



The rise and demise of plastic shopping bags in Chile – Broad and informal coalition supporting ban as a first step to reduce single-use plastics

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ABSTRACT

Single-use plastic bags (SUPBs) were introduced to society as a way to facilitate our daily lives, but due to their low post-use value they are found as litter in many different environments, from urban to rural and remote, natural environments. Given the increasing awareness about environmental litter, many communities have banned SUPBs in the recent past. Here we explore an emerging economy to document the rise and demise of SUPBs in society. Through a review of scientific and grey literature (including governmental documents and media coverage) we reconstruct the timeline of SUPBs in Chile, including the development of the plastic industry and retail business within Chile, the introduction, spread and finally the demise of SUPBs. Focused on the demise phase, we document the creation and succession of municipal ordinances to reduce SUPBs in local commerce, and the development of a national law to regulate the use of SUPBs. In order to document the involvement of the general public during the demise phase, we also examined current behavior and behavioral intentions of people in (i) a local project introducing reusable cloth bags to reduce the use of SUPBs, and (ii) a consumer survey about public perception of SUPBs and their use. Plastic bags were introduced in Chile in the 1970s, then spread with the emergence of supermarkets and retail stores in the 1980s and 1990s, and were widely used in commerce by the turn of the century. During the first decade of the 21st century the first scientific studies reported large amounts of plastic litter and high proportions of single-use plastics in coastal environments, public awareness grew, and numerous initiatives aiming to reduce consumption and littering of plastics developed. The first municipal ban of SUPBs in 2013 was emulated during the following five years by 62 other Chilean municipalities and in 2018 translated into a national law, which was highly approved and supported by the population. We conclude that the ban of SUPBs in Chile was facilitated by a broad concern among the general public, which led to a bottom-up movement culminating in the national government taking stakes in the issue. Finally, we argue that this can only be a first step that must be followed by further actions to abolish single-use products in order to effectively protect the environment and in particular the world's oceans.

1. Introduction

The plastics industry has developed considerably during the past century, diversifying the product offer and expanding its market worldwide with a predominant growth in the packaging sector and the consequent rise in profits for the chemical, oil and manufacturing

companies (Dauvergne, 2018a). The introduction of synthetic polymers has revolutionized the type of packaging and the materials used for containers and carrier bags, which are designed for immediate disposal after single use (Nkwachukwu et al., 2013). The enormous consumption of single-use plastic products has become a major waste management challenge and generates severe environmental problems (Gall and

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Thompson, 2015).

Plastic pollution of the oceans has been recognized as a significant global problem during the past two decades, after it had escaped the attention of the general public for many years; reasons for this belated awareness seem to be related to the distance and relative invisibility of the problem, considering that many marine plastics either accumulate in the remote center of the oceans, break down into less visible microplastics, or sink to the inaccessible seafloor (Mendenhall, 2018). Currently, there is no global strategy for governing marine plastic pollution matching the scale of the problem, the policy coordination is scarce at the international level, and governance is fragmented across sectors and product lines (Dauvergne, 2018b).

The use of Single-Use Plastic Bags (SUPBs) involves varied aspects within economic, social and environmental dimensions. In fact, the difficulties in tackling this problem lie at the heart of globalization, current economic models and consumption levels, among others. Increasing economic power in many global markets has resulted in the acquisition of goods by individual customers in large retail stores, and acquired products are often carried home in large plastic shopping bags. The convenience for consumers to receive SUPBs at the stores for free and for distributors to facilitate them at very low cost resulted in a wide availability and use of plastic bags for shopping that reached a point where the use of plastic bags became a habit and is no conscious decision anymore (Danner et al., 2008). Waste mismanagement and the low rates of recycling (Geyer et al., 2017) increase the probability of SUPBs leaking into the environment. Most problematic is the fact that after littering them in the environment, due to their light weight and parachute-shaped design, SUPBs can travel easily through air and water (Knoblauch et al., 2018).

