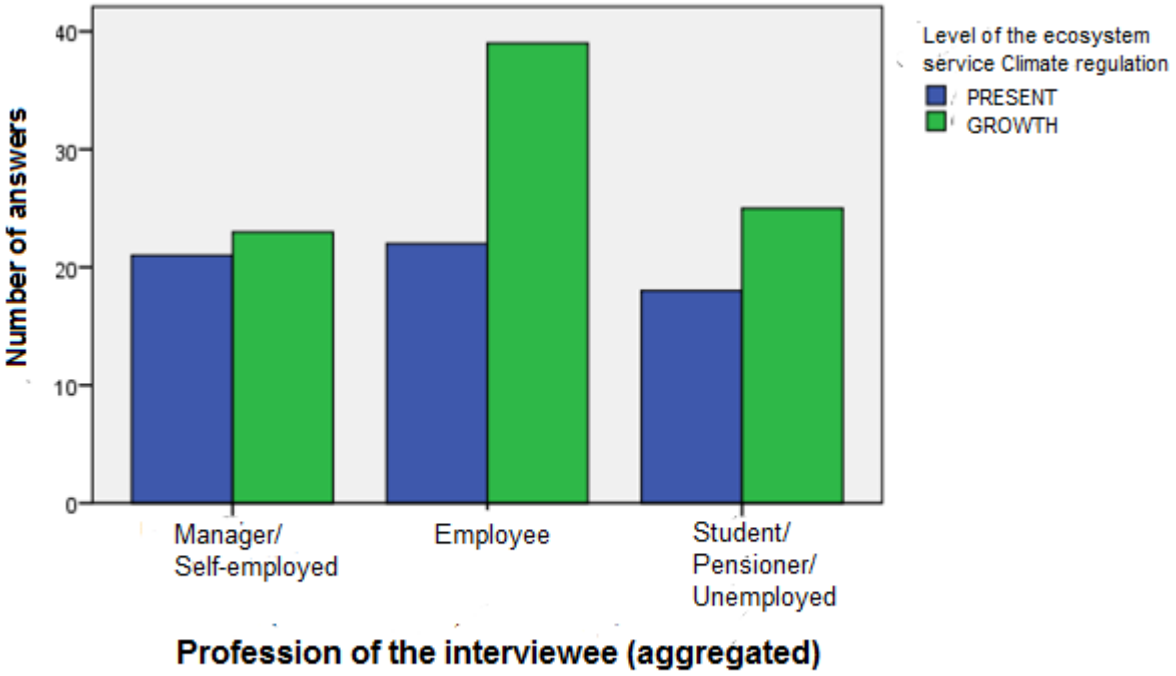


Fig. 20. Profession of interviewees aggregated in three categories, distinguished by the Level of the ecosystem service *Climate regulation* in the Choice experiment. Number of answers.

Comment. In the previous case, we have provided for the creation of contingency tables that considered all professions separately. However, the sample size did not allow for inferential analysis. So it was decided to unify the professions into three groups and reformulate the contingency tables. The result, shown in the bar chart in Fig. 20, indicates that the sample is large enough to make the test applicable, but the result does not provide a sufficient significance. From a qualitative analysis of the bar graph, it appears that Employees are the category of workers who are more likely to choose combinations of attributes of the choice experiment in which the ecosystem service *Climate regulation* grows through enhanced conservation of Posidonia meadows. Instead, the occupational category of Managers / Self-employed, have provided a similar number of responses of the two levels of delivery of the ecosystem service.

- *Profession of interviewees and Level of the ecosystem service Aesthetic benefits.* We reproduce the bar graph.

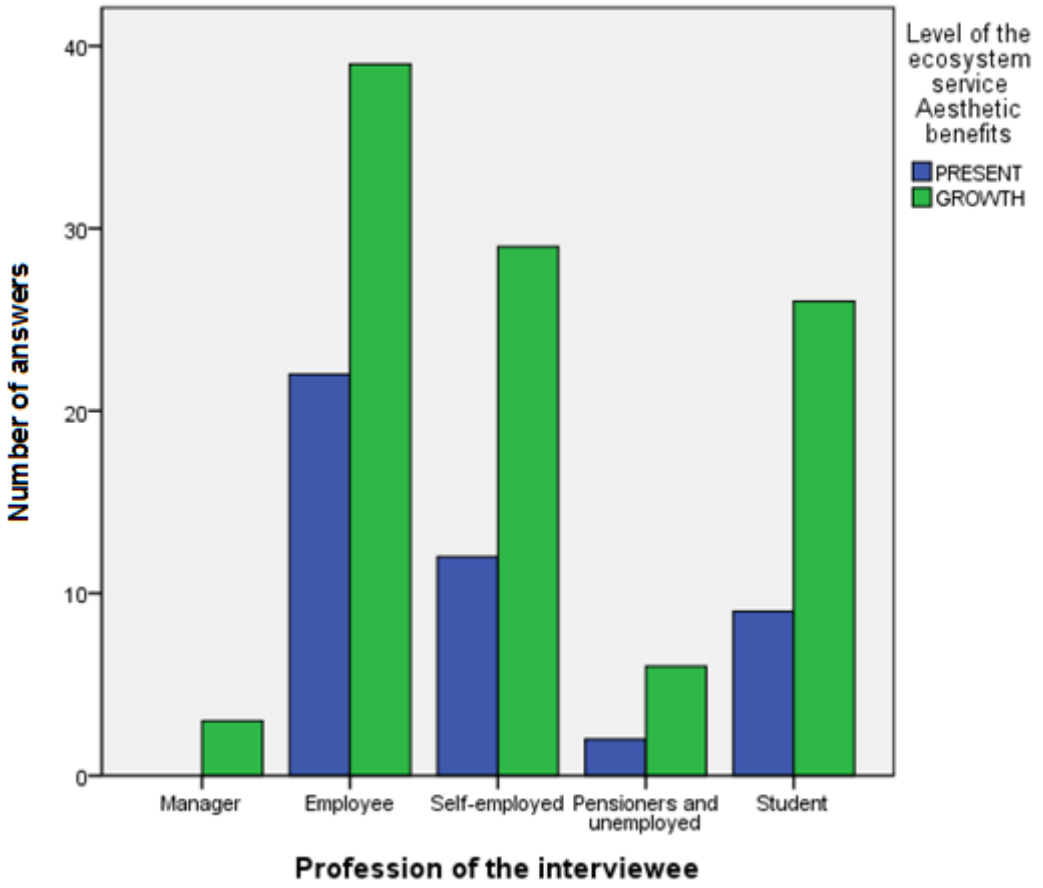


Fig. 21. Profession of interviewees distinguished by the Level of the ecosystem service *Aesthetic benefits*. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Figure 21) shows an orientation of all classes of workers interviewed to options in which the ecosystem service *Aesthetic benefits* grows.

- *Profession of interviewees (in which it was made a* ***unification of groups of workers****) and Level of the ecosystem service Aesthetic benefits in the Choice experiment.* We reproduce the bar graph.

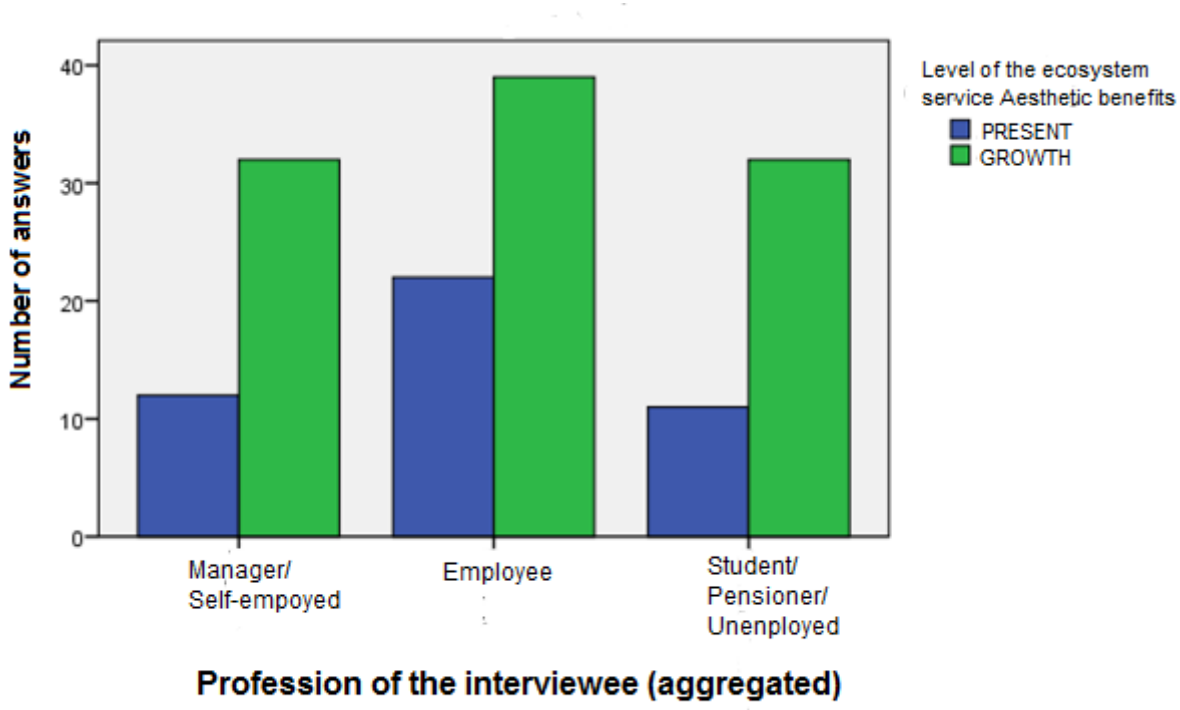


Fig.22. Profession of interviewees aggregated in three categories, distinguished by the Level of the ecosystem service *Aesthetic benefits* in the Choice experiment. Number of answers.

Comment. The Chi-square test applied by the unification of the categories indicates that the sample is large enough to make the test applicable, but the result does not provide a sufficient significance. The qualitative analysis of the bar graph (Fig. 22) shows a propensity by all three categories of workers to choose combinations of Choice experiment where the service *Aesthetic benefits* grows. Unlike the ecosystem service *Climate regulation*, also the category of Managers / Self-employed in showed in the Choice experiment great attention to this ecosystem service. More attention was also observed for the category of workers Students / Pensioners / Unemployed.

- *Profession of interviewees and Level of the ecosystem service Food.* We reproduce the bar graph.

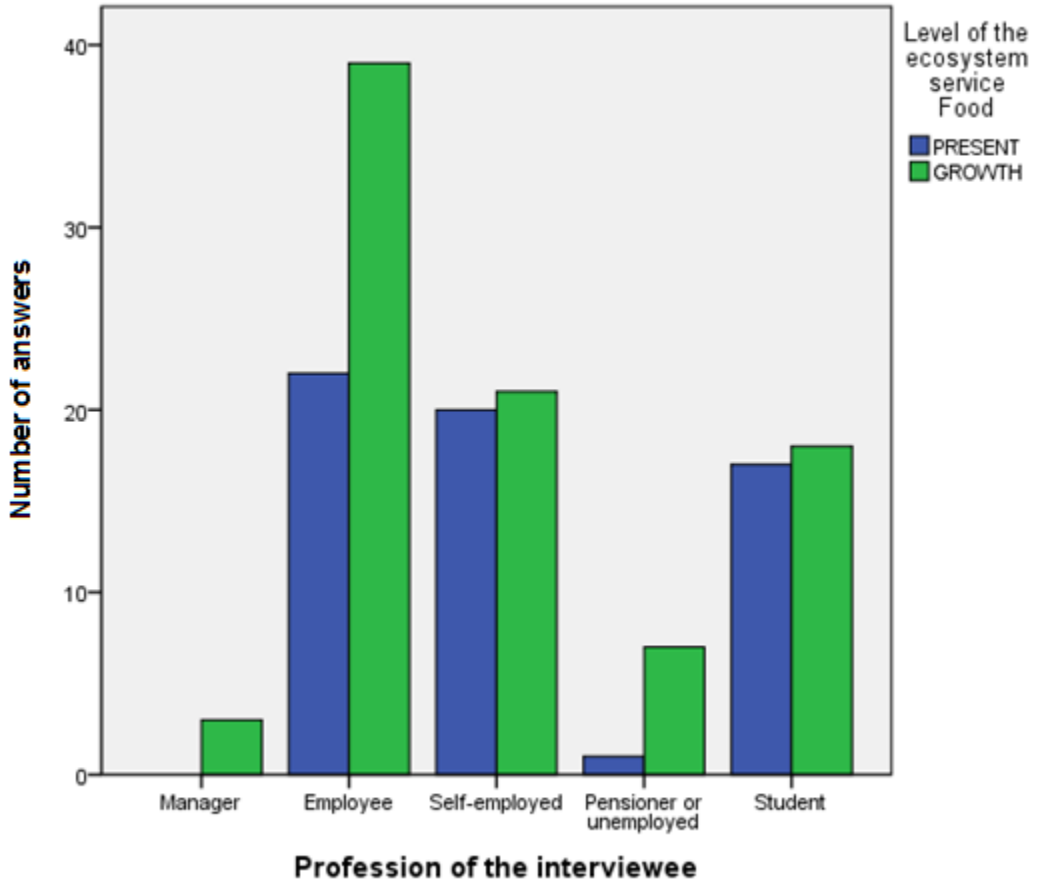


Fig.23. Profession of interviewees distinguished by the Level of the ecosystem service *Food*. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph (Fig. 23), with the aim of making a qualitative analysis of the data. Managers, Employees and Pensioners and unemployed show a greater propensity to choose combinations of attributes of the Choice experiment in which the ecosystem *Food* grows through increased conservation. The choices made by the Self-employed and the Students seem to indicate that these classes of workers are less sensitive than other classes regarding this ecosystem service.

- *Profession of interviewees (in which it was made a* ***unification of groups of workers****) and Level of the ecosystem service Food in the Choice experiment.* We reproduce the bar graph.

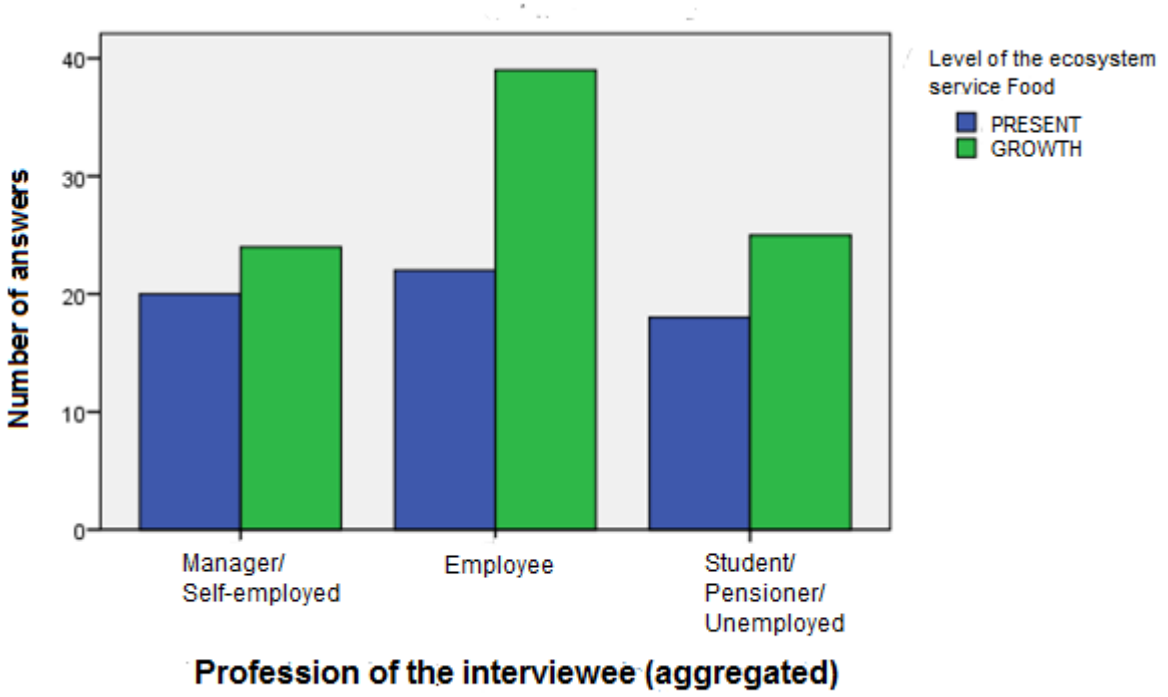


Fig.24. Profession of interviewees unified in three categories, distinguished by the Level of the ecosystem service *Food* in the Choice experiment. Number of answers.

Comment. The Chi-square test applied by the unification of the categories indicates that the sample is large enough to make the test applicable, but the result does not provide a sufficient significance. The qualitative analysis of the bar graph (Fig.24) shows a similar behavior by the categories of respondents to the service of *Climate regulation*.

- *Profession of interviewees and Level of the attribute Cost in the Choice experiment.* We reproduce the bar graph.

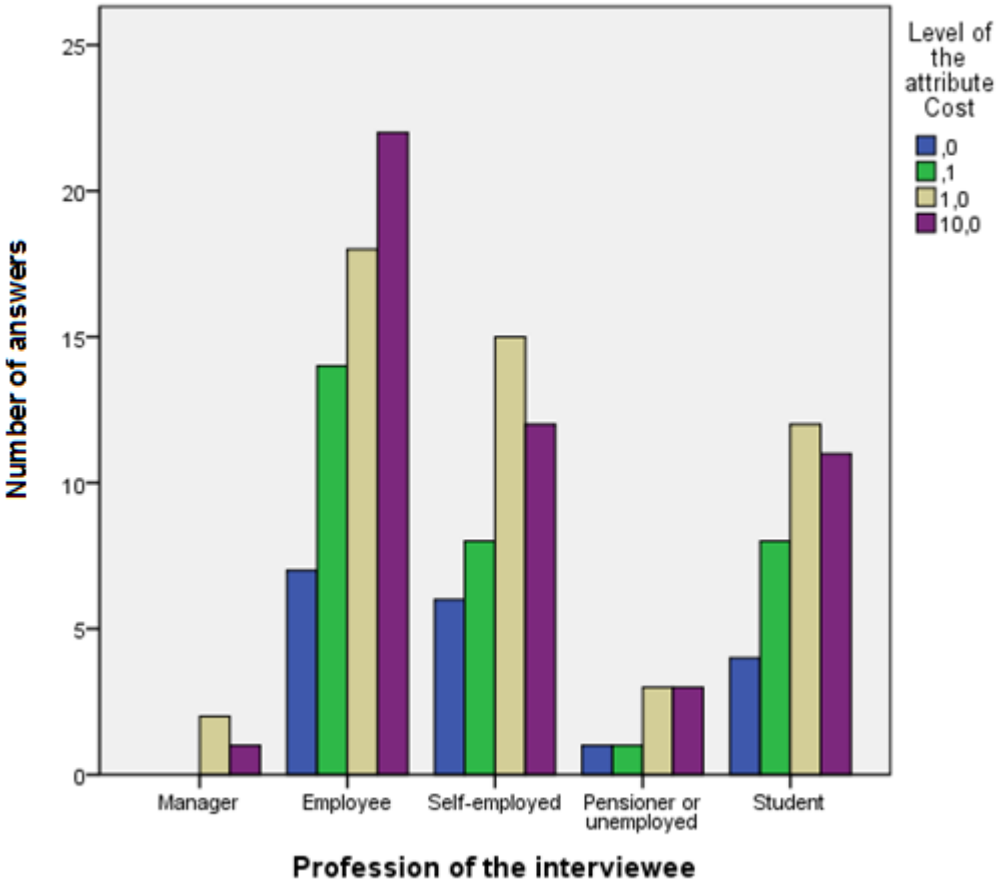


Fig. 25. Profession of interviewees distinguished by the Level of the attribute *Cost* in the Choice experiment. Number of answers.

Comment. The sample size does not allow inferential analysis. For this reason it has not reported the contingency table but only the bar graph, with the aim of making a qualitative analysis of the data. The bar graph (Fig. 25) indicates that the Employees have chosen more than other classes of workers options of the Choice experiment where the level of the attribute *Cost* was maximum (10 €). All Managers have chosen options with high values of the level of the attribute *Cost* (€ 1 and € 10).

- *Profession of interviewees (in which it was made a **unification of groups of workers**) and Level of the attribute Cost in the Choice experiment.* We reproduce the bar graph.

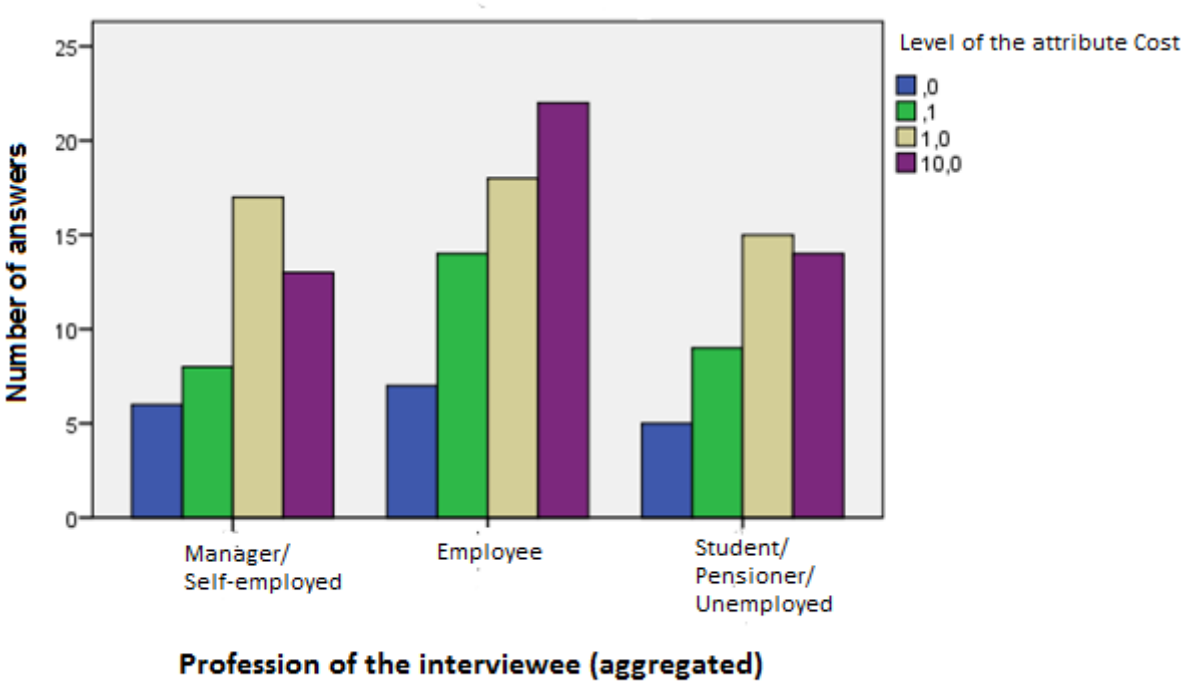


Fig. 26. Profession of interviewees aggregated in three categories, distinguished by the Level of the attribute *Cost* in the Choice experiment. Number of answers.

Comment. The Chi-square test applied by the unification of categories indicates that the sample is large enough to make the test applicable, but the result does not provide a sufficient significance. From a qualitative analysis of bar graphs (Fig. 26) we can observe that the Employees are the category that has most selected the options in the Choice experiment in which the attribute *Cost* is maximum (10 €). The other levels of the attribute *Cost* are evenly distributed among the three aggregated categories of workers.

- *Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas and Sex of the interviewee.* We reproduce the bar graph.

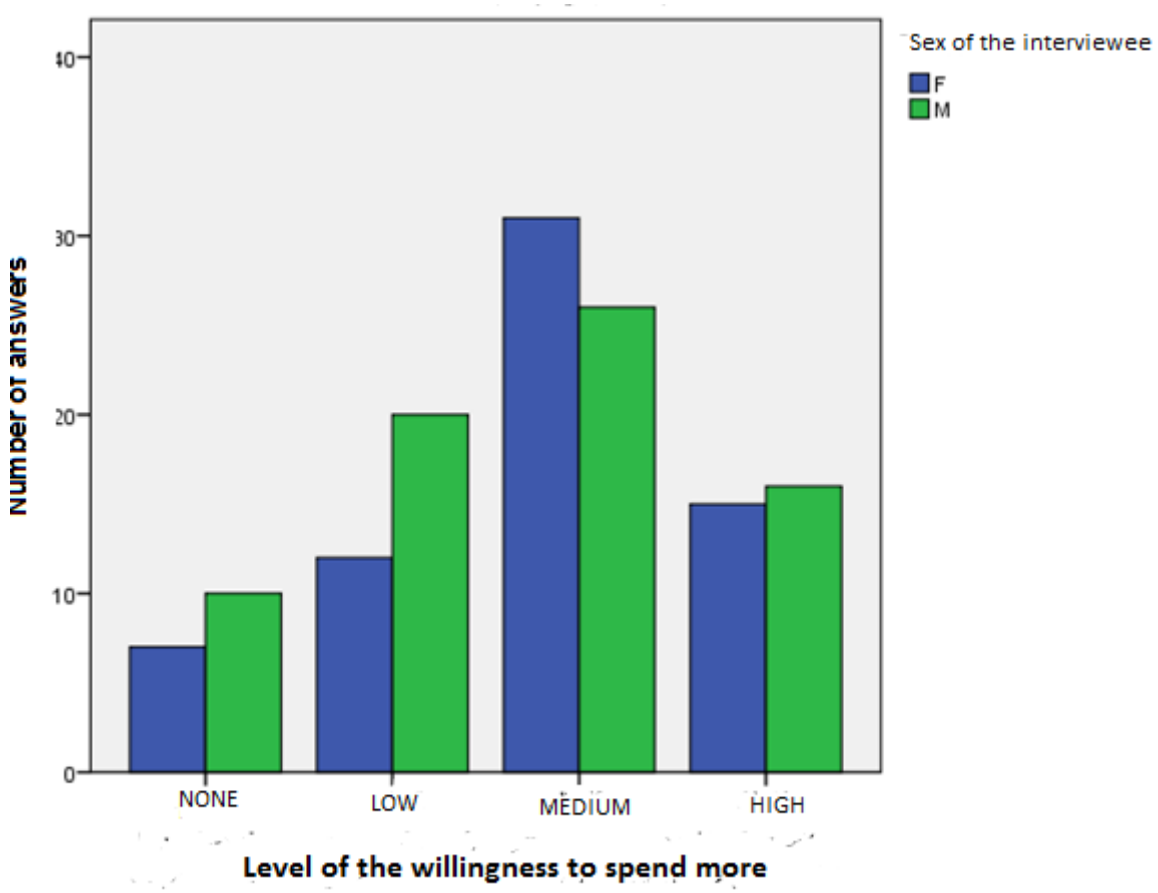


Fig. 27. Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas distinguished by the sex of the interviewee

Comment. The Chi-square test applied by the unification of categories indicates that the sample is large enough to make the test applicable, but the result does not provide a sufficient significance. From a qualitative analysis of the bar graph (Fig. 27) it results that a greater amount of male respondents are willing to spend an additional tax that is "Low2 or zero ("None") than female respondents. Instead, a greater amount of female individuals are willing to spend a "Medium" tax.

4. *Multinomial logit models.* Analysis of aggregate combinations and economic valuation of ecosystem services

As state in *Section 2.4* we can use multinomial logit models to determine the probability to choose A over j options (Bermann et al., 2006; Hanley & Barbier, 2009). Recall that:

$$P(U_{An} > U_{jn}) = \frac{\exp(\mu V_A)}{\sum j \exp(\mu V_j)} \quad \forall A \neq j$$

This chapter consists of two parts. In the first part we report the estimated coefficients (β) for each option and service (tables 1-20) and we discuss these results. In this first part we have reported the parameter estimates of the models that have been developed with the aim of assessing, using the multinomial logit, the relations between the different variables extracted from the questionnaire put to respondents (choice experiment, relative score of the attributes, willingness to pay an additional tax, age of respondents). The models in which the coefficients have a high level of significance have been reported, and the results of each model have been commented.

In the second part (Tables 21 and 22) we have analyzed the data of Choice experiment using the conditional logit model to estimate the coefficients that allow estimate the monetary value of ecosystem services. In addition to the table with the parameter estimates of the model, it is given a summary table (Table 22), similar to those found in the literature, where there are the coefficients, the related implicit prices of ecosystem services, and supplementary information regarding the model (constants, the Log-likelihood and the pseudo-R^2).

4.1 Models developed with the aim of assessing the relations between the different variables extracted from the questionnaire

Table 1. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the level of ecosystem service* Climate regulation *(provided by the* Posidonia oceanica *meadows) in Choice Experiment (Present/Growth); the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* The category "Aggregation options where the level of ecosystem service Climate regulation = GROWTH" is the aggregation of all chosen combinations of the Choice experiment in which the value of the ecosystem service Climate regulation is growth, regardless of the level of the remaining attributes. The reference category is Option 1 (status quo). The remaining options in the table are those in which the level of service Climate regulation is "Present".

Parameter Estimates of the Model									
		β	Std Error	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Upper Bound
Option 4 (level of the Climate regulation service = PRESENT)	Intercept	-20,603	1,000	424,496	1	,000			
	Level of willingness to spend more : HIGH	33,564	461,246	,005	1	,942	37739289435023 7,060	,000	.[b]
	Level of willingness to spend more : MEDIUM	20,603	,000	.	1	.	886954234,994	886954234,994	886954234,994
	Level of willingness to spend more : LOW	34,075	486,273	,005	1	,944	62918733986945 0,600	,000	.[b]

	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Option 5 (level of the Climate regulation service = PRESENT)	Intercept	-20,757	8041,999	,000	1	,998			
	Level of willingness to spend more : HIGH	33,718	8055,215	,000	1	,997	440291702998333,440	,000	.[b]
	Level of willingness to spend more : MEDIUM	20,064	8041,999	,000	1	,998	517389962,097	,000	.[b]
	Level of willingness to spend more : LOW	34,230	8056,687	,000	1	,997	734051884715718,800	,000	.[b]
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Option 7 (level of the Climate regulation service = PRESENT)	Intercept	-22,549	19698,793	,000	1	,999			
	Level of willingness to spend more : HIGH	34,817	19704,193	,000	1	,999	1320875111946202,500	,000	.[b]
	Level of willingness to spend more : MEDIUM	7,651	19736,230	,000	1	1,000	2102,749	,000	.[b]
	Level of willingness to spend more : LOW	19,659	19812,501	,000	1	,999	344926642,191	,000	.[b]
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Option 8 (level of the Climate regulation service = PRESENT)	Intercept	-20,470	,866	558,682	1	,000			
	Level of willingness to spend more : HIGH	33,836	461,246	,005	1	,942	4953281765082800,800	,000	.[b]
	Level of willingness to spend more : MEDIUM	21,163	,000	.	1	.	1552169919,617	1552169919,617	1552169919,617
	Level of willingness to spend more : LOW	32,843	486,273	,005	1	,946	1835129751191235,500	,000	.[b]

	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Option 18 (level of the Climate regulation service = PRESENT)	Intercept	-19,984	,775	665,618	1	,000			
	Level of willingness to spend more : HIGH	33,351	461,246	,005	1	,942	304817345011204,900	,000	.[b]
	Level of willingness to spend more : MEDIUM	21,594	,000	.	1	.	2387953766,527	2387953766,527	2387953766,527
	Level of willingness to spend more : LOW	19,659	750,911	,001	1	,979	344926655,187	,000	.[b]
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Option 22 (level of the Climate regulation service = PRESENT)	Intercept	-21,856	13929,151	,000	1	,999			
	Level of willingness to spend more : HIGH	19,659	14005,310	,000	1	,999	344926638,606	,000	.[b]
	Level of willingness to spend more : MEDIUM	7,651	13955,623	,000	1	1,000	2102,749	,000	.[b]
	Level of willingness to spend more : LOW	34,923	13937,636	,000	1	,998	1468103757309124,200	,000	.[b]
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Option 23 (level of the Climate regulation service = PRESENT)	Intercept	-21,451	1,225	306,752	1	,000			
	Level of willingness to spend more : HIGH	34,412	461,247	,006	1	,941	880583408259221,200	,000	.[b]
	Level of willingness to spend more : MEDIUM	20,757	,000	.	1	.	1034779926,852	1034779926,852	1034779926,852
	Level of willingness to spend more : LOW	19,659	1286,554	,000	1	,988	344926642,306	,000	.[b]

	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Aggregation options where the level of ecosystem service Climate regulation = GROWTH	Intercept	-2,773	1,031	7,235	1	,007			
	Level of willingness to spend more : HIGH	17,931	461,246	,002	1	,969	61271004,345	,000	.[b]
	Level of willingness to spend more : MEDIUM	5,743	1,260	20,768	1	,000	312,000	26,391	3688,513
	Level of willingness to spend more : LOW	18,282	486,273	,001	1	,970	87017244,685	,000	.[b]
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
The reference category is: Option 1 (Status quo)									

b. Si è verificato un overflow in virgola mobile durante il calcolo di questa statistica. Il relativo valore verrà pertanto impostato sul sistema mancante.

c. Questo parametro è impostato su zero perché è ridondante.

Comment. The analysis of the values of β and Sig. of the intercepts of the category "Aggregation options where the level of ecosystem service *Climate regulation* = GROWTH" in Table 1 indicates that the combinations in which the level of ecosystem service *Climate regulation* is maximum is less probable to be chosen than the *status quo* (combination 1) in which the level of all the attributes is minimal (β <0; p-value <0.05).

The analysis of levels of *Willingness to spend more* of the category "Aggregation options where the level of ecosystem service *Climate regulation* = GROWTH" indicates that it is more probable that respondents who stated a willingness to pay a tax of Medium level (β <0; p-value <0.05) to choose this category rather than the *status quo* in comparison with respondents who said they are not willing to pay any additional tax for the conservation of marine biodiversity throw Marine Protected Areas. This seems to indicate that there is a willingness to

pay an additional tax of medium level for the conservation of *Posidonia oceanica* in favor of an increase in the flow of ecosystem service *Climate regulation* through the Italian Marine Protected Areas.

Table 2. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the level of ecosystem service* Climate regulation *(provided by* Posidonia oceanica*) in Choice Experiment (Present / Growth); the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* All chosen combinations of Choice experiment in which the value of the ecosystem service *Climate regulation* is growth have been aggregated, regardless of the level of the remaining attributes (*Aesthetic benefits, Food, Cost*). The reference category is the aggregation of all the chosen combinations of Choice experiment in which the value of the ecosystem service *Climate regulation* is "Present", regardless of the level of the other three attributes.

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Aggregation options where the level of ecosystem service Climate regulation = GROWTH	Intercept	-2,773	1,031	7,235	1	,007			
	Level of willingness to spend more : HIGH	3,098	1,093	8,032	1	,005	22,154	2,600	188,773
	Level of willingness to spend more : MEDIUM	3,440	1,067	10,400	1	,001	31,200	3,855	252,492
	Level of willingness to spend more : LOW	3,711	1,103	11,314	1	,001	40,889	4,705	355,358
	Level of willingness to spend more : NONE	0[b]	.	.	0	.	.	.	.

The reference category is: Aggregation options where the level of ecosystem service Climate regulation = PRESENT

b. This parameter is set to zero because it is redundant.

Comment. Considering the intercept of Table 2, we found that it is more probable that respondents choose combinations in which the level of ecosystem service *Climate regulation* remains "Present" than combinations in which the level of this ecosystem service grows ($\beta < 0$, p - value < 0.05).

Considering the individual levels of the *Willingness to spend more* in Table 2, it is more probable that respondents who are willing to pay (payment per year High, Medium, Low ($\beta > 0$, p-value < 0.05)) choose the aggregation of combinations in which *Climate regulation* is growth rather than the aggregation of combinations in which *Climate regulation* is " Present" in comparison with respondents who are not willing to pay an additional tax for the financing of Marine Protected Areas. This result can be interpreted as a willingness of respondents to pay an additional tax for an increase of *Climate regulation* ecosystem service. In other words, it is more probable that those who have chosen in the Choice experiment options in which the ecosystem service *Climate regulation* increases have subsequently declared to be willing to pay an additional tax for MPAs, rather than have said they are not willing to pay any additional tax.

Table 3. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the level of ecosystem service* Aesthetic benefits *(provided by Coralligenous) in Choice Experiment (Present / Growth); the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* All chosen combinations of Choice experiment in which the value of the ecosystem service *Aesthetic benefits* is growth have been aggregated, regardless of the level of the remaining attributes (*Climate regulation, Food, Cost*). The reference category is the aggregation of all the combinations selected in Choice experiment in which the value of the ecosystem service *Aesthetic benefits* is current, regardless of the level of the other three attributes.

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Aggregation options where the level of ecosystem service Aesthetics benefits = GROWTH	Intercept	2,773	1,031	7,235	1	,007			
	Level of willingness to spend more : HIGH	-4,005	1,117	12,861	1	,000	,018	,002	,163
	Level of willingness to spend more : MEDIUM	-4,625	1,099	17,720	1	,000	,010	,001	,084
	Level of willingness to spend more : LOW	-3,283	1,094	9,015	1	,003	,038	,004	,320
	Level of willingness to spend more : NONE	0[b]	.	.	0	.	.	.	.

The reference category is: Aggregation options where the level of ecosystem service Aesthetics benefits = PRESENT

b. This parameter is set to zero because it is redundant.

Comment. Considering the intercept of Table 3, it is more probable that respondents choose options of the Choice expeiment where there is a growing flow of the *Aesthetic benefits* ecosystem service than the options where the flow of the service remains at the current level (β> 0 , p-value> 0.05).

The analysis of the results of the individual levels of the variable *Willingness to spend more* in Table 3 indicates a lower probability (β <0, p-value <0.05) that respondents who are willing to pay an additional tax choose, in comparison with respondents who say they are not willing to pay an additional tax, the options in which there is a growing *Aesthetic benefits* ecosystem service (Aggregation of combinations in which *Aesthetic benefits* = GROWTH) instead of options where the service *Aesthetic benefits* remains "Present" (the reference category is: Aggregation of the combinations in which *Aesthetic benefits* = PRESENT). In other words, it is more probable that those who said they would not be willing to pay an additional tax chose, compared with those who said they were willing to do, the options in the Choice experiment in which there is an increase of *Aesthetic benefits* ecosystem service.

This result leads to an interesting consideration. Take into account, in fact, that in the questionnaire were asked to respond, in order of time, before to the Choice experiment, and after to a question on willingness to pay an additional tax for the system of Italian Marine Protected Areas. The result obtained with the Multinomial logit model suggests that in front of the requirement to pay, the respondents would not be willing to confirm the choice previously taken to conserve the Coralligenous. This could indicate that the choice of options in which the flow of this ecosystem service increases is weak, as not supported by an actual willingness to pay for conservation of marine biodiversity through the MPAs.

At this point it becomes interesting to make a comparison with the results obtained for the *Climate regulation*. In this case, it was found a willingness to pay an additional tax, by the respondents, in relation to the options of the Choice experiment in which the ecosystem service grows. This seems to show that the respondents associate major social and economic benefits to the ecosystem service *Climate regulation* provided by the *Posidonia oceanica* meadows than (a) the *Aesthetic benefits* that derive from knowing that through MPAs the area of seabed occupied by the climax community of Coralligenous can be incremented, and (b) the benefits of conservation for fishing.

Tabel 4. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the Level of ecosystem service* Food *in the Choice Experiment (Present / Growth); the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* All combinations of choices Choice experiment in which the value of ecosystem service Food is growth have been aggregated, regardless of the level of the remaining attributes (Climate regulation, Aesthetic benefits, Cost). The reference category is the aggregation of all the combinations selected in Choice experiment in which the value of ecosystem service *Food* is "Present", regardless of the level of the other three attributes.

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Aggregation options where the level of ecosystem service *Food* = GROWTH	Intercept	2,773	1,031	7,235	1	,007			
	Level of willingness to spend more : HIGH	-3,370	1,097	9,440	1	,002	,034	,004	,295
	Level of willingness to spend more : MEDIUM	-4,036	1,078	14,030	1	,000	,018	,002	,146
	Level of willingness to spend more : LOW	-2,521	1,091	5,344	1	,021	,080	,009	,681
	Level of willingness to spend more : NONE	0[b]	.	.	0	.	.	.	.

The reference category is: Aggregation options where the level of ecosystem service *Food* = PRESENT

b. This parameter is set to zero because it is redundant.

Comment. Considering the intercept of Table 4, it is more probable that respondents choose options of the Choice expeiment where there is a growing flow of the ecosystem service *Food* in comparation with the options where the flow of the service remains at the present level (β> 0, p-value> 0.05).

The analysis of the results of each levels of the variable *Willingness to spend more* indicates a lower probability (β <0, p-value <0.05) that respondents who are willing to pay an additional tax choose, compared with respondents who say they do not be willing to pay an additional tax, the options in which there is an increase of ecosystem service *Food* (Aggregation of combinations in which *Food* = GROWTH) instead of options where the service *Food* it remains current (Aggregation of combinations in which *Food* = PRESENT). For comments on these results please refer to the previous table (Table 3) on the *Aesthetic benefits* ecosystem service.

Considerations on Tables 2, 3 and 4. A comparison between the tables of classifications in which, for each of the three ecosystem services, the level of service "Present" is related with the level of service "Growth", can be made additional considerations.

(1) Comparing the value of the intercept β of the tables of the three ecosystem services (Table 2, 3, 4), we deduce that there is a greater propensity by the respondents to increase conservation policies of marine biodiversity that enhance the availability of food and the health of corallligenous, rather than the ability of the seagrass *Posidonia oceanica* to reduce greenhouse-gas emissions and increase Corg stores.

(2) Considering, however, the payment per year, the results show a willingness to pay, from those who comes to the MPA of Portofino, an additional tax for Italian MPAs when these are intended to help regulate climate change, rather than to maintain in good state of health deep ecosystems or increase the conservation of fish species useful for food.

Table 5. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the options of Choice experiment aggregated with regard to the level of the attribute Cost; the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* The aim of Table 5 is to relate the options of the Choice experiment chosen by respondents in which the level of the attribute *Cost* is maximum (option of choice in which the attribute Cost is € 1 *versus* option that is € 0.1 ; € 10 *versus* € 1), with options where instead cost was given less importance (€ 0.1; 1 *versus* 10 €), or no importance (*status quo*: Cost = 0, option 1).

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Status quo: Cost= 0	Intercept	2,773	1,031	7,235	1	,007			
	Level of willingness to spend more : HIGH	-18,756	645,285	,001	1	,977	7,148E-009	,000	.
	Level of willingness to spend more : MEDIUM	-5,951	1,258	22,364	1	,000	,003	,000	,031
	Level of willingness to spend more : LOW	-18,541	709,466	,001	1	,979	8,869E-009	,000	.
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
Aggregation of the options where the cost was attributed less importance	Intercept	-17,142	,363	2227,144	1	,000			
	Level of willingness to spend more : HIGH	16,400	,529	962,117	1	,000	13261639,647	4704732,320	37381741,224
	Level of willingness to spend more : MEDIUM	15,468	,000	.	1	.	5221770,611	5221770,611	5221770,611

	Level of willingness to spend more : LOW	17,394	,509	1168,425	1	,000	35806427,047	13207690,015	97072252,336
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.
The reference category is : Aggregation of the options where the cost has been attributed greater importance									

c. This parameter is set to zero because it is redundant.

Comment. We begin our analysis of the outputs from the models that relate the category "Aggregation of the options where to the cost was attributed less importance." The examination of the intercept shows that is less probable that respondents choose the category "Aggregation options where the cost has been attributed less importance" (options where the cost of the attribute levels are greater than zero but low) than the category "Aggregation options where the cost has been attributed greater importance" (options where the cost levels of the attribute are high) ($\beta < 0$, p-value < 0.05). Therefore, according you results from our sample, it is expected that those who are willing to pay an additional tax for the conservation of marine biodiversity through the MPAs is determined to choose options where the relative value of the level of the economic attribute is maximum.

Let us examine the results of each levels of the variable *Willingness to spend more.* For levels of *Willingness to spend more High, Medium* and *Low* coefficients are $\beta > 0$, p-value < 0.05. The analysis shows that respondents that have claimed that they be willing to pay an additional tax per year, compared to respondents that said they are not willing to pay any additional tax, it is more probable to have chosen options of Choice experiment where the level of the *Cost* attribute has relative values that are low (0.1 or 1 €) rather than relative values that are high (1 or 10 €). For the interpretation of this result, we must first take into account that the monetary values of the attribute *Cost* of Choice experiment are between 0.1 € and 10 €, i.e. values that correspond, in the next question on the willingness to pay an additional annual tax, to the classes "Low" (0.1 to 9 €) and "Medium" (10-24 €). The analysis with the Multinomial logit model, therefore, shows a substantial

consistency of the answers by the respondents willing to pay an additional tax of intermediate level for the Italian MPAs. It is interesting that a number of respondents who chose the category "Aggregation of the options where the cost was attributed less importance" rather than the category "Aggregation options where the cost has been attributed greater importance", has later declared to be willing to pay a high tax. This behavior could be explained by the fact that the choice of the option is also determined by the other attributes, in one or more of which the respondent could have put more emphasis compared to the *Cost* during the experiment of choice.

We now consider the models that concern the option 1 (*status quo*). The analysis of the intercept ($\beta > 0$, p-value <0.05) indicates that it is more probable that respondents choose option 1 (Cost = 0), rather than the category "Aggregation of the options where the cost has been attributed greater importance" (levels of cost = max). So we can expect that respondents at the Portofino MPA are disposed to not pay an additional tax rather than pay a high tax.

The analysis of the models for different classes of *Willingness to spend more* indicates significant values of the coefficient only in the case of the *Medium* level ($\beta > 0$; p-value <0.05). It can be assumed that respondents who choose to pay an additional tax of medium class (10-24 €), compared with those who have chosen not to support any additional payment, is less probable to have chosen the option in the Choice experiment in which the level of the attribute *Cost* is zero, instead of options in which the level of the attribute *Cost* is maximum. This result allows to locate in the medium class of the *Willingness to spend more* for the monetary amount that most probable would pay visitors of the Marine protected area that are available to choose options of the Choice experiment with high levels of tax. This is an important and original result of this research. In fact it allows, in the complex preliminary phase of determination of the levels of the attributes of Choice experiment, to identify the highest levels usable for the monetary attribute. Therefore, the present study, which was characterized right from the premises by the desire to put in the questionnaire, next to choice set, original questions with respect to the practice in the literature, is also a pilot research aimed at providing valuable information for setting the Choice experiment methodology for future research in the specific context of the Italian Marine Protected Areas.

Table 6. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the options of Choice experiment aggregated with regard to the relative level of the attribute Cost; the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* The aim of Table 6 is to relate the options of the Choice experiment chosen by respondents in which the relative level of the *Cost* attribute is minimal (0,1 €; 1 compared to 10 €) with the option in which the level of *Cost* attribute is zero (*status quo*: option 1).

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Status quo: Cost = 0	Intercept	19,915	1,093	332,040	1	,000			
	Level of willingness to spend more : HIGH	-35,157	645,285	,003	1	,957	5,390E-016	,000	.
	Level of willingness to spend more : MEDIUM	-21,419	1,258	289,751	1	,000	4,987E-010	4,234E-011	5,874E-009
	Level of willingness to spend more : LOW	-35,934	709,466	,003	1	,960	2,477E-016	,000	.
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.

Aggregation of the options where the cost has been attributed greater importance	Intercept	17,142	,363	2227,144	1	,000			
	Level of willingness to spend more : HIGH	-16,400	,529	962,117	1	,000	7,541E-008	2,675E-008	2,126E-007
	Level of willingness to spend more : MEDIUM	-15,468	,000	.	1	.	1,915E-007	1,915E-007	1,915E-007
	Level of willingness to spend more : LOW	-17,394	,509	1168,425	1	,000	2,793E-008	1,030E-008	7,571E-008
	Level of willingness to spend more : NONE	0[c]	.	.	0	.	.	.	.

The reference category is: Aggregation of the options where the cost was attributed less importance.

c. This parameter is set to zero because it is redundant.

Comment. The analysis of the intercept ($\beta > 0$, p-value < 0.05) indicates that it is more probable that respondents choose option 1 (Cost = 0), rather than the category "Aggregation of the options where the cost was attributed less importance" (levels of cost = minimum). The analysis of the different classes of payment indicates that those who are willing to pay an additional tax annual of medium level, compared to those not willing to pay any tax, is more probable to choose options in the Choice experiment where the level of *Cost* attribute has values lower than the *status quo* ($\beta < 0$, p-value < 0.05). The levels *Low* and *High* of *Willingness to spend more* are not significant (p-value > 0.05).

Table 7. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the Option* status quo *and the aggregation of the options of the Choice experiment in which the level of the attribute* Cost *is greater than zero (there is a tax: all options except the status quo); the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* The aim of Table 7 is to assess whether respondents are more probable to choose options of the Choice experiment in which they pay a tax, or the *status quo* in which any tax is paid.

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Aggregation of the options for which there is a tax	Intercept	-2,773	1,031	7,235	1	,007			
	Level of willingness to spend more : HIGH	25,145	,000	.	1	.	83250376455,647	83250376455,647	83250376455,647
	Level of willingness to spend more : MEDIUM	6,122	1,257	23,724	1	,000	456,000	38,816	5357,022
	Level of willingness to spend more : LOW	25,145	,000	.	1	.	83250376455,647	83250376455,647	83250376455,647
	Level of willingness to spend more : NONE	0[b]	.	.	0	.	.	.	.

The reference category is : Status quo (Option 1)

b. This parameter is set to zero because it is redundant.

Comment. The analysis of the intercept indicates that is less probable that the sample of respondents choose the classification that includes all the options for which is expected to pay a tax compared to the choice in which there is any tax increases (option 1, *status quo*) ($\beta < 0$, P-value < 0.05).

Therefore, it is more probable that those who visit or live at Portofino is not willing to pay any additional tax to increase the flow of one or more ecosystem services provided by marine biodiversity present in the MPA, rather than pay an additional tax to the taxes that are already paid.

Comments on the Tables 5, 6 and 7. From the outputs of Table 7 was observed that the people interviewed in the town of Portofino are more probably to choose the option in which the attribute *Cost* of Choice experiment is zero (option 1), rather than the classification that groups options in which the attribute *Cost* is greater than zero (category "Aggregation of the options for which there is a tax"). We can find various explanations for this behavior. In fact, it is interesting to consider the comments from those who have chosen the status quo detected during the field interviews. We have never found a lack of interest in the conservation of marine biodiversity through the MPA. It also takes into account that the option with zero cost is the condition in which is actually present the annual funding by the Italian State to MPAs; this funding guarantee the level of conservation of ecosystems to produce a positive flow of ecosystem services (at the level defined “Present”). The most frequent explanation for the choice of the *status quo*, by the respondents, is that they are not available to pay State taxes in addition to those that already are paid; this consideration is part of broader assessments, reported by respondents, of malaise towards the use of monetary resources from the State and the tax burden on citizens. A second view, expressed by other respondents, is that the Portofino MPA already receives many financings that are believed to be used improperly, and / or in favor of measures that produce costs for the population living in municipalities present in the area of the MPA, in terms of conflicts of land use; this explanation was given almost unanimously by residents, and people from other places who claimed to attend so very assiduous the protected area and know the needs and uneasiness of the residents.

By breaking down the category "Aggregation options for which there is a tax" in the two classifications in which the relative level of the attribute *Cost* is minimum and maximum (respectively category "Aggregation of the options where the cost was attributed less importance" and "Aggregation of the options where the cost has been attributed greater importance"), it was observed that even when the level of tax in Choice experiment is low, it is more probable that respondents choose the *status quo* (Table 6). It can be concluded that the population of respondents is more inclined to not pay additional taxes, rather than paying a tax that allows an increase in socio-economic benefits at the present from the marine biodiversity conservation through MPAs, and that this result leave the level of taxation aside.

Table 8. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the* status quo *option and by the aggregation of the options of Choice experiment in which the level of the attribute Cost is greater than zero (there is a tax: aggregation of all options except the status quo); the independent variable is represented from the Age the respondents.* With Table 8 we wonder what combination of ecosystem services are chosen by individuals with different ages. The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years).

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Aggregation of the options for which there is a tax	Intercept	,860	,360	5,720	1	,017			
	Younger individuals (< 46 anni)	1,857	,531	12,248	1	,000	6,407	2,264	18,129
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is: Status quo (Option 1)									

b. This parameter is set to zero because it is redundant.

Comment. The Multinomial logit model indicates that, relatively to the age of respondents, is more probable to be chosen options where there is an increase in taxation than the *status quo*.

The table shows that it is more probable that younger individuals choose options of Choice experiment in which is required to pay a tax, compared to older individuals. So we can expect that the younger visitors the Marine protected area of Portofino are more probable to consider the socio-economic benefits of an increase of ecosystem services.

Table 9. *The data are analyzed using a Conditional logit model, in which the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas; the independent variable is represented by the Age of the respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years). Table 9 is designed to investigate whether there is a difference between the younger and older respondents in the willingness to pay an additional tax for the increase of the deliver of ecosystem services through the marine biodiversity conservation by means Italian MPAs.

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Level of willingness to spend more : HIGH	Intercept	-1,204	,658	3,345	1	,067			
	Younger individuals (< 46 anni)	2,590	,782	10,965	1	,001	13,333	2,878	61,771
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Level of willingness to	Intercept	,336	,414	,660	1	,416			

spend more : MEDIUM	Younger individuals (< 46 anni)	1,524	,580	6,905	1	,009	4,592	1,473	14,314
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Level of willingness to spend more : LOW	Intercept	-,105	,459	,053	1	,819			
	Younger individuals (< 46 anni)	1,295	,630	4,219	1	,040	3,651	1,061	12,561
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.

The reference category is: Level of willingness to spend more : NONE.

b. This parameter is set to zero because it is redundant.

Comment. Table 9 shows that for classes *High*, *Medium* and *Low* of the additional tax is more probable that younger respondents are, compared to individuals not young, willing to pay an additional tax rather than not pay it ($\beta > 0$; p-value < 0.05).

Therefore, it can be concluded that in the sample of people interviewed in Portofino, the younger people are more willing to pay an annual tax compared to older people, even medium levels of tax (10-24 €) and significantly high (25 to 100 €).

Table 10. *The data are analyzed using a Conditional logit model, in which the dependent variable is represented by the level of ecosystem service* Climate Regulation *(provided by the* Posidonia oceanica *meadows) in Choice Experiment (Present / Growth); the independent variable is represented from the Age the respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years).

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Level of the Climate regulation service = PRESENT	Intercept	,054	,329	,027	1	,869			
	Younger individuals (< 46 anni)	-,541	,382	2,011	1	,156	,582	,275	1,230
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.

The reference category is: Level of the Climate regulation service = GROWTH.

b. This parameter is set to zero because it is redundant.

Table 11. *The data are analyzed using a Conditional logit model, in which the dependent variable is represented by the level of ecosystem service* Aesthetic benefits *(provided by Coralligenous) in Choice Experiment (Present / Growth); the independent variable is represented by the Age of the respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years).

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Level of the Aesthetic benefits service = PRESENT	Intercept	-,163	,330	,243	1	,622			
	Younger individuals (< 46 anni)	-,948	,395	5,749	1	,016	,388	,179	,841
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.

The reference category is: Level of the Aesthetics benefits service = GROWTH

b. This parameter is set to zero because it is redundant.

Table 12. *The data are analyzed using a Conditional logit model, in which the dependent variable is represented by the Level of ecosystem service* Food *in the Choice Experiment (Present / Growth); the independent variable is represented by the Age of the respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years).

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Level of the *Food* service = PRESENT	Intercept	,272	,332	,672	1	,413			
	Younger individuals (< 46 anni)	-,912	,386	5,577	1	,018	,402	,188	,856
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is: Level of the *Food* service = GROWTH									

b. This parameter is set to zero because it is redundant.

Comments on the Tables 10, 11 and 12. Tables 10, 11 and 12 relate the age the respondents (divided into 2 classes: younger individuals and older individuals) with the level of each of the three ecosystem services of Choice experiment. By analyzing the tables we deduced that it is more probable that the younger respondents, compared with older, choose options in which the *Aesthetics benefits* ecosystem service grows ($\beta < 0$, p-value < 0.05) and grows the *Food* ecosystem service ($\beta < 0$, p-value < 0.05). For the ecosystem service *Climate regulation* is detected a similar trend to the previous two ecosystem services ($\beta < 0$), but the value of significance is low (p-value> 0.05).

Table 13. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the level of the attribute* Cost *of the Choice experiment (0, 0.10, 1, 10 €); the independent variable is represented from the Age of respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years).

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Cost = 0 €	Intercept	,201	,449	,199	1	,655			
	Younger individuals (< 46 anni)	-1,968	,608	10,492	1	,001	,140	,042	,460
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Cost = 0,10 €	Intercept	-,405	,527	,592	1	,442			
	Younger individuals (< 46 anni)	-,089	,585	,023	1	,879	,915	,291	2,878
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Cost =1 €	Intercept	,201	,449	,199	1	,655			

	Younger individuals (< 46 anni)	-,225	,501	,202	1	,653	,798	,299	2,133
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is : Cost = 10 €									

b. This parameter is set to zero because it is redundant.

Comment. An analysis of Table 13 shows that it is more probable that younger respondents, compared to the older respondents, choose the options in which the level of the attribute *Cost* has the higher value (10 €) rather than choose the option with Cost = 0 (*status quo*) ($\beta < 0$; p-value < 0.05). For the other models it is not possible to draw conclusions because of the high value of significance of the coefficient (p-value> 0.05).

Table 14. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by its score attributed to the ecosystem service* Climate regulation*.; the independent variable is represented from the Age of respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 46 years). Through the Table we want to evaluate how the score (1-4; 4 = max) attributed to ecosystem service *Climate regulation* changes according to the age of the respondents.

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Relative score of the ecosystem service of Climate regulation = 1	Intercept	-2,526	,735	11,814	1	,001			
	Younger individuals (< 46 anni)	-1,235	1,025	1,451	1	,228	,291	,039	2,169
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Relative score of the ecosystem service of Climate regulation = 2	Intercept	-1,609	,490	10,793	1	,001			
	Younger individuals (< 46 anni)	-,899	,628	2,049	1	,152	,407	,119	1,394
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.

Relative score of the ecosystem service of Climate regulation = 3	Intercept	-1,609	,490	10,793	1	,001			
	Younger individuals (< 46 anni)	,045	,554	,007	1	,935	1,047	,353	3,101
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is: Relative score of the ecosystem service of Climate regulation = 4.									

b. This parameter is set to zero because it is redundant.

Comment. We begin with the analysis of the intercept. Table 14 shows that it is less probable that the respondents attribute value 1 rather than value 4 to this ecosystem service ($\beta < 0$, p-value < 0.05). It is less probable to be attributed value 2 rather than value 4 ($\beta < 0$, p-value < 0.05). And less probable to be chosen value 3 rather than value 4 ($\beta < 0$, p-value < 0.05). This result of the Multinomial logit model is consistent with findings in the proposition of the interviews, in which was a great interest from the public to the ecosystem service *Climate regulation*.

Analyzing the coefficient of ages, it is observed that it is less probable that young people attribute, compared to the older, value 1 compared to the value 4 ($\beta < 0$). However, this result is not very reliable because not significant (p-value > 0.05).

Table 15. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by its score attributed to ecosystem service* Aesthetic benefits *(provided by Coralligenous); the independent variable is represented by the Age of respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 45 years). Through Table 15 we want to evaluate as the score (1-4; 4 = max) attributed to ecosystem service *Aesthetic benefits* changes according to the age of respondents.

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Relative score of the ecosystem service of Aesthetic benefits = 1	Intercept	,981	,677	2,099	1	,147			
	Younger individuals (< 46 anni)	,292	,801	,133	1	,715	1,339	,279	6,434
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Relative score of the ecosystem service of Aesthetic benefits = 2	Intercept	1,609	,632	6,476	1	,011			
	Younger individuals (< 46 anni)	,539	,748	,519	1	,471	1,714	,396	7,427
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.

Relative score of the ecosystem service of Aesthetic benefits = 3	Intercept	1,299	,651	3,979	1	,046			
	Younger individuals (< 46 anni)	-,201	,784	,066	1	,798	,818	,176	3,804
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is: Relative score of the ecosystem service of Aesthetic benefits = 4									

b. This parameter is set to zero because it is redundant.

Comment. In this case, the analysis of the intercept shows that is more probable that the respondents attribute the score 2 rather than the maximum score (4) to the ecosystem service *Aesthetic benefits* ($\beta > 0$, p-value < 0.05). It is more probable that respondents assign the score 3 rather than 4 ($\beta > 0$, p-value < 0.05). The analysis of the intercept referred to the score 1 indicates that it is more probable that the respondents attribute to the *Aesthetic benefits* a score lower than the higher score ($\beta > 0$), but the significance value of the coefficient β is very low (p – value > 0.05). It can be concluded that respondents give low importance to ecosystem service Aesthetic benefits, relative to the other attributes (*Climate regulation*, *Food*, *Cost*).

Table 16. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the score attributed to ecosystem service* Food*; the independent variable is represented by the Age of respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 45 years). Through Table 15 we want to evaluate as the score (1-4; 4 = max) attributed to ecosystem service *Food* changes respect to the age of the respondents.

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Relative score of the ecosystem service of Food = 1	Intercept	-,693	,707	,961	1	,327			
	Younger individuals (< 46 anni)	-,916	,949	,933	1	,334	,400	,062	2,568
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Relative score of the ecosystem service of Food = 2	Intercept	,511	,516	,979	1	,323			
	Younger individuals (< 46 anni)	,039	,610	,004	1	,949	1,040	,315	3,436
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Relative score of the ecosystem	Intercept	1,099	,471	5,431	1	,020			

service of Food = 3	Younger individuals (< 46 anni)	,427	,551	,602	1	,438	1,533	,521	4,513
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is: Relative score of the ecosystem service of Food = 4									

b. This parameter is set to zero because it is redundant.

Comment. Table 16, which relates the attribute *Food* with age (ages are divided into two classes: younger and older individuals), indicates that it is more probable to be given a score 3 to the ecosystem service rather than the higher score (4) ($\beta > 0$, p-value < 0.05). The analysis of the other factors would seem to indicate that the score 4 is attributed more probably than the score 1 ($\beta < 0$), and the score 2 more probably to score 4 ($\beta > 0$); in both cases, however, the significance of the coefficient is not sufficiently high (p-value > 0.05). The analysis of the coefficients of the age does not allow to fulfill considerations reliable because of the low significance (p-value> 0.05).

Table 17. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the score put to the attribute* Cost*; the independent variable is represented by the Age of respondents.* The ages have been divided into two classes: younger individuals (with an age under 46 years); and older individuals (with an age above 45 years). Through Table 15 we want to evaluate as the score (1-4; 4 = max) attributed to the attribute *Cost* changes according to the age of respondents.

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Relative score of Cost = 1	Intercept	2,079	,612	11,531	1	,001			
	Younger individuals (< 46 anni)	,248	,716	,120	1	,729	1,281	,315	5,210
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Relative score of Cost = 2	Intercept	,847	,690	1,508	1	,220			
	Younger individuals (< 46 anni)	,069	,807	,007	1	,932	1,071	,220	5,210
	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
Relative score of Cost = 3	Intercept	,000	,816	,000	1	1,000			
	Younger individuals (< 46 anni)	-,981	1,061	,855	1	,355	,375	,047	2,998

	Older individuals (> 46 anni)	0[b]	.	.	0	.	.	.	.
The reference category is: Relative score of Cost = 4									

b. This parameter is set to zero because it is redundant.

Comment. The analysis of the table indicates that it is more probable that the respondents give to the attribute *Cost* the lower score (1) rather than the higher score (4) ($\beta > 0$, p-value < 0.05). Due to the low significance associated with other coefficients, we can not draw reliable conclusions.

Table 18. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas; the independent variable is represented by the score attributed to the ecosystem service* Climate regulation. In Table 18 we want to evaluate how the willingness to spend more per year, change as a function of the relative score attributed to the ecosystem service *Climate regulation*.

Parameter Estimates of the Model									
		B	Errore std	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Level of willingness to spend more : HIGH	Intercept	,916	,374	5,997	1	,014			
	Relative score of the ecosystem service of Climate regulation = 1	-20,084	,000	.	1	.	1,896E-009	1,896E-009	1,896E-009
	Relative score of the ecosystem service of Climate regulation = 2	-1,204	,850	2,004	1	,157	,300	,057	1,589
	Relative score of the ecosystem service of Climate regulation = 3	,182	1,214	,023	1	,881	1,200	,111	12,953
	Relative score of the ecosystem service of Climate regulation = 4	0[b]	.	.	0	.	.	.	.
Level of willingness to spend more : MEDIUM	Intercept	1,435	,352	16,634	1	,000			
	Relative score of the ecosystem service of Climate regulation = 1	-2,128	1,274	2,789	1	,095	,119	,010	1,447

	Relative score of the ecosystem service of Climate regulation = 2	-1,435	,790	3,301	1	,069	,238	,051	1,120
	Relative score of the ecosystem service of Climate regulation = 3	1,050	1,099	,913	1	,339	2,857	,332	24,612
	Relative score of the ecosystem service of Climate regulation = 4	0[b]	.	.	0	.	.	.	.
Level of willingness to spend more : LOW	Intercept	,956	,372	6,594	1	,010			
	Relative score of the ecosystem service of Climate regulation = 1	-20,091	,000	.	1	.	1,882E-009	1,882E-009	1,882E-009
	Relative score of the ecosystem service of Climate regulation = 2	-2,342	1,178	3,950	1	,047	,096	,010	,968
	Relative score of the ecosystem service of Climate regulation = 3	,654	1,157	,319	1	,572	1,923	,199	18,568
	Relative score of the ecosystem service of Climate regulation = 4	0[b]	.	.	0	.	.	.	.

The reference category is: Level of willingness to spend more : NONE.

b. This parameter is set to zero because it is redundant.

Comment. The analysis of the intercept of Table 18 shows that it is more probable that respondents are willing to pay an additional annual tax (*High, Medium, or Low*) rather than not pay any additional tax ($\beta > 0$, p-value < 0, 05). This result indicates that those present in Portofino give importance to the socio-economic ecosystem service *Climate regulation*.

Considering each score class of ecosystem service, we see that coefficients are not significant. For this reason we have aggregated the classes of scores; the results are reported in the following table (Table 19).

Table 19. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the score attributed to the ecosystem service* Climate regulation*; the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* With this table (Table 19) we want to evaluate how changed the willingness to spend more for Marine protected areas, as a function of the relative score attributed to the ecosystem service *Climate regulation*. The scores were grouped into two classes, with the aim of obtaining lower significance values: Class 1 (high score) in the table includes the scores 1 and 2; Class 2 (Low Score) includes the scores 3 and 4.

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Score: Class 1 = High	Intercept	-,606	,508	1,426	1	,232			
	Level of willingness to spend more : HIGH	-1,627	,792	4,227	1	,040	,196	,042	,927
	Level of willingness to spend more : MEDIUM	-1,773	,690	6,606	1	,010	,170	,044	,656
	Level of willingness to spend more : LOW	-2,828	1,136	6,200	1	,013	,059	,006	,548
	Level of willingness to spend more : NONE	0[b]	.	.	0	.	.	.	.

The reference category is: Score: Class 2 = Low

b. This parameter is set to zero because it is redundant.

Comment. An examination of each class of additional tax, we can infer that respondents who said they were willing to pay an additional tax (*High*, *Medium*, *Low*, in all three cases: $\beta < 0$, p-value < 0.05), compared to those who are not willing to pay any tax, it is more probable to choose a *Low* score rather than a *High* score.

Table 20. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the score attributed to ecosystem service* Aesthetic benefits*; the independent variable is represented by the level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas.* With this table (Table 20) we want to evaluate how changed the willingness to spend more, per for the Italian Marine Protected Areas, as a function of the relative score attributed to ecosystem service *Aesthetic benefits*. The scores were grouped into two classes, with the aim of obtaining lower significance values: Class 1 (high score) in the table includes the scores 1 and 2; Class 2 (Low Score) includes the scores 3 and 4.

Parameter Estimates of the Model

		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Score: Class 1 = High	Intercept	-,118	,486	,059	1	,808			
	Level of willingness to spend more : HIGH	1,350	,649	4,332	1	,037	3,857	1,082	13,751
	Level of willingness to spend more : MEDIUM	,941	,562	2,802	1	,094	2,562	,851	7,713
	Level of willingness to spend more : LOW	2,386	,777	9,430	1	,002	10,875	2,371	49,879
	Level of willingness to spend more : NONE	0[b]	.	.	0	.	.	.	.

The reference category is: Score: Class 2 = Low

b. This parameter is set to zero because it is redundant.

Comment. By examining each class of additional tax, we can make the following observations. Respondents who said they were willing to pay an additional *High* tax, compared to those who are not willing to pay any additional tax, it is more probable to have attributed to the *Aesthetic benefits* ecosystem service a *High* score rather than *Low* ($\beta > 0$, p-value < 0.05). Who said he/she was willing to pay a *Medium* tax is more probable that, compared to those who said he/she would not be willing to pay additional tax, has given a *High* score to ecosystem *Aesthetic benefits* service rather than *Low*; in this case, the result is less significant: significance at the 10% level ($\beta > 0$). Finally, if we consider the respondents who said they pay an additional *Low* tax rather than no tax, it is more probable that they have given a *High* score rather than *Low* to the *Aesthetic benefits* service ($\beta > 0$, p-value < 0.05). In conclusion, it can be assumed that respondents who considered the ecosystem service *Aesthetic benefits* important in relation to other importantattributes (*Climate regulation*, *Food* and *Cost*) declared, in the continuation of the questionnaire, to be willing to pay an additional tax in favor of the Italian marine Protected Areas.

For the remaining two attributes, *Food* and *Cost*, the results are not significant; it was not therefore possible to make conclusions. From a comparison of the results of Table 19 and 20 can be concluded that respondents are more willing to pay an additional tax for *Aesthetic benefits* ecosystem service rather than for ecosystem service *Climate regulation*.

4.2 Estimation of the implicit price

Table 21. *The data are analyzed using a Conditional logit model, where the dependent variable is represented by the choice of respondents (Option A, Option B or status quo); the independent variables are the ecosystem services and the attribute Cost of the Choice experiment.*

Parameter Estimates of the Model									
		β	Errore std	Wald	df	Sig.	Exp(β)	95% Confidence Interval for Exp(β)	
								Lower Bound	Lower Bound
Option A	Intercept	97,592	5898,957	,000	1	,987			
	Cost	-3,910	,069	3237,859	1	,000	,020	,018	,023
	Climate regulation = PRESENT	-38,219	3526,933	,000	1	,991	2,522E-017	,000	.
	Climate regulation = GROWTH	0[c]	.	.	0	.	.	.	.
	Aesthetic benefits = PRESENT	-39,338	3364,419	,000	1	,991	8,240E-018	,000	.
	Aesthetic benefits = GROWTH	0[c]	.	.	0	.	.	.	.
	Food = PRESENT	-38,608	3535,000	,000	1	,991	1,709E-017	,000	.
	Food = GROWTH	0[c]	.	.	0	.	.	.	.
Option B	Intercept	100,577	5898,957	,000	1	,986			

	Cost	-4,005	,000	.	1	.	,018	,018	,018
	Climate regulation = PRESENT	-41,972	3526,934	,000	1	,991	5,914E-019	,000	.
	Climate regulation = GROWTH	0[c]	.	.	0	.	.	.	.
	Aesthetic benefits = PRESENT	-37,760	3364,419	,000	1	,991	3,992E-017	,000	.
	Aesthetic benefits = GROWTH	0[c]	.	.	0	.	.	.	.
	Food = PRESENT	-41,943	3535,000	,000	1	,991	6,085E-019	,000	.
	Food = GROWTH	0[c]	.	.	0	.	.	.	.

The reference category is: Option C: *Status quo*

c. This parameter is set to zero because it is redundant.

Table 22. Table 22, which is represented in a form similar to those reported in the literature, summarizes results of the multinomial logit model reported in Table 21. The coefficients, the implicit prices of ecosystem services, and supplementary information regarding the model (constants, the log-likelihood and the pseudo-R^2).

	Simple model (attributes)	
Descriptor	Coefficient	Implicit price (€ / household / year)
Climate regulation *(Increase)*	38,219	**9,77**
Aesthetic benefits *(Increase)*	39,338	**10,06**
Food *(Increase)*	38,608	**9,87**
Cost	- 3,910*	
ASCA	97,592	
ASCB	100,577	
Log-likelihood	- 79,315	
No. of participants	150	
Pseudo-R^2	0,618	

* p-value < 0,001

Comment. The sign of all ecosystem service attribute coefficients and of *Cost* attribute have the expected signs (Bergmann et al., 2006; Christie and Rayment, 2012): the positive coefficients of the ecosystem services indicate that respondents were more likely to choose an option if it delivered higher levels of service provision; the *Cost* attribute is negative indicating that participants were less likely to choose an option that have a higher cost. This implicit price has been estimated as a ratio of coefficients:

$$IP = - \frac{\beta_{Ecosystem\ service}}{\beta_{Cost}}$$

5. Discussion and conclusions

5.1 Discussion

Introduction. The aim of the study was to estimate the monetary value of three ecosystem services provided by some of the most important habitats and species protected through the Italian Marine Protected Areas, showing the social benefits of the conservation of marine biodiversity through the MPAs.

The research has used the Choice experiment method, with the addition of a questionnaire designed to obtain extra information, administered to 150 interviews of a sample of visitors of the Marine Protected Area of Portofino.

The study demonstrated that ecosystem services considered have a significant economic value. Moreover, our analysis has provided useful information for future applications of Choice experiment in the specific context of the Italian MPAs.

Method. Our research evaluated the economic benefits across a range of ecosystem services delivered by Italian MPAs using a single valuation protocol based on a Choice experiment. The Choice experiment approach also helps to avoid double counting from aggregating individual service values (Christie & Rayment, 2012).

In the Choice experiments estimated coefficients of the attributes maybe also used to estimate the economic value of different ways in which the attributes can be combined. Choice experiment allows to calculate the welfare effects of alternative scenarios to illustrate the most and least preferred management options. In our case, we decided to not consider different scenarios but to focus our work on the monetary estimates of ecosystem services. In particular, we only considered an increase of ecosystem services value (from the level "Present" to the level "Growth"); this means that only a best scenario can be defined, that cannot be compared with other different scenarios (Juutinen et al., 2011).

Results. In our study we have chosen to interview the general public who attended in summer the MPA of Portofino. This choice was dictated by several reasons. First, we felt that, considered the ecosystem services treated in the study, to interview specific stakeholders could lead to the risk of generating unidirectional answers. For example, the willingness to pay for the *Aesthetic benefits* ecosystem service provided by coralligenous could lead to a distortion in the responses of divers. The service *Food* could lead to

distortions in the responses by fishermen (professional or sports). Second, the issue of preserving the environment and funding to MPAs has acquired public importance; it is therefore scientifically important to know the opinion of the general public.

Our sample is mainly composed by tourists (144 persons); only 6 people were resident in the municipalities present in the territory of the Portofino MPA. The residents were less available to answer questionnaires than tourists. For this reason it has not been possible to make willingness to pay comparisons between the two groups.

The sign of all ecosystem service attribute coefficients and of Cost attribute of the model we used for the monetary valuation of ecosystem services have the expected signs (Bergmann et al., 2006; Christie and Rayment, 2012; Juutinen et al., 2011): the positive coefficients of the ecosystem services indicate that respondents were more likely to choose an option if it delivered higher levels of service provision; the Cost attribute is negative indicating that participants were less likely to choose an option that have a higher cost. These facts provides evidence of construct validity.

We have estimated the implicit prices of the three ecosystem services (*Climate regulation*, *Aesthetic benefits*, *Food*) on the basis of the coefficients obtained using the multinomial logit model. Implicit prices are interpreted as the incremental willingness to pay (WTP), through an increase in a national tax for Italian Marine Protected Areas per annum per household, for a change in any of the ecosystem services. Our results show that people is willing to pay € 9.77 per household per year for an increase of the ecosystem service *Climate regulation*, through greater protection of *Posidonia oceanica* meadows by the Italian Marine Protected Areas, in comparison to have a level of the ecosystem service that is maintained at the current level. For the ecosystem service *Aesthetic benefits* provided by the coralligenous, the WTP is € 10.06 per household per year. For the ecosystem service *Food*, the WTP is € 9.87 per household per year. The total WTP of each family for an increase in the flow of the three ecosystem services through the Italian MPAs is 29.7 euro per household per year.

A synthesis of the implicit prices is shown in Table 1. These values are related to changes in the flow of ecosystem services from the political scenario in which the annual funding from the State for the conservation of marine biodiversity through the Italian MPAs remains current, to the political scenario in which the funds are increased to allow for more conservation.

Ecosystem service	**Implicit price of ecosystem services** (€/household/year)	**Aggregate value of ecosystem services (All households in Italy*)** (€/year)
Climate regulation (Regulating ecosystem service)	9,77	240 342 000
Aesthetic benefits (Cultural ecosystem service)	10,06	247 476 000
Food (Provisioning ecosystem service)	9,87	242 802 000
Total	29,7	730 620 000

The implicit prices of ecosystem services could be an underestimation of the total economic value (VET) of the ecosystem services. It should be considered that the *Posidonia oceanica* meadows, the coralligenous and fish populations provide a much wider variety of ecosystem services, and that in the Italian MPAs there are other habitats and species that contribute to the supply of a wide range of ecosystem services. For example, *Posidonia oceanica* meadows, in addition to the *Climate regulation* service, provides other important services as Disturbance regulation, Nutrient cycling, Waste treatment, Habitat/Refugia for commercial species, Protection from predators for young fish and young organisms (nurseries), Erosion control, Food production. Other relevant

habitats present in Italian Marine Protected Areas are the seagrass *Cymodocea nodosa* and "Trottoir à *Lithopyllum lichenoides*".

The three implicit prices obtained through the Choice experiment for each ecosystem service have a similar value. This result can be interpreted as a tendency of respondents to the overall conservation of ecosystem services provided by marine biodiversity, rather than to a specific ecosystem service. However, we can add to these conclusions a consideration. Through the additional questionnaire, in fact, respondents were asked to indicate the relative importance of each of the ecosystem services. The analysis of joint distributions obtained by crossing this data with responses to Choice experiment, seems to indicate a particular attention by the interviewed population to the ecosystem service *Climate regulation,* followed in importance by the ecosystem service *Food*. Instead, a comparison of the previous two ecosystem services with the *Aesthetic benefits* shows that this ecosystem service is considered less relevant.

For future applications of Choice Experiment with interviews face-to-face, it will be interesting to examine whether, by administering the question on the relative importance of attributes before the proposition of the choice set, the respondent has the opportunity to make a greater reasoning on the importance of individual attributes, and whether this procedure can influence the selection of the options of the choice set.

The obtained monetary values of ecosystem services indicate consistency of the answers with the utility theory, that is a willingness to accept a tax increase to get a greater provision of ecosystem services. This result is emphasized in our study by the analysis of contingency tables of the demand on the willingness to pay a tax in favor of the Italian MPAs based on an initial budget - which represents a peculiar information of our study - and the level the ecosystem service *Climate regulation* in Choice experiment (Present/Growth). In fact, in this case it emerged that for a growing provision of ecosystem service there is an increase in the percentage of respondents willing to pay an additional tax, at least up to a certain point (increase in taxation "Medium") beyond which instead willingness to pay decreases.

Our study showed a higher sensitivity for ecosystem services, and a greater willingness to pay for their additional provision, by the younger respondents (aged less than 46 years) compared to older respondents (with an age above 46 years). In particular, it has been possible to make three considerations. First, in the study it is emerged that it is more probable that the younger respondents, compared with older, choose options of Choice

experiment in which there is an increase in the flow of ecosystem service Aesthetic benefits and of the ecosystem service Food; for the ecosystem service Climate regulation we found a similar trend to the previous two ecosystem services but the statistical significance is low. Second, the study shows that it is more probable that younger individuals, compared to older individuals, choose options of the Choice experiment in which there is a tax. So we can expect that the younger visitors of the Marine Protected Area of Portofino are more disposed to take into account the socio-economic benefits of an increase of the ecosystem services provision. Third, we have found that it is more probable that younger respondents, compared with older respondents, choose the options where the cost level of the attribute has the higher value (€ 10) rather than choosing the status quo (option of the Choice experiment with Cost = 0).

Some interesting considerations emerged when we have analyzed the answers of the respondents in relation to the profession. All classes of workers (Managers, Employees, Self-employed, Pensioners and unemployed, Students) have given a high importance to the ecosystem service *Climate regulation* provided by the *Posidonia oceanica* meadows and, though to a lesser extent, to the service *Food*. Less importance has been attributed to ecosystem service *Aesthetic benefits* provided by coralligenous, with the exception of the category “Pensioners and unemployed", for which the *Aesthetic benefits* service was more important compared to other classes of workers. Moreover, the importance attributed to the service *Aesthetic benefits* was more homogeneous, in comparison with the other two ecosystem services, between different classes of the profession; this could be explained by the fact that, unlike the other ecosystem services, the benefits of which are felt indispensable to society, *Aesthetic benefits* is an ecosystem service whose benefits are more subjective. Finally, the Employees have chosen, more than other classes of workers, options of the Choice experiment where the level of the attribute Cost was maximum (€ 10).

Our study, using evaluations through the multinomial logit model, allowed to identify in the average class of the Level of willingness to spend more, per year, of the own current budget for the Italian Marine Protected Areas (corresponding to values ranging between € 10 and € 24) the monetary amount that the frequenters of the MPA of Portofino, that are available to select the options of Choice experiment with high levels of tax, most probably would be willing to pay. This is an important and original result of this research. In fact it allows, in the complex preliminary phase of determination of the levels of the attributes of Choice experiment, to identify the higher levels usable for the monetary attribute. For this reason, the present study (which was characterized right from the premises by the will to

put in the questionnaire, beside the choice set, original questions compared to the practice in the literature) is also a pilot research aimed at providing valuable information to set up the Choice experiment method for future research in the specific context of the Italian Marine Protected Areas.

Comparison with the literature. The Choice experiment has been used in many contexts for the evaluation of the benefits of biodiversity. We now wish to propose some considerations on the analogies between the results of our study and two studies that have similar methodological characteristics. In particular, the study of Christie and Rayment in 2012 where has been estimated the economic value of changes in ecosystem services provided by different habitats present inside protected areas in England and Wales. And the recent study of Christie et al. (2015), where the authors presented an evaluation of the monetary value of ecosystem services provided by Marine Protected Areas in the Caribbean. It is not possible to make quantitative comparisons between our results and that of the other two studies, because the levels of the attributes used are different, including the economic attribute; however, we can identify similarities in the trends observed.

In 2012 Christie and Rayment published an interesting study as regards the aim of our research. The two authors estimated the economic value of changes in biodiversity and associated ecosystem services provided by different habitats present inside the "Sites of Special Scientific Interest" (SSSI) present in England and Wales. The objective is to evaluate the benefits of biodiversity conservation and compare them with the costs of management. To reach their objective, the authors used a Choice experiment to assess the economic value of ecosystem services provided by SSSI habitats. The conclusions of this study have similarities with our study. In fact, the result of the research is that the public are willingness to pay to secure the levels of services currently delivered by SSSI conservation activities in England and Wales, and to secure the benefits that would be delivered if all SSSIs all in favorable condition. These values are greater than the annual public costs of SSSI sites management, proving that biodiversity conservation is cost effective.

During the final phase of our study, has been published a work of Christie et al. (2015) in which the authors report the results of a Choice experiment that estimated the values of ecosystem services provided by Marine Protected Areas in Caribbean. The authors considered two future scenarios: an "improved" scenario in which marine protection is increased, and a "decline" scenario in which the current protection mechanisms are removed. Similarly to our study, this work demonstrated that locals and tourists attending

Marine Protected Areas in Caribbean have high values to protect against deterioration in current levels of ecosystem services provision and significantly value improvements in the level of ecosystem service provision.

In our study, we did not consider some issues regarding the monetary valuation of ecosystem services through the Choice experiment method.

The first concerns the estimation of aggregate value of ecosystem services. A further measure of the value of ecosystem services, in fact, can be achieved by aggregating the implicit prices of ecosystem services with the number of households in the Country where the study was carried out (Christie & Rayment, 2012). However, we considered that our sample of the survey population at the Portofino MPA was not necessarily representative of the Italian population with regard to the socio-demographic. For this reason we decided to not furnish this estimate.

A second aspect concerns the valuation of a "per Area" value. Usually this information is not provided by Choice experiment studies; however Christie & Rayment (2012) were able to calculate this value because they estimated attribute levels on the basis of the area of habitats considered.

More founding for conservation. With more funding which conservation measures could be undertaken by Italian MPAs managers? To answer this question we refer to the Marine Protected Area of Portofino (Dr. Fanciulli, Director of the MPA of Portofino, pers. comm.).

For the *Posidonia oceanica* meadows, the MPA would use funding to manage boating activities to reduce the impact of the anchors on the meadows. The impact of anchors has become worrying for Posidonia oceanica meadows in the Portofino MPA because of the considerable number of leisure boating, not only during the touristic season but all year round at weekends (Boudouresque, 2008; Relini, 2008). Since the Marine Protected Area was set up in 1998, there are rules for activities that provide for the defining of anchoring areas and regulated mooring areas. With more founding, new moorings could be created in the areas occupied by Posidonia meadows.

Another use of funding in Portofino MPA for *Posidonia oceanica* protection is the increase of scientific studies through more extensive use of Remotely Operated Vehicles (ROVs), so far limited due to lack of funds. ROV are vehicles with one or more cameras on board, linked to the surface by a special cable leading power and video signals that can be recorded (Colantoni, 1995). ROV is used to map the Posidonia oceanica meadows, with the aim to evaluate its dynamics with regard future regressions or developments.

More founding for *Posidonia oceanica* protection, finally, could be used for oceanographic studies of streams to monitor pollution of regional-wide origin in the Ligurian sea.

For the coralligenous, the MPA of Portofino would use funding to mapping the assemblages, and for the construction of artificial reefs near the Zone B (Area of General Reserve: the zone directly surrounding the integral reserve, where some activities are allowed such as commercial fishing) to attract fish, in order to avoid fishing and other activities impacting on coralligenous inside the protected area.

As regards fishes and lobster, with more founding scientific studies would be increased. For example, could be undertaken studies for lobster (*Palinurus elephas*) on the deeper bathymetries, with the involvement of fishermen and use of ROVs.

In addition, more funds could be used to raise environmental awareness and for environmental education (progettoisea.it).

Future research. Further Choice experiments for the monetary valuation of ecosystem services provided by biodiversity of Italian MPAs are needed. In particular, new studies should address other MPAs and an Italian population sample selected on the basis of socio-economic representativeness. The studies carried out in other Italian MPAs can highlight differences in the choice of the sample population interviewed (Christie et al., 2015). For example, the results of studies conducted at different MPAs could be affected both by the way people perceive to be the conditions of the protected ecosystems, and the level of external pressures (anthropogenic pressures are different in different MPAs). The sample socioeconomic will get aggregate values of the Italian households reliable enough to apply a cost-benefit analysis for environmental national policies.

5.2 Conclusions

This study assessed the economic value of some important ecosystem services provided by some of the most important habitats and species protected through the Italian Marine Protected Areas, using the Choice experiment method. In addition, the study has laid the foundation for future applications of Choice experiment for the economic valuation of ecosystem services in the specific context of the Italian Marine Protected Areas.

Our analysis shows that the benefits to people, interviewed at the MPA of Portofino, from an increase of ecosystem services *Climate regulation* provided by the *Posidonia oceanica* meadows, *Aesthetic benefits* provided by coralligenous and *Food* provided by fish populations, is € 29,7 per household per year.

If we consider that from 2008 to present the budget of the Ministry of the Environment with regard to the MPAs has been reduced by 50% (source: Italian Ministry of the Environment, Land and Sea), our research indicates that it is beneficial and desirable a reversal of the trend towards an increase in public funding for Italian MPAs.

Additional applications of Choice experiment for the valuation of ecosystem services provided by Italian MPAs, which take the conclusions and considerations of our study into account, might extent the scope of the research. In particular, it is useful to apply the method to the other Italian MPAs and to a selected sample of the Italian population representative with regard to the socio-demographic.

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