Environmental Research 143 (2015) 4–10

Contents lists available at ScienceDirect

Environmental Research

journal homepage: www.elsevier.com/locate/envres

Marine environmental contamination: public awareness, concern and perceived effectiveness in five European countries

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ARTICLE INFO

Article history:
Received 30 January 2015
Received in revised form
6 August 2015
Accepted 11 August 2015
Available online 29 August 2015

Keywords:
Marine environment
Pollution
Perceived Consumer Effectiveness (PCE)
Pro-environmental behavior
Structural Equation Modeling (SEM)
Survey

ABSTRACT

Given the potential of Perceived Consumer Effectiveness (PCE) in shaping pro-environmental behavior, the relationships between PCE, awareness of causes of contaminants in the marine environment, and concern about marine environmental contamination were investigated using Structural Equation Modeling (SEM). PCE is the belief that an individual has in being able to make a difference when acting alone. A web-based survey was performed in one western European country (Belgium), one northern European country (Ireland) and three southern European countries (Italy, Portugal and Spain), resulting in a total sample size of 2824 participants. The analyses confirm that European citizens are concerned about marine environmental problems. Participants from the southern countries reported the highest concern. In addition, the study participants did not have a strong belief in themselves in being capable of making a difference in tackling marine environmental problems. However, a higher awareness, which was associated with a higher degree of concern, enhanced the belief that an individual can make a difference in tackling marine environmental problems, though only when a concrete action was proposed. Consequently, information campaigns focusing on pro-environmental behavior are recommended to raise public awareness about marine environmental problems and at the same time explicitly refer to concrete possible actions. The findings indicate that when only awareness and concern are raised without mentioning a concrete action, PCE might even decrease and render the communication effort ineffective.

1. Introduction

Pollution of the marine environment with emerging contaminants (ECs) is one of the main problems that threatens the world's marine resources. ECs are a group of organic and inorganic contaminants with potential adverse health effects on living organisms, including humans and seafood (Mostofa et al., 2013). Examples of ECs are (1) brominated flame retardants which are widely used in a variety of polymer and plastics applications and in a broad range of consumer products, (2) musks used as fragrances in detergents, fabric softeners, household cleaning products, air fresheners, cosmetics, soaps, shampoos and perfumes, (3) perfluoroalkyl substances, which are a class of persistent contaminants widely used as surfactants, lubricants, adhesives, fire or flame retardants, propellants and medicines, and (4) pharmaceuticals (Alaee et al., 2003; Balk and Ford, 1999; Renzi et al., 2013). The presence of ECs in marine ecosystems is attributed to various causes with anthropogenic activities as one of the major sources. Specific examples are effluents of municipal, industrial and agricultural activities, compounds excreted from the human body (e.g. pharmaceuticals and their metabolites), discharge of expired and unused pharmaceuticals from households, hormones and antibiotics used in aquaculture and terrestrial livestock production, fishery activities, tourism and ship breaking. In addition to human activities, ECs can also emerge naturally as a result of algal blooms or from events such as storms or floods which remobilize pollutants from sediments (Allen, 2011; Moore et al., 2013; Mostofa et al., 2013; Shao, 2009). Moreover, the issues related to the pollution of the marine environment are exacerbated

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http://dx.doi.org/10.1016/j.envres.2015.08.009
0013-9351/

by global warming and by the growing world population. Pollution of the marine environment as well as overfishing are key factors imposing pressure on the availability and safety of seafood species and products, which entails a potential threat to human health and specific challenges for environmental and public health policy (Allen, 2011; Moore et al., 2013; Nelleman et al., 2008).

As it is estimated that marine ecosystems will be polluted three times more in the next 50 years compared to the last 50 years, mitigation measures are urgently needed (Mostofa et al., 2013). The importance of raising public awareness about the problems related to pollution of the marine environment has been stressed in various studies (Moore et al., 2013; Mostofa et al., 2013; Nelleman et al., 2008). This is particularly relevant because processes and changes in the ocean take place under its surface, meaning that marine environmental problems do not belong to the typical "radar screen" of human perception (Nelleman et al., 2008). An increased awareness and concern about environmental problems may encourage consumers to behave in a more sustainable manner and purchase more environmentally friendly products (Vanhonacker et al., 2013). Specifically in relation to environmental contamination, heightened awareness and concern may induce them to choose an appropriate means of pharmaceuticals disposal, to choose eco-friendly products such as post-consumer plastics or paper, recyclable or reusable packaging and detergents containing ingredients that are biodegradable, non-polluting and free of synthetic dyes or perfumes (Bound et al., 2006; Mainieri et al., 1997). Consequently, increasing public awareness may help in limiting avoidable pollution in marine ecosystems (Mostofa et al., 2013). However, raising awareness and challenging concern may also lead to ignorance among the general public due to a potential overload of risk-related information (Bound et al., 2006; Verbeke et al., 2007).

In addition, people may perceive that they are contributing to marine environmental contamination, and therefore are partly responsible. At the same time, they may feel to lack the power to contribute to solving the problem (Ellen et al., 1991). The self-perception that an individual is capable of making a difference in tackling marine environmental problems determines whether the individual will act upon his/her environmental concern (Berger and Corbin, 1992; Ellen et al., 1991). This type of self-perception is referred to as "Perceived Consumer Effectiveness" (PCE). PCE is defined as "the extent to which a consumer believes that the efforts of an individual acting alone can make a difference" (Ellen et al., 1991). PCE is a direct predictor of pro-environmental behavior (Berger and Corbin, 1992; Ellen et al., 1991). Research with relevance to the field of sustainable and ethical food consumption showed that PCE can be successfully triggered by communication activities and that PCE is a key factor shaping intentions to buy sustainable products (Vermeir and Verbeke, 2006).

Van de Velde et al. (2010) demonstrated that promotion activities focusing on potential solutions to overcome environmental problems (*i.e.*, the use of environmentally friendly energy sources in that specific study) trigger PCE and consequently pro-environmental behavior to a larger extent than messages that just stress on the gravity of the environmental problems. Therefore, this study proposes that the indication of a concrete action to solve a marine environmental problem within a communication strategy will increase PCE for solving marine environmental problems. The latter has been referred to as the "well-baby appeal", meaning that emphasizing in a positive way that a problem can be solved through communicating a concrete action, may reduce the feeling of being helpless or lost (Berger and Corbin, 1992; Ellen et al., 1991).

In this study, three constructs are assessed, namely: (1) awareness of causes of contaminants in the marine environment, (2) concern about marine environmental contamination and (3) Perceived Consumer Effectiveness (PCE). The interrelationships between these constructs are tested in a statistical model that has been developed based on theoretical insight and knowledge from previous empirical research. The findings of this study may contribute to the development of environmental policies and communication strategies to enhance the perceived effectiveness among citizens and consumers in order to catalyze their pro-environmental behavior in relation to the marine environment.

2. Conceptual model and hypotheses

This study develops and tests a conceptual model treating PCE as the final dependent variable that is determined by awareness and concern. PCE is a generally acknowledged antecedent or predictor of pro-environmental behavior (Berger and Corbin, 1992; Ellen et al., 1991). The model distinguishes between two PCE constructs, namely PCE in general and PCE specifically in relation to seafood choice. *PCE general* refers to the perceived impact of an individual on the status of the marine environment in general, whereas *PCE through seafood choice* refers to the perceived impact on the marine environment of one potential concrete action of an individual, namely the impact of the conscious act of choosing, buying and eating of specific seafood products. The reason for this distinction is the fact that when a specific action is proposed to consumers instead of a general statement, the belief that the individual can have an influence on tackling marine environmental problems might be higher (Ellen et al., 1991). It is therefore hypothesized that the mean score of *PCE through seafood choice* is higher than the mean score on *PCE general* (H1); *i.e.* consumers have a stronger belief in themselves for tackling marine environmental problems when a concrete action is proposed, in comparison with the situation where no concrete action is proposed.

In addition, previous research showed that PCE can be modeled as a moderator of the relationship between environmental concern and pro-environmental behavior. The self-perception that an individual can make a difference in tackling environmental problems influences whether or not concern is translated into pro-environmental behavior (Berger and Corbin, 1992). Hence, besides investigating the relationship between the two PCE constructs, the relationship between concern and the PCE constructs is also investigated in this study. It is hypothesized (H2) that concern about marine environmental problems has a stronger impact on PCE through seafood choice in comparison with its impact on *PCE general*.

Other antecedents for pro-environmental behavior are knowledge and country-specific factors. Knowledge or awareness may play a role as individuals who are more aware of environmental problems and their causes may be more motivated to act toward improving the marine environment in the specific case of this study (Vicente-Molina et al., 2013). A higher level of awareness has been found to be associated with both a higher concern and a higher PCE (Berger and Corbin, 1992; Ellen et al., 1991). This study hypothesizes a positive relation between concern about marine environmental problems and awareness of causes of contaminants in the marine environment (H3), and that awareness of causes of contaminants in the marine environment has a stronger impact on *PCE through seafood choice* in comparison with its impact on *PCE general* (H4).

Finally, as environmental legislation, cultural influences, perceptions of environmental problems and environmental beliefs may differ between countries, possible effects of country are also taken into account. Hence, country-wise differences in awareness, concern and PCE are hypothesized (H5).