On the other hand, the number of marine species reported to be impacted by anthropogenic litter has increased dramatically over the past decades and continues to grow (Gall and Thompson, 2015). Moreover, it is estimated that at least 17% of the species ingesting or becoming entangled in marine debris are on the IUCN Red List as near threatened, vulnerable, endangered or critically endangered (Gall and Thompson, 2015). Plastic bags, balloons and plastic beverage bottle caps, fishing nets and gears are among the 20 most common marine litter items being rated as harmful for wildlife due to the risk of entanglement (Hardesty et al., 2015).

Those results provide support and the base for initiatives and attempts to reduce marine litter. Many organizations have expressed particular concerns about single-use consumer items, such as plastic bags (Hardesty et al., 2015). These widespread concerns have led to an increasing number of policy and legislative initiatives aiming to reduce plastic bags in the environment and the likelihood to end up in the ocean (Xanthos and Walker, 2017). In fact, since 1991, 39 countries have adopted a tax on the sale of plastic bags, while 51 countries and states adopted a ban on their production, sale or use (Knoblauch et al., 2018). Although few studies have documented the effectiveness of these strategies (Xanthos and Walker, 2017), regulation of plastic bags has been seen as an opportunity to promote public awareness and foster pro-environmental behaviors (PEB) (Jakovcovic et al., 2014). Steg and Vlek (2009) described PEB as “the behavior that harms the environment as little as possible, or even benefits the environment”. According to Kollmuss and Agyeman (2002), PEB is determined by several intrinsic (e.g. knowledge, attitudes and feelings of responsibility) or extrinsic (e.g. laws and social and cultural circumstances) factors. Reducing the numbers of SUPBs being used can be a decision of consumers who actively engage in pro-environmental behavior and avoid SUPBs in their daily life. The main challenge remains to examine factors influencing environmental behavior and find effective ways to encourage PEB (Steg et al., 2018).

In recent years the perceptions about plastic bags have changed, and many citizens are now recognizing them as hazards that threaten the environment. Consequently, anti-plastic bag social norms (i.e., ideas and beliefs about appropriate behaviors; Bernstein, 2001; Clapp and

Swanston, 2009) have emerged, spread rapidly and widely in society, and in many countries translated into policies in varied ways (Nielsen et al., 2019). This phenomenon raises new insights about the dynamics between norm adoption and policy implementation, as in many cases the regulation of SUPBs has been based on local and regionally specific concerns that have led to ad-hoc bottom-up initiatives (Clapp and Swanston, 2009).

Aiming to achieve an integral overview about the history of SUPBs in Chile, we explore how SUPBs invaded an emerging economy in South America, how they were recognized as an environmental threat, and how the population and the country initiated actions to replace them. Using historic records, we describe the events that led to the rise and demise of SUPBs in Chile. Furthermore, based on a model of predictors of environmental behavior (Hines et al., 1987), we examine behavioral intention and current behavior related to SUPBs in two case studies done at different times during the demise phase. The first case study is about a local mitigation project done in 2014 (as an example for many similar initiatives across the country), showing how a coastal community took action in reducing the use of SUPBs, and we examined how a socio-environmental intervention influences the community's behavior. The second case study is a consumer survey conducted at the national level in 2018 to examine the influence of local ordinances regulating SUPBs just before the national ban.

Thus, to document the history of SUPBs in Chile, and in particular the role of the general public in their demise, we present (i) a timeline of the rise, spread and demise of SUPBs in Chile, (ii) a local mitigation project introducing reusable cloth bags with the goal to reduce the use of SUPBs, and (iii) the results of a consumer survey about the public's perception of SUPBs.

2. Material and methods

2.1. Study area and socio-economic background

Chile is a country with a coastline extension of >4500 km between 18°S and 56°S, covering a large part of the South-East Pacific coast with sandy beaches and rocky shores between 18°S and 42°S, changing to fjords, channels and archipelagos south of ~42°S in the Patagonian region (Aguilera et al., 2019). The heterogeneity and oceanographic conditions of the Chilean coast result in high levels of endemism (near 40%) for many invertebrate groups (Miethke et al., 2007; Miloslavich et al., 2011). Most Chilean cities are located close to the coast (Kiessling et al., 2017), with the exception of the capital Santiago, which concentrates >40% of the national population (INE, 2018) but is directly connected to the coast via a mountain river (Rech et al., 2014). The smallest unit of administration in Chile is the community, governed and administrated by a municipality, with a total of 346 municipalities along the country (of which 102 are coastal). There are 54 provinces that are more or less evenly distributed among the 16 administrative regions of Chile (BCN, 2017).

The economy in Chile is dominated by the service sector followed by industrial manufacturing. Specifically, during 2018 the most important contributors to the national GDP were financial and business services (15.0%), education, health and other personal services (11.6%), commerce, restaurants and hotels (11.5%), industrial manufacturing (10.4%), and mining (9.9%) (COCHILCO, 2019). In recent years, the tourism industry has experienced a sustained rise, contributing directly and indirectly to different sectors, but mainly directed to the commerce, restaurants and hotels (INE, 2014). Recent studies by the Organization for Economic Cooperation and Development (OECD) determined that tourism in Chile has become one of the sectors with the fastest growth and employment generation (OECD, 2016).

2.2. Timeline about the use of SUPBs in Chile

The timeline is composed of three phases: (i) introduction of SUPBs

in the market, (ii) widespread use, and (iii) demise of SUPBs in Chile. The reconstruction of the first phase is mainly based on reports (scientific, private and governmental) and data that reveal how the process of insertion and rise of SUPBs occurred in Chile. This approach includes statistics about the emergence of factories that produce SUPBs in Chile, using data reported in the 2014 year book of the Chilean Association of Plastic Producers (ASIPLA for its Spanish abbreviation, “Asociación Gremial de Industriales del Plástico de Chile”). In addition, we searched for historic information about the petrochemical and manufacturing industry and about the rise of supermarkets and retailing businesses in Chile, which were the principal agents of introducing SUPBs to the general public. For the second phase of widespread use of SUPBs, information was taken from studies by the Center of the Packaging Industry in Chile (CENEM, “Centro de Envases y Embalajes de Chile”) and the Environmental Ministry of Chile (MMA, “Ministerio de Medio Ambiente de Chile”), which provide statistics about production and circulation of SUPBs within the country.

To describe the final phase of the timeline about the demise of SUPBs in Chile, it was necessary to compile information about all the different efforts and initiatives that aim to reduce the impact of SUPBs in the environment (policies, programs, and norms). Using publicly available information, we compiled a chronological list of municipalities that have promulgated ordinances to regulate the service of SUPBs in their communities (involving local shops and supermarkets). Additionally, a review of the history of Law number 21.100 (prohibiting the service of SUPBs in the commerce in the entire national territory) was done through the National Library of Congress (BCN, “Biblioteca del Congreso Nacional”), specifically in the section called “history of the law” (“historia de la ley” in Spanish), which was searched to identify key drivers for the establishment of the law. We also reviewed the national environmental annual surveys done by the Environmental Ministry of Chile since 2014 (to 2018) to look for hints related to SUPBs. Finally, we used the online version of the BCN and the website of the Environmental Ministry to search for policies, norms and programs of the federal government aiming to reduce environmental impacts of SUPBs by searching the keywords *bolsas plásticas*, *manejo de residuos* and *reciclaje* (the search was done in Spanish, and these keywords translate to plastic bag, waste management, and recycling, respectively).

2.3. Mitigation project: participatory action plan - coastal community interested in reusable shopping bags

During the past two decades numerous local initiatives have been implemented throughout the country, focusing on prevention, recycling, cleanups and environmental education. Many of these initiatives are created by concerned citizens, but also by non-governmental organizations (NGOs) and governmental institutions. Among the latter, the Permanent Commission of the South Pacific (CPPS, “Comisión Permanente del Pacífico Sur”) has been seeking actions to foster marine litter management in coastal areas along the South Pacific. For a first action in 2014 the program “Científicos de la Basura” (the litter scientists) led the elaboration of a marine litter action plan in the rural county of La Higuera (29°30'S 70°11'W) in close collaboration with local actors and the municipality. The county has a surface of 4200 km², with 4300 inhabitants according to the last census (INE, 2018); the population is dispersed over eight small localities. The main economic activities are extraction of marine resources, cattle raising, and during the last 20 years ecotourism associated with the national reserve “Pinguino de Humboldt” and the marine protected area “Islas Choros y Damas”.

The coordination team of the action plan (coauthors PN, SNR, MT) identified the key stakeholders with the support of the community's authorities and invited them to participate in a one-day collaborative workshop, including authorities, social and economic agents, government and educational institutions, NGOs and others. The “Workshop about marine litter - Ideas for an action plan in La Higuera”, conducted in May 2014 comprised several steps: (i) participants learned about

marine litter, its sources and impacts on marine ecosystems, (ii) through motivating questions they identified and presented to the group the main problems/sources of marine litter in their own community and possible solutions, (iii) based on teamwork discussions they proposed diverse strategies to mitigate the marine litter problem that are within their capacities to solve them, (iv) in two steps they voted among the different proposed strategies, and finally (v) they collectively agreed upon the activities for the selected intervention plan.

The main objective of the resulting intervention was to promote the reduction of single-use plastic grocery bags through an intervention that took place in the main coastal localities: Punta de Choros (332 inhabitants), Chungungo (279 inhabitants), and Caleta Los Hornos (585 inhabitants). One of these rural localities (Punta de Choros) is located close to a Marine Protected Area (MPA) that is beneficial to local residents in different aspects, primarily the profit from ecotourism; residents offer boat trips to observe marine fauna including penguins, dolphins and whales that can be found in the marine reserve surrounding the islands of the “Islas Choros y Damas” Marine Reserve (Cárcamo et al., 2014).

The intervention consisted of two simultaneous components: outreach and direct (non-monetary) incentives to the residents of the main communities in La Higuera. The outreach component of the socio-environmental intervention consisted of talking with people, mainly housekeepers about: (1) details of the ‘Local Action Plan’ and its objectives (to show that representatives from their communities were involved in the design of the plan), (2) the impacts of plastic litter on the natural environment (representing a problem), and (3) the benefits of individual reduction of SUPBs (representing a first step towards a solution). The incentive consisted of the distribution of reusable fabric shopping bags at no cost to each person and household that received the information.

Having this setting of three localities with one directly and positively impacted by an MPA, in parallel to the implementation of the action plan, we examined the influence of residence and social context on the outcomes of this intervention. It is well documented that a behavioral change can be encouraged by socio-environmental interventions (De Young, 1993; Stern, 1999; Brito and Pasquali, 2006; Steg and Vlek, 2009). For example, when the behavior in question is due to a lack of knowledge (e.g. not knowing how to recycle), interventions can include informational strategies (Schultz, 1999; Tobias et al., 2009). However, information alone might not be sufficient to provoke a change (Schultz, 1999; Stern, 1999). Pro-environmental attitudes and behaviors can also depend on the geographical context (Bonaiuto et al., 2002; Holmes, 2003). For example, when a protected area does not interfere with access to natural resources or even generates a benefit for stakeholders, attitudes tend to be positive (e.g. Infield, 1988), but attitudes are mostly negative when protected areas restrict access to resources or limit other aspects of the way of living of these communities (e.g. Akama et al., 1995). Based on these considerations, herein it was hypothesized that (1) pro-environmental intentions and behaviors, like green consumerism, are positively influenced by the level of association with a protected area, and (2) a socio-environmental intervention will result in a greater pro-environmental intention and behavioral change in communities that are directly associated to a protected area.

To evaluate how the intervention influenced pro-environmental intention and behaviors towards reduction of the plastic grocery bag, two surveys were performed in each locality, the first (pre-campaign survey) was done one week before the intervention and the second (post-campaign survey) one week after the intervention by two or three trained interviewers. Taking advantage of the small size of all coastal communities, the main areas and a significant proportion (9–15%) of the population from each locality were reached.

Using the model of predictors of environmental behavior (Hines et al., 1987), which is based on the theory of planned behavior (Ajzen and Fishbein, 1980; Ajzen 1991), we use the framework of predictor variables to examine behavioral intentions towards PEB in the context of

SUPBs. The variables used are: *knowledge of issues* (problem and causes), *knowledge of action strategies* (how to act to lower her/his environmental impact), *locus of control* (individual's perception about how one's own behavior can bring about change), *attitudes* (related to the likelihood to engage in pro-environmental behavior), *verbal commitment* (about individual's perception/communicated willingness to take action) and *personal responsibility*.

The survey consisted of three sections to measure; the first corresponds to self-reported current behavior, the second to behavioral intention predicted by verbal commitment, and the third corresponds to behavioral intention predicted by four other predictors, including knowledge of issue, knowledge of action strategies, locus of control and attitude. The survey consisted of 17 questions about plastic bag reduction and reuse, reusable shopping bag use and environmental litter, 12 of which were part of a multi-item measuring scale consisting of five step Likert-type items measured in a hierarchical manner (Table S1). The remaining five questions were about other information related to the topic (i.e. about quantity and type of bags) and basic demographic data, including gender and number of home residents. The answers to Likert-type items were then graded from 1 to 5 points according to the direction of the question; that is to say, in environmentally positive questions 'always' or 'totally agree' answers were equivalent to the maximum score of 5 points. In contrast, in environmentally negative questions the same answers were given the minimum score of 1 point (Hernández Sampieri et al., 2014).

Repeated measures research design (same people measured before and after) is preferred for the evaluation of interventions as most of the individual differences are controlled (Hanna and Dempster, 2012). As the intervention aimed to reach a large part of the population of La Higuera, and both the intervention and evaluation had to take part in a short period of time, in the present research we have both cases: (i) Matched pairs (people who answered both, pre- and post-campaign survey), and (ii) Separate Pre-Post Sample (not the same people were measured before and after the intervention). This Quasi-experimental Design (non-random samples) implies that the appropriate analyses to test the effect of the intervention, by measuring the difference between pre- and post-campaign survey scores, are independent sample analyses (Hernández Sampieri et al., 2014). Therefore, the sets of answers (matched pairs and separate pre-post samples) were separated, the matched-pairs were excluded from the post-campaign survey sample when performing the independent-sample analyses, and, on the other hand, matched-pairs were explored through repeated-measure analysis (parametric paired *t*-test and non-parametric Wilcoxon Signed Ranks test), pooling the three localities in one dataset and only testing the intervention effect.

For statistical analyses, the dependent variables were the sum of each person's (1) self-reported current behavior domain scores, (2) behavioral intention predicted by verbal commitment domain scores, (3) behavioral intention predicted by domain scores for other variables, and (4) Total score [current behavior (1) + behavioral intention (2 + 3)], where the Total score for each person represents the pro-environmental attitude towards the plastic bag issue. Normality tests (Kolmogorov-Smirnov) were conducted over each dependent variable sample to determine if the use of parametric analyses was suitable. The independent variables were the samples of (a) each locality (Punta de Choros, Chungungo and Caleta Los Hornos), and (b) the samples of the different survey instances (Pre- and Post-campaign).

To test the hypothesis of the effect of locality of residency (association with an MPA), as well as the effect of the socio-environmental intervention and the interaction of both effects on the resulting scores, a 3 (number of localities) by 2 (number of surveys) Two-way ANOVA was conducted when dependent variables were normally distributed. Otherwise, non-parametric independent sample Mann-Whitney U-tests on pre- and post-campaign survey scores from each locality were used to test for the effect of the intervention in each locality. To analyze the differences between localities (the influence of the presence of an MPA),

an independent samples Kruskal-Wallis test over pooled pre- and post-campaign survey scores was conducted.

2.4. Consumer survey: People's perceptions about SUPBs and ordinances to regulate SUPBs

In order to gain information about the current behavior related to SUPBs, and the behavioral intentions predicted by knowledge of issue, verbal commitment, locus of control and personal responsibility among the Chilean general public, we conducted an online questionnaire. In particular, we were interested in examining the differences between communities with and without a SUPB ordinance. It was expected, that people from municipalities with an ordinance would report lower levels of SUPB use, and higher behavioral intentions than those from municipalities without ordinances.

The survey was done during the summer vacation period of the year 2018 (austral summer: January & February). Based on the model of predictors of environmental behavior (Hines et al., 1987), the questionnaire consisted of 32 items designed to determine the current behavior (via self reporting) and to predict behavioral intention (via predictor variables) through measures of knowledge of issue, locus of control, verbal commitment and personal responsibility. The questionnaire is in Spanish and its original version can be found in Table S2. Several questions were adapted from the study by Eastman et al. (2013). A pilot study was previously conducted at the market of Coquimbo and the questionnaire was adjusted accordingly.

Socio-demographic questions: The participants were asked six questions to investigate gender, age, education, occupation, place of growing up, and actual place of living. Aiming to assess the influence of regulations for the use of SUPBs on public behavior, the results were analyzed in function of the response to the first question about the existence of any regulation for the use of SUPBs, where each set of responses for the questions in Table 1 was related to one of the three categories of responses (0 – Yes; 1 – No; 2 - I don't know). As previously recommended by Hernández Sampieri et al. (2014), since the data were not normally distributed, a Kruskal-Wallis rank sum test was conducted to evaluate whether the existence of regulation for use of SUPBs had a significant effect on the variables examined (each domain) and on the sum of those variables (Total Score). Additionally, aiming to have an overview of the examined variables among the surveyed population, for each question we calculated the descriptive statistics for the pooled dataset.

3. Results

3.1. Historic timeline

3.1.1. Introduction of SUPBs to the market in Chile

Long before the production of the first bags, the plastic industry in Chile started in the 1930s with the foundation of the first company that produced user items from a hard and thermo-stable plastic (Zamanillo, 2009). During the 1940s and 1950s the plastic industry was growing, with more companies and a larger variety of products entering the market. Even though Chile is not rich in hydrocarbons, an industry of transforming oil and in particular plastic products developed to serve the national market (Coq-Huelva and Ríos, 2010). Attending the interests of the plastic industry and the growing need to deal with import permits, in September 1954 the Chilean Association of Plastic Producers (ASIPLA) was founded to represent the sector.

Around the mid 1950s, the global petrochemical industry became firmly established in core economies (US, Japan, Western Europe), coinciding with a general tendency towards the internationalization of manufacturing and a trend of establishing new products as plastic and synthetic fibers in the market (Chapman, 1992). Despite the rapid growth in the core economies, the petrochemical industry changed importantly during the 1970s, due to the introduction of the industry

Table 1
Variables analyzed for survey of the perception of SUPBs by people.

Domain	Via/predictor variable	Question/Statement	Alternatives				
			1	2	3	4	5
Current Behavior	Self-reported	How many single-use plastic bags do you use daily?	1 or less	1–2	2–5	5–10	More than 10
	Self-reported	I use a new plastic bag every time I go shopping	Never	Rarely	Occasionally	Frequently	Very Frequently
Behavioral intention	Verbal commitment	I am willing to change my use of single-use plastic bags	No I am not willing at all	I am unwilling	I am undecided	I am willing	I am totally willing
	Verbal commitment	I am willing to change my use of SUPBs if there are accessible alternatives	No I am not willing at all	I am unwilling	I am undecided	I am willing	I am totally willing
	Verbal commitment	I am willing to pay for a plastic bag in the supermarket	No I am not willing at all	I am unwilling	I am undecided	I am willing	I am totally willing
	Verbal commitment	I am willing to reduce my use of single-use plastic bