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# Environmental attitude, motivations and values for marine biodiversity protection

George Halkos<sup>1</sup> and Steriani Matsiori<sup>2</sup>

## Abstract

This study explores people's environmental attitudes and motives for putting economic values to marine biodiversity and its protection. Primary data were collected from a sample of 359 people living in two important Greek coastal port cities: Thessaloniki and Volos. Respondents' environmental attitude was measured with the New Ecological Paradigm (NEP) scale, and economic values were derived from a referendum, contingent valuation method (CVM) survey for protecting marine biodiversity. Use of appropriate statistical methods revealed three factors of environmental attitudes; namely, man dominate to nature, anti-anthropocentrism and limits to growth. Significant relationships are found between NEP scale factors and socio-economic characteristics and individuals' opinions about marine biodiversity utility. Pro-environmental behavior or attitudes are associated with higher NEP scale scores. At a second stage and in a logistic regression setup the relation between people's willingness to pay (WTP) for marine biodiversity protection with their socio-economic characteristics and the PCA extracted results are explored. Pro-environmental attitudes influence the estimates of mean WTP. Significant relationships are found between environmental attitudes and non-use motivations and WTP and ethical motives for species protection. Finally individuals' mean WTP for marine biodiversity protection was calculated approximately equal to € 29 per person.

**Keywords:** Environmental attitudes; NEP scale; CVM; WTP; biodiversity.

**JEL classifications:** C10; C52; Q20; Q51; Q57.

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## **1. Introduction**

Last decades many studies have extensively focused on the fields of sociology and psychology to explain the changes of people's behavior toward the natural environment. According to Marquart-Pyatt (2007) social research is interested in the environmental concern of the general public because it is crucial for supporting environmental policies. For this reason the existing literature investigates how people think, believe, and take action on issues related to the environment. It is important to understand how people decide to act friendly for the environment, explain the link between one's everyday behavior and natural environment conservation and even more how psychology can improve ecological behavior (Schmuck and Vlek 2003).

Environmental psychology studies the consequences of people's different behaviors to the environment and moreover the discipline that describes human behavior and its connection with conservation (or protection) of natural environment called conservation psychology (Clayton and Myers 2009). For many researches environmental psychology can be defined as the study of interaction between the environment and human influence, knowledge about environmental problems and finally human behavior (Gifford 2007). More recently a new discipline called conservation psychology (Clayton and Myers 2009; Saunders and Myers 2003) and ecopsychology psychology (Doherty 2011) gives emphasis to understanding and troubleshooting issues related to people's decisions about environmental conservation.

According to the literature conservation psychology is based on environmental ethics and leads to a number of questions. Namely, why some people are environmentally concerned and some others are not; what drives people to care for the

environment; why we are concerned about the quality of the environment; and what encourages people's environmental attitudes, concerns and behavior.

For many researchers environmental concern is synonymous to environmental attitude (Van Liere and Dunlap 1981), while others argue for the differential of these terms (Stern and Dietz 1994; Schultz *et al.* 2004). Schultz *et al.* (2004, p. 31) describe environmental attitude as "*the collection of beliefs, affect, and behavioral intentions a person holds regarding environmentally related activities or issues*". On the other hand environmental concern is the "*degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicate a willingness to contribute personally to their solution*" (Dunlap and Jones, 2002 p. 485).

For many researchers the knowledge of people's attitude will help to predict their behavior. The correlation of attitudes and behavior was examined in order to define the strength and direction between them (Wright and Klȳn 1998). According to Ogunbode (2013) positive attitudes lead people to develop pro-environmental behavior. In general, there are studies trying through observations and primary research to measure environmental attitudes and ecological behavior (Milfont and Duckitt 2010). Therefore if we want to encourage pro-environmentalism we have to understand public environmental attitudes (Milfont and Duckitt 2004).

Similar to Schultz *et al.* (2004), Clayton and Myers (2009) claim that environmental attitude is based on moral and social values and is a combination of people's beliefs, affective responses and behavioral intentions toward the environmental problems. According to psychology attitudes cannot be directly observed but must be supposed from people's responses (Himmelfarb 1993; Heberlein 1981). So the challenge is to construct a reliable and appropriate tool for

environmental attitudes. More than 700 measures have been designed for this reason (Dunlap and Jones 2002) but only three of them (New Ecological Paradigm, Ecocentric and Anthropocentric Environmental Attitude Scales, Ecological World View Scale) are the most popular and had their validity and reliability assessed.

On the other hand, the relationship between attitudes and behavior as predictor of specific environmentally based actions and participation decisions for environmental protection is based on the “*theory of reasoned action*” by Ajzen and Fishbein (1980). As a result various studies have concentrated specifically on the correlation between environmental attitudes and environmentally related behaviors. Specifically, there are studies that investigate the relation between environmental attitudes and political participation, conservation behaviors or willingness to modify behavior (Mohai 1992; Luzar *et al.* 1995; Guagnano *et al.* 1995; Weaver 1996; Walsh and McGuire 1992). There are also studies measuring environmentally related willingness to pay (WTP) in connection to individuals environmental attitudes (Widegren 1998; Stern *et al.* 1993). The attempt to include environmental attitudes in CVM studies begins from the questions about membership to environmental organizations (Hanley and Graig 1991; Brown *et al.* 1996) with many objections about its ability to reflect people’s real environmental behavior.

Our paper reports findings from a primary research investigating people’s environmental concern. More specifically it provides unified evidence of public understanding, attitudes and behaviors and in addition it measures the effect of socioeconomic characteristics to levels of environmental concern. Public knowledge and concern about marine biodiversity are related with people’s willingness to pay for biodiversity conservation. In this way, we also explore the sensitivity of WTP to changes in environmental attitudes.

More specifically the objectives are:

- To confirm the factors describing environmental concern
- To find the relation between people's environmental concern and socioeconomic characteristics
- To recognize the changes in people's beliefs, attitudes, and values in connection to their opinions and knowledge about marine biodiversity
- To investigate how environmental concern influences people's willingness to pay for marine biodiversity protection.

For this reason we use the New Ecological Paradigm (NEP) scale, one of the most widely used scale for measuring environmental concern of groups of people. The scale focuses on people's beliefs about our ability to upset nature, the existence of limits to growth and humanity's right to rule over the rest of nature (Dunlap *et al.* 2000). Using a primary research involving marine biodiversity conservation, the task is to extend the knowledge of how attitudinal reflections may contribute to CV methodologies. This information may help the design of effective environmental policies by understanding people's opinion relative to marine biodiversity.

The structure of the paper is the following. Section 2 provides the background information of the existing relative literature while section 3 discusses the materials of the primary research like the study area and the survey design. Section 4 presents the empirical results obtained from the statistical and econometric methods used in measuring and modelling environmental concern. The last section concludes the paper discussing the policy implications of the derived empirical results.

## 2. Background

One of the most well known measures of an environmental belief system is the NEP scale. The original NEP scale was published by Dunlap and van Liere (1978) and consisted of three dimensions: the balance of nature, anthropocentrism, and limits to growth. With the years in an attempt to obtain better its psychometric ability, it was later corrected with new items with a 5-point Likert response scale (Hawcroft and Milfont 2010). According to Dunlap *et al.* (2000) the new NEP scale consists of fifteen items and has five sub-scales; namely limits to growth, antianthropocentrism, fragility of nature's balance, rejection of exemptionalism, and the possibility of an eco-crisis.

The NEP scale has been used widely for different groups of people (like farmers, students, ethnic minorities etc) for measuring environmental attitudes, beliefs and worldviews in several countries (Schultz and Zelezny 1999; Johnson *et al.* 2004) with valid ability to distinguish between members of environmental groups and members of the public (Widegren 1998). According to the empirical results of various studies, NEP scale measures pro-environmental beliefs in relation to behavioral intentions, and real pro-environmental behaviors (Scott and Willits 1994; Stern *et al.* 1995; Tarrant and Cordell 1997; Ebreo *et al.* 1999; Rauwald and Moore 2002; Casey and Scott 2006).

Stern *et al.* (1995) insist that NEP scale results are associated with beliefs, norms, intentions, and behaviors towards the natural environment. On the other hand NEP scale had been used to predict environmental activism, environmentally significant behaviors, people's real environmental behavior, awareness for environmental problems (e.g. global warming, participation in the green electricity program, waste-reduction, landscape preferences, household location choices etc) and

emotional connectedness to nature (Stern 2000; Chung and Poon 2001; Clark *et al.* 2003; Poortinga *et al.* 2004; Mayer and McPherson Frantz 2004; Peterson *et al.* 2008; Yabiku *et al.* 2008).

The validity and reliability of NEP scale has been tested in many studies and has been proved as a valid tool to measure environmental values (Fransson and Garling 1999; Olli *et al.* 2001). Environmental behavior is associated with values and interest about environmental issues and is based on people's general set of values (Stern and Dietz 1994). According to Homer and Kahle (1988) an environmental value leads to environmental attitude and this in turn leads to environmental behavior. The correlation between pro-environmental values and high NEP scores (Dunlap *et al.* 2000) is evident in previous studies (Scott and Willits 1994; Stern *et al.* 1995; Tarrant and Cordell 1997; Ebreo *et al.* 1999; Kaltenborn and Bjerke 2002; Rauwald and Moore 2002; Hunter and Rinner 2004; Berenguer *et al.* 2005; Casey and Scott 2006; Kaltenborn *et al.* 2008; Luo and Deng 2008; Ardahan 2012).

Other studies have shown that socio-economic characteristics (as gender, age, ethnicity, income, education level, family incomes, occupation, religion etc), personality, individuality (sensitivity, leisure time activities etc), parents, friends or living area influences (parents' educational backgrounds and their life paradigms, friends value systems, development level of country etc), socio-demographic, cultural, attitudinal and behavioral variables are related to nature effect on persons' environmental value systems (Rokeach 1973; Rokeach 1979; Dunlap *et al.* 1983; Mohai and Bryant 1998; Kim 1999; Dunlap *et al.* 2000; Johnson *et al.* 2004; Poortinga *et al.* 2004; Zinn and Graefe 2007; Taskin 2009).

According to Lopez and Cuervo - Arango (2008) NEP scale has significant relation with behavioral intentions. In addition environmental orientation and

environmental knowledge are often used to explain people's pro-environmental behaviors (Sherburn and Devlin 2004; Pursley 2000). In general, many studies have shown that environmental concern does not necessarily rely on people's knowledge about ecological processes, their influence on these processes, or the implications of human induced environmental change (Bord *et al.* 2000; Henry 2000; Jacobson and Marynowski 1997; Kempton 1991).

The knowledge of wildlife and biodiversity issues differ along several socio - demographic dimensions. For instance gender and type of preferred recreation activities are related with the degree of individuals' knowledge for biodiversity (Kellert 1985; Kellert and Berry 1987; Mankin *et al.* 1999). The link between environmental concern and environmental knowledge was also proved in previous studies with the help of the NEP scale (Hunter and Rinner 2004).

### **3. Materials and methods**

Our study is based on two representative samples of 359 randomly selected people living in Thessaloniki and Volos<sup>3</sup>. Face-to-face interviews were accomplished on-site. The questionnaire contained a total of 26 questions, some of which were behavioral or attitude measures. The attitudinal questions used are the type of questions commonly used in market and social research to measure what are assumed to represent attitudes. These attitudinal questions sought respondents' attitudes to marine biodiversity in general, but some attempted to measure attitudes towards economic value or utility of them. Individuals' beliefs concerning their relationship to

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<sup>3</sup> Thessaloniki and Volos were chosen as they are two of the most important coastal port cities in Greece. Both are built near gulfs (Thermaikos and Pagasitikos) with very important marine biodiversity and fishing fleets and fisheries production. Thermaikos' and Pagasitikos' ecosystems are very important providing shelter to endangered or rare species. Thermaikos gulf is considered one of the most vulnerable systems with the greatest sensitivity and is part of a protected area. On the other hand very near to Volos is the National Marine Park of Alonnisos Northern Sporades the first designated Marine Park in Greece and the largest marine protected area in Europe.

the natural world were measured with the help of NEP scale that consisted of 15 items and was based on the revised version presented in Dunlap *et al.* (2000) designed to measure environmental attitudes.

To have a better image for people’s opinion for marine biodiversity the questionnaire contained four questions for measuring people’s willingness to pay (WTP) for marine biodiversity conservation and were tested according to guidelines established by the NOAA panel (Arrow *et al.* 1993). Finally the questionnaire also contained a series of demographic information including age, sex, income, social status etc.

#### 4. Empirical results and discussion

Table 1 presents the descriptive statistics of the respondents’ socio-economic characteristics.

**Table 1:** Descriptive statistics of respondents’ basic socioeconomic characteristics

	Number of observations	Mean	Standard Deviation
Gender (%)	359	53.9% (Female)	
Age (years)	359	33.01	13.71
Education level (years)	358	13.87	3.065
Marital Status (%)	359	58.1 (Single)	
Monthly personal income (€)	275	727.17	477.70
Monthly family income (€)	309	1667.22	731.60

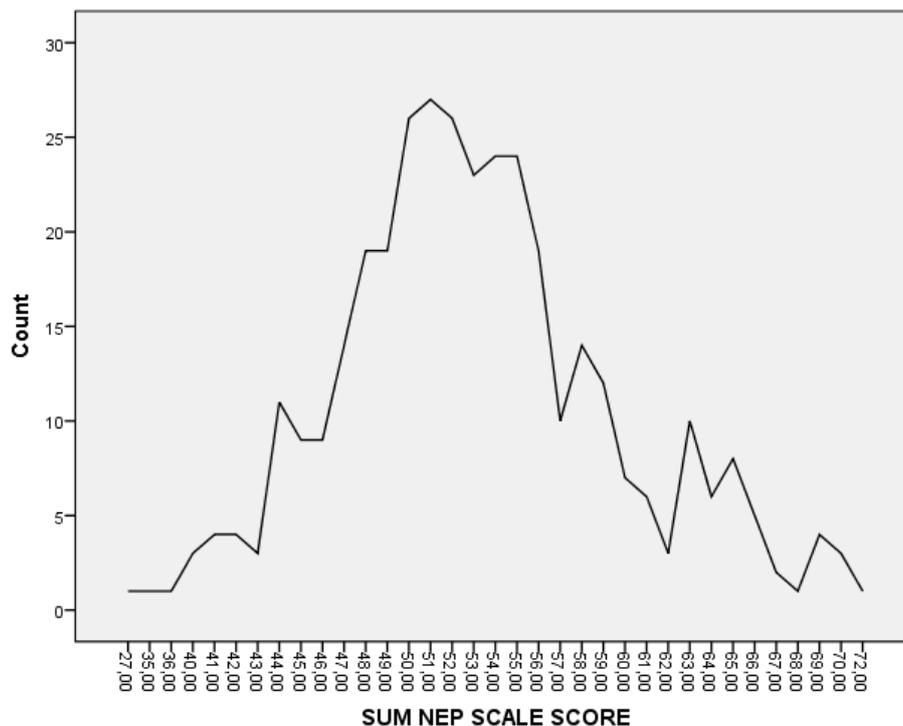
Next we present the empirical results derived by the use of the proposed statistical and econometric methods.

##### 4.1 Principal Components Analysis

NEP scores were calculated as an average of all scores on the individual scale items. For many researchers a NEP score of 3 indicates a behavior between an anthropocentric and a pro-ecological worldview (Rideout *et al.* 2005; Van Petegem and Blicck 2006). The mean score for the full NEP scale in this study was 3.56. The

multi items question (NEP scale items) was designed to represent the five hypothesized facets of an ecological worldview. More specific items 1, 6 and 11 referred to reality of limits to growth, items 2, 7 and 12 to anti-anthropocentrism, items 3, 8 and 13 to fragility of nature’s balance, items 4, 9 and 14 to rejection of human exemptionalism and items 5, 10 and 15 to possibility of an eco-crisis (Dunlap *et al.* 2000).

Looking at Figure 1, NEP total scores ranged from 27 to 72 with a mean score of 53 ( $\pm 6.58$ ). According to the Rideout *et al.* (2005) a NEP score above 45 indicates a pro-ecological attitude.



**Figure 1:** Total NEP scale score

There was no significant difference between male ( $M = 3.55$ ) and female ( $M = 3.58$ ) respondents ( $U = 15,555.5$ ,  $P = 0.646$ ) in total NEP scores; however, a Mann - Whitney test revealed a significant difference between pro-environmental behavior and NEP scores ( $U = 9,598.5$ ,  $P = 0.027$ ). Also Mann - Whitney test shows no

significant relationship between mean NEP scale score and other variables as place of residence, member of non-government organizations etc. On the contrary no parametric test revealed a high relation between mean NEP scores and individuals' opinions about marine biodiversity utility (Table 2). Respondents, who recognize limits of nature and the contribution of marine biodiversity to human wellbeing, score higher in NEP scale and accept marine biodiversity intrinsic value.

**Table 2:** Descriptive statistics of respondents' basic socioeconomic characteristics

	<b>Grouping variable</b>	<b>p</b>	<b>Decision</b>
<b>Mean NEP scale score</b>	Recognition of marine biodiversity utility for supplying food	.000	Reject the null hypothesis
	Recognition utility to marine biodiversity for offering products, such as medicines, etc.	.000	Reject the null hypothesis
	Recognition utility to marine biodiversity for recreational activities	.000	Reject the null hypothesis
	Recognition utility to marine biodiversity for contributing to culture	.000	Reject the null hypothesis
	Recognition utility to marine biodiversity for contributing ecological balance	.007	Reject the null hypothesis
	Recognition of intrinsic value of marine biodiversity	.000	Reject the null hypothesis

In various empirical studies female respondents scored higher in NEP scale compared to male respondents (Diamantopoulos *et al.* 2003; Zelenzy *et al.* 2002; Mohai 1992). The influence of education on environmental attitude has been investigated in many studies and according to the results people with higher education level score higher on all environmental themes (Lovelock 2010). Also age is an

important factor of environmental attitude with many studies having found that younger people are more likely to hold environmental viewpoints compared to older respondents (Arcury *et al.* 1987; Arcury and Christianson 1990; Edelman 1988; Mohai and Twight 1987).

On the other hand NEP scale scores are positively associated with residence with people grew up in an urban setting averaged slightly higher on the NEP scale (Van Liere and Dunlap 1980). In several studies residence is proved as determinant factor of environmental attitude. People living in an urban area have greater environmentalism (Buttel 1992; Mohai and Twight 1987).

The internal consistency of the NEP constructs was tested with the use of corrected item-total correlation<sup>4</sup> ( $r_{i-t}$ ), the Cronbach's coefficient alpha ( $\alpha$ ), and principal components analysis (PCA) (Aldrich *et al.* 2007; Clark *et al.* 2003; Dunlap *et al.* 2000). The value of corrected item-total correlation (Table 3) ranges from a low 0.09 for NEP13 to a high of 0.37 for NEP6. The value of corrected item-total correlations are higher than 0.30 for only four items. In the literature the accepted level of  $r_{i-t}$  is expected higher than 0.3 (Aldrich *et al.* 2007; Clark *et al.* 2003; Dunlap *et al.* 2000).

The total Cronbach's coefficient alpha is 0.592 (as reported in Table 4) and this does not change much (only increases by 0.03) when NEP13 is not included in the list of the items so while its correlation with the others items is low its inclusions does not reduce the reliability of the scale. According to previous studies a value greater than 0.7 can be taken as "acceptable" reliability (Clark *et al.* 2003; Dunlap *et al.* 2000).

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<sup>4</sup> The corrected item-total correlation is the correlation coefficient between each item's score and the sum of the scores of the other 14 items (Ndebele and Marsh 2014)

**Table 3:** Percentage distributions of corrected item-total correlations for NEP Scale items

NEP scale	Scale items	Responses (%)					(N)	Mean	SD	r <sub>i-t</sub>
		SDi	Di	N	Ag	SAg				
Reality of limits to growth	We are approaching the limit of the number of people the earth can support	6.1	6.7	20.4	40.2	26.5	359	3.73	1.096	0.23
	The earth has plenty of natural resources if we just learn how to develop them	3.4	10.9	16.2	23.5	46.1	359	3.99	1.150	0.13
	The earth has only limited room and resources	6.1	11.5	20.4	34.1	27.9	359	3.66	1.172	0.12
Antianthropocentrism	Humans have a right to modify the natural environment to suit their needs	20.7	27.9	24.9	21.8	4.7	359	2.62	1.167	0.18
	Humans were meant to rule over the rest of the nature	22.2	14.0	21.3	28.4	14.0	359	2.99	1.370	0.24
	Plants and animals do not have equal rights as humans to exist	5.0	3.3	11.4	35.4	44.8	359	4.14	1.045	.37
Fragility of nature's balance	When humans interfere with nature, it often produces disastrous consequences	1.7	1.9	8.9	39.0	48.5	359	4.31	.830	.15
	The balance of nature is strong enough to cope with the impacts of modern industrial development	27.7	28.3	22.4	14.8	6.7	359	2.43	1.220	.24
	The balance of nature is very delicate and easily upset	1.7	3.6	15.4	38.1	41.2	359	4.15	.895	.30
Rejection of human exceptionalism	Human intelligence will ensure that we don't make the earth unlivable	9.7	23.7	30.1	24.0	12.5	359	3.06	1.158	.32
	Despite our special abilities, humans are still subject to the laws of nature	3.1	6.1	17.9	40.8	32.1	359	3.92	1.007	.11
	Humans will eventually learn enough about how nature works to be able to control it	14.3	26.1	24.2	23.0	12.4	359	2.94	1.251	.33
Possibility of an ecocrisis	Humans are severely abusing the environment	2.2	1.4	9.5	39.4	47.5	359	4.28	.853	.09
	Human destruction of the environment has been greatly exaggerated	13.7	16.9	29.7	26.3	13.4	359	3.11	1.224	.22
	If things continue going as they presently are, we will soon experience a major ecological disaster	2.5	2.8	11.4	44.6	38.7	359	4.14	.897	.27

Where SDi: strongly disagree; Di: disagree; N: neither; Ag: agree; SAg: strongly agree.

A principal component analysis was conducted on all 15 NEP scale items with varimax rotation to investigate if respondents were able to clearly distinguish the hypothesized structure of the NEP. Specifically, with the use of NEP scale, consisting of 15 items with a 5-point Likert scale response system, we explore people's beliefs about humanity's ability to upset nature, the existence of limits to human economic growth and development, and humanity's right to rule over the rest of nature (Dunlap

and Van Liere 1978; Dunlap *et al.* 2000; Hunter and Rinner, 2004). All items of the revised NEP scale were translated without any other major changes. Every one of the five facets of an ecological worldview (recognition of limits to growth, anti-anthropocentrism belief in a delicate balance of nature, anti-exemptionalism, and recognition of the possibility of an Eco-crisis) was addressed by three items.

Three factors are derived from the NEP scale, which explains 60.21% of total variance (Table 4). The results confirm the grouping of the 15 items into three value orientations; namely man domination to natural environment, antianthropocentrism and limits to growth. Cronbach alphas' were calculated for each dimension within each culture, all ranged between .53 and .74 and constructs can thus be considered reliable measures for environmental concern. The Kaiser-Meyer-Olkin (KMO) criterion for sampling adequacy was equal to 0.691 and the Bartlett's test of sphericity was equal to 974.9 (with a P-value of 0.000). Components with eigenvalues greater than 1 were preceded and solutions with three and more components were considered. A solution of three components was finally employed, as the number of derived factors at this level is a function of the point where the total variance explained starts to level off (Addams 2000). The three dimension solution is in line with previous studies that also used PCA to analyze the factors of NEP scale (Albrecht *et al.* 1982; Noe and Snow 1990; Schetzer *et al.* 1991; Bechtel et al. 1999).

Using PCA, five items (NEP 8, 4, 14, 2 and 6) load heavily on the first component. Five items (NEP 3, 5, 7, 9 and 13) were loaded on the second and five (NEP 11, 1, 12, 10 and 15) were loaded on the third component. Many researchers have analyzed the dimensionality of the adult NEP scale with the number of dimension to fluctuate from one dimension to up to four dimensions (Dunlap *et al.* 2000).

**Table 4:** Results of PCA analysis on NEP scale items

NEP scale items	F1	F2	F3
The balance of nature is strong enough to cope with the impacts of modern industrial nations	0.726		
Human ingenuity will insure that we do not make the earth unlivable	0.713		
Humans will eventually learn enough about how nature works to be able to control it.	0.705		
Humans have the right to modify the natural environment to suit their needs	0.662		
The earth has plenty of natural resources if we just learn how to develop them	0.593		
When humans interfere with nature it often produces disastrous consequences		0.734	
Humans are severely abusing the environment		0.707	
Plants and animals have as much right as humans to exist		0.682	
Despite our special abilities humans are still subject to the laws of nature		0.425	
The balance of nature is very delicate and easily upset		0.398	
The earth is like a spaceship with very limited room and resources			0.741
We are approaching the limit of the number of people the earth can support			0.681
Humans were meant to rule over the rest of nature			0.549
The so-called 'ecological crisis' facing human kind has been greatly exaggerated			0.461
If things continue on their present course we will soon experience a major ecological catastrophe			0.314
Eigenvalue	2.803	2.238	1.747
Total Variance	60.21%		
Cronbach' s a	0.74	0.59	0.53
Total Cronbach's a	0.592		
K.M.O.: 0.691			
Bartlett's Test of Sphericity: Approx. $\chi^2=974.9$ df = 105 Sig. = .000			

The NEP scale does not generate consistent results as proposed by Dunlap *et al.* (2000). Only three factors are derived, namely humans' domination to nature, antiantropocentrism and limits of nature (Table 3). Even then, these three dimensions do not have a satisfactory internal consistency. The items from the proposed dimension fragility of nature's balance, rejection of exceptionalism and possibility of

an eco-crisis is scattered in the dimensions of limits to growth and antiantropocentrism and a new dimension has been described. According to the results human has the ability to dominate nature without negative results for its balance or sustainability.

Specifically all items loaded in the first factor are associated with man ability (or right) to dominate nature. The second factor is consisted with items that are referred to antianthropocentrism and finally the third factor is associated with the limits of nature. Our results are in line with all previous researches that have used the 12 items NEP scale (Albrecht *et al.* 1982; Geller and Lasley, 1985; Noe and Snow 1990) or partially with them that have used 15 item scale (Van Petegem and Blicck 2006; Boeve-de Pauw and Van Petegem 2012; Ogunbode 2013) .

Table 5 presents a Mann-Whitney  $U$  test conducted to evaluate the hypothesis that environmental attitude of respondents would be related to their socioeconomic characteristics of their beliefs about natural environment protection. Our null hypothesis is that the distribution of each factor is the same across the variables presented in Table 4 like gender, education level, income, membership in environmental organizations etc. Looking at these results (Table 5) and with the exception of the antiantropocentrism the two others PCA factors have significant relation with the most of test variables.

“Antiantropocentrism” is related with gender, age, family status and recognition of general utility to marine biodiversity and membership to environmental organization. On the other hand “limits of nature” is highly significant related to all tested variables except gender, income, family status and recognition of marine biodiversity utility fro supplying food. Finally, “man dominated to nature” is related with almost all variables except gender, recognition of general utility to marine

biodiversity and recognition utility to marine biodiversity for contributing ecological balance.

The relation of NEP scale with individual's behavior was examined by several studies and was conceptually and psychometrically tested (Stern *et al.* 1995; Pierce *et al.* 1997; Kaltenborn and Bjerke 2002; Rauwald and Moore 2002; Hunter and Rinner 2004; Berenguer *et al.* 2005; Kaltenborn *et al.* 2008; Luo and Deng 2008; Ardahan 2012). Generally individuals who score high on NEP scale indicate more pro-environmental attitudes. According to the results of many previous studies NEP scale has the ability to differentiate between members of environmental groups and members of the public (Widegren 1998; Mobley *et al.* 2010).

The NEP scale is correlated positively with perceived seriousness of ecological problems, pro-environment policies, and personal pro-environmental behaviour (Hawcroft and Milfont 2010). Results of empirical studies have proved that samples including a descent number of environmentalists scored significantly higher than samples of general population. According to the literature NEP scale is positively correlated with pro-environmental values (Dunlap *et al.* 2000). Anthropocentrism (where humans view nature solely as a source of food and water) is related with low NEP scores (Gangaas *et al.* 2014). On the contrary ecocentrism is associated with high NEP scores (Kortenkamp and Moore 2001; Hunter and Rinner 2004).

In our study only the first and third dimensions of NEP scale (“men domination to nature” and “limits of nature”) are associated with pro-environmental behavior. Namely, membership to environmental organizations is related positively to first PCA factor and negatively to third factor. Previous studies have found positive correlation between people's environmental concern and recycling habits (Simmons and Widmar 1990; Thapa 1999). On the other hand previous participation in acts for

protection of natural environment is positively related with first and second PCA factor and also negatively related with the third factor.

According to the Hawcroft and Milfont (2010) NEP scale is correlated with many national or social-psychological characteristics. Furthermore, Dunlap *et al.* (2000) point out that the socioeconomic profile of individual (e.g. age, gender, education level, and race) may influence their behavioral intentions in a specific condition. The application of NEP scale in several groups of people from different social categories has shown that its scores were positively related to age and negatively related to education level and also the negative significant relation of NEP with age and on the contrary the passively relation with education and liberalism (Hawcroft and Milfont 2010). More specific several studies have also proved that females score higher than males on the NEP scale (Mohai 1992; Zelenzy *et al.* 2002). At present study only one dimension of NEP scale has been found related with gender with females to have a more antiantropocentrism attitude.

The others individuals' characteristics as age, income, education have also relation with PCA factors. According to the literature younger and better educated people with more liberal ideological orientations have a higher environmental attitude than their counterparts (Dietz *et al.* 1998; Fransson and Garling 1999; Kideghesho *et al.* 2007). Environmental concern in relation with biodiversity knowledge was examined by Hunter and Rinner (2004) while in the present study we examine its relation to people's opinion about marine biodiversity utility (value). Previous studies connect individuals' values for endangered species with ethical beliefs (Kotchen and Reiling 2000; Stevens *et al.* 1991; Spash and Hanley 1995). These ethical beliefs are related with environmental attitudes (Kotchen and Reiling 2000; Spash 1997).

**Table 5:** Results of the nonparametric tests with PCA factors

PCA factor	Grouping variable	P	Decision	PCA factor	Grouping variable	P	Decision	PCA factor	Grouping variable	P	Decision
humans' domination to nature	Gender	.584	Retain the null hypothesis	Anthropocentrism	Gender	.001	Reject the null hypothesis	Limits of nature	Gender	.506	Retain the null hypothesis
	Residence	.000	Reject the null hypothesis		Residence	.729	Retain the null hypothesis		Residence	.000	Reject the null hypothesis
	Age	.000	Reject the null hypothesis		Age	.004	Reject the null hypothesis		Age	0.11	Reject the null hypothesis
	Income	.002	Reject the null hypothesis		Income	.589	Retain the null hypothesis		Income	.164	Retain the null hypothesis
	Family status	.001	Reject the null hypothesis		Family status	.029	Reject the null hypothesis		Family status	.279	Retain the null hypothesis
	Education level	.001	Reject the null hypothesis		Education level	.585	Retain the null hypothesis		Education level	.000	Reject the null hypothesis
	Participation in acts for natural environment protection	.050	Reject the null hypothesis		Participation in acts for natural environment protection	.567	Retain the null hypothesis		Participation in acts for natural environment protection	.013	Reject the null hypothesis
	Membership to environmental organizations	.000	Reject the null hypothesis		Membership to environmental organizations	.046	Reject the null hypothesis		Membership to environmental organizations	.026	Reject the null hypothesis
	Recognition of general utility to marine biodiversity	.922	Retain the null hypothesis		Recognition of general utility to marine biodiversity	.032	Reject the null hypothesis		Recognition of general utility to marine biodiversity	.003	Reject the null hypothesis
	Recognition of marine biodiversity utility for supplying food	.000	Reject the null hypothesis		Recognition of marine biodiversity utility for supplying food	.366	Retain the null hypothesis		Recognition of marine biodiversity utility for supplying food	.154	Retain the null hypothesis
	Recognition utility to marine biodiversity for offering products, such as medicines, etc.	.000	Reject the null hypothesis		Recognition utility to marine biodiversity for Offering products, such as medicines, etc.	.441	Retain the null hypothesis		Recognition utility to marine biodiversity for Offering products, such as medicines, etc.	.011	Reject the null hypothesis
	Recognition utility to marine biodiversity for recreational activities	.000	Reject the null hypothesis		Recognition utility to marine biodiversity for recreational activities	.516	Retain the null hypothesis		Recognition utility to marine biodiversity for recreational activities	.000	Reject the null hypothesis
	Recognition utility to marine biodiversity for contributing to culture	.000	Reject the null hypothesis		Recognition utility to marine biodiversity for contributing to culture	.804	Retain the null hypothesis		Recognition utility to marine biodiversity for contributing to culture	.000	Reject the null hypothesis
	Recognition utility to marine biodiversity for contributing ecological balance	.093	Retain the null hypothesis		Recognition utility to marine biodiversity for contributing ecological balance	.275	Retain the null hypothesis		Recognition utility to marine biodiversity for contributing ecological balance	.001	Reject the null hypothesis
Recognition of intrinsic value of marine biodiversity	.000	Reject the null hypothesis	Recognition of intrinsic value of marine biodiversity	.430	Retain the null hypothesis	Recognition of intrinsic value of marine biodiversity	.000	Reject the null hypothesis			

## 4.2 Cluster Analysis

Next we have used cluster analysis to group the respondents of the survey according to their preferences and attributes in the direction of environmental attitude. Cluster analysis was conducted using factor scores extracted from PCA relying on the NEP scale.<sup>5</sup> Specifically, in the present study we use K-means Cluster Analysis after running Hierarchical Cluster Analysis as a tool to decide the number of clusters. As the number of clusters is unknown we carry out a hierarchical cluster analysis using Ward's method to find groups in our data. Hair *et al.* (2005) point out that using the Ward method in hierarchical cluster analysis produces stable and interpretable results by increasing the homogeneity between observations of the formed group.

Thus after hierarchical cluster analysis a two-cluster solution was preferred offering an acceptable distribution of cases across the clusters together with the most interpretable results. The identification of clusters helps us to classify observations and create segments with the same environmental attitude. Psychographic research segments consumers into groups using their personal characteristics and preferences (Solomon *et al.* 2002).

According to the results only the first PCA factor has the ability to distinguish participants to different categories and from other variables residence, gender, members of family and participation in organization and acts for protecting natural environment have also non influence. According to the results education (in years), income (personal and family) have the greatest influence in the forming of clusters and age has the least influence. The first and second PCA factors hold positive value to first cluster and negative to third cluster.

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<sup>5</sup> The results of the cluster analysis are available on request.

### **4.3 Ecological attitude and ecological behavior toward marine biodiversity**

Usually a contingent valuation method employs questions to bring out a person's WTP for a change in the provision of environmental goods. In our case, we were looking at changes to marine biodiversity and services derived from them. In our CVM study, the dichotomous choice method (seeking simple 'yes' or 'no' answers to an offered bid) is preferred to other methods (like an open-ended one) as it is easier for respondents to respond to the questions; households may also answer subject to their budget constraints in view (that is the upper bounds on bids may be managed); and it minimizes any motivation to deliberately over-stated or under-stated WTP (Loomis 1988; Moran 1994; Ninan and Sathyapalan 2005). The discrete choice model has been converted into the most commonly used approach for agreeing on whether people are willing to pay for a non-market good (Del Saz-Salazar *et al.* 2009). In cases that our dependent variable (WTP) is a dichotomous one (Yes/No), a binary logistic regression model may be used (Halkos 2006, 2011; Hosmer and Lemeshow 2000).

Using the primary data from the questionnaire and to estimate the WTP the econometric model that best fits this data set is identified. Then, knowing the values of the explanatory variables we are able to predict any WTP. Thus after formulating a function that explains the relationship between a respondent's WTP (dependent variable) and a number of socio-economic variables features (independent variables) that affect this selection and variables associated with people's pro-environmental behavior and attitude in the direction of marine biodiversity economic value (Kotchen and Reiling, 2000).

Specifically, in the questionnaire a question was included about the reason that a person can value economically marine biodiversity. For this research, the model specification was:

$$\text{logit}[\text{Pr}(Y=1)] = f(\text{BID}, \text{RES}, \text{GEN}, \text{AGE}, \text{MARITAL}, \text{EDUC}, \text{INC}, \text{MEM\_ORG}, \text{ECOL\_BEH}, \text{MB\_EV1}, \text{MB\_EV2}, \text{MB\_EV3}, \text{MB\_EV4}, \text{MB\_EV5}, \text{MB\_EV6}, F_1, F_2, F_3)$$

where  $Y$  is our dichotomous-choice dependent variable (the response to the WTP question as Yes=1 and No=0),  $BID$  is the specified amount (in €) respondents were asked to pay;  $RES$  refers to city that respondents live;  $GEN$  refers to gender;  $AGE$  refers to the age of the respondent;  $MARITAL$  refers to the marital status;  $EDUC$  is the education level of respondents (in years);  $INC$  stands for respondent's (family) income (in € or in levels);  $MEM\_ORG$  is membership to ecological organizations;  $ECOL\_BEH$  corresponds to the ecological behavior of the respondents;  $MB\_EV1$ ,  $MB\_EV2$ ,  $MB\_EV3$ ,  $MB\_EV4$ ,  $MB\_EV5$ ,  $MB\_EV6$  correspond to reasons that respondents put economic value to marine biodiversity; and  $F_1$ ,  $F_2$ ,  $F_3$  are the extracted factors, named option and man domination to nature ( $F_1$ ), antiantropocentrism ( $F_2$ ) and limits to growth ( $F_3$ ).

In Table 6, the first model (columns 2-3) considers all the extracted factors and other socioeconomic variables (like age, gender, marital status, ecological behavior) while the final model (columns 4-5) consists of the statistically significant variables and is represented as:<sup>6</sup>

$$\text{logit}[\text{Pr}(Y=1)] = \beta_0 + \beta_1 \text{BID} + \beta_2 \text{INC} + \beta_3 \text{ECOL\_BEH} + \beta_4 \text{MB\_EV5} + \beta_5 \text{MB\_EV6} + \beta_6 F_3 + \varepsilon_i$$

where  $\varepsilon_i$  is the disturbance term with the usual properties.

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<sup>6</sup> Protest answers and missing observations were not included in the binary-choice model estimations of yes/no responses.

Looking at Table 6, the coefficients have the expected signs. According to the derived empirical findings, people were responsive to the price asked to pay. The bid amount (BID) was negative and statistically significant and as a consequence higher prices (BIDs) implied lower probabilities of responding 'yes'. On the other hand, higher income gives confidence to the CVM scenario, as income (INC) was positive and statistically significant. In a number of studies personal income has been hypothesized as a determinant of environmentally related behaviors (Mohai, 1985; Guagnano *et al.* 1995). Jacobsen and Hanley (2008) explore the influence of income in 46 CVM surveys. They find that the income effect size was not present in all cases.<sup>7</sup> In our study and in support of the CVM scenario, *income* showed a positive and significant relation as in previous CVM studies and this is consistent with economic theory.

In several researches ethical and attitudinal variables have been included in CVM studies as important variables in explaining WTP variability (Johansson - Stenman 1998; Luzar and Cosse 1998; Spash 2000). The application of others environmental attitude measure scales have indicated that individuals' anthropocentric orientations have important influence in pro-environmental attitudes when valuing goods while biospheric orientation has lower influence to economic behavior (Stern *et al.* 1993, 1995).

Significant relationship between the NEP scale and behavioral intentions has been found (Lopez and Cuervo - Arango 2008). High NEP scale is positively associated with people's willingness to pay for biodiversity conservation (Kotchen and Reiling 2000). On the contrary NEP scale has no relation with WTP in Cooper *et*

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<sup>7</sup> Hanemann (1984) showed the way a theoretically correct specification may not include income as an explanatory variable.

**Table 6:** Econometric results of the proposed logit model formulations

Variables	Logit models			
	Estimates	Odds Ratios	Estimates	Odds Ratios
Constant	-5.482 [0.185]	0.004	-4.159 [0.027]	0.016
<i>BID</i>	-0.073 [0.000]	0.930	-0.033 [0.000]	
Residence	-1.207 [0.155]	0.299		
Gender	-0.737 [0.223]	0.479		
Age	-0.003 [0.865]	1.003		
Marital	0.037 [0.573]	1.473		
Education	.037 [0.705]	1.038		
<i>Income</i>	0.001 [0.013]	1.001	0.00049 [0.040]	1.000
Membership to environmental organizations	2.566 [0.100]	13.008		
<i>Ecological Behavior</i>	0.326 [0.100]	1.385	1.860 [0.036]	6.421
MB_EV1	-1.417 [0.242]	0.242		
MB_EV2	-0.476 [0.653]	0.621		
MB_EV3	-0.817 [0.342]	0.442		
MB_EV4	1.509 [0.212]	4.521		
<i>MB_EV5</i>	2.227 [0.021]	9.276	0.738 [0.036]	2.162
<i>MB_EV6</i>	0.721 [0.277]	2.057	0.730 [0.027]	2.075
F <sub>1</sub>	-0.827 [0.052]	0.438		
F <sub>2</sub>	-0.249 [0.393]	0.779		
F <sub>3</sub>	-0.234 [0.502]	0.791	-0.485 [0.005]	0.616
Nagelkerke R <sup>2</sup>	0.605		0.315	
LR $\chi^2_{17}$	70.722 [0.000]			
LR $\chi^2_8$			55.689 [0.000]	
Hosmer-Lemeshow	10.904 [0.207]		5.617 [0.690]	
Cox & Snell R Square		0.451		0.238
Log-Likelihood		90.684		228.457

*al.* (2004). In the present study we investigate the influence of NEP scale to people's WTP with the help of the PCA results. As consequences WTP explanatory variables are not the mean (or total) NEP scale score but the three new variables that resulted from the application of PCA analysis. With this approach we try to explore which dimension of NEP scale is associated with individual's WTP. According to the results only the third PCA factor has negative relation with WTP. Cooper *et al.* (2004) point out that NEP score would only be positively associated with WTP for those whose motivation is dominated by non-use values.

The mean WTP was calculated by assuming no negative values for protection of marine biodiversity and using the formula suggested by Hanemann (1989):

$$E(WTP) = \left( \frac{1}{\beta_1} \right) * \ln(1 + \exp^{\beta_1})$$

The mean WTP was approximately equal to € 29.2 per person.

## **5. Conclusions**

Through the application of contingent valuation and the use of NEP scale we have tried to include “non-economic” motives for explaining individuals' WTP for marine biodiversity protection and policy making. First with the help of NEP scale we investigate individuals' environmental attitude. There is not uncertainty that respondents have a level of concern for the environment. However, respondents' ecological worldviews appear to vary significantly depending on their socioeconomic characteristics and their knowledge and understanding of utility of marine biodiversity.

Next the application of CVM using the results of the NEP scale application proved that individuals do consider ethical aspects in their decision making process.

People's pro-environmental behavior is influenced by ethical values and it plays an important role in the formation of people's WTP for environmental goods and services. According to the results of the present study, the theory of environmental concern may be used to explain individuals' WTP.

Employing the NEP scale in a primary research of marine biodiversity valuation, we have found that the recognition of limits to nature is a significant motive to value marine biodiversity. Based on our findings, we recommend that future studies must pay attention to the psychometric properties of the NEP scale and focus on the dimensions and structure of the scale. At present, our results suggest that the revised NEP scale gives three dimensions that reflect people's ecological beliefs.

The lack of a significant relationship between all dimensions of the NEP scale and WTP perhaps reflects the fact that the goods under valuation have potential use value for respondents. On the other hand, our results suggest that individuals being informed about the utility or value of marine biodiversity have more possibilities to become committed to arguments for conserving marine biodiversity.

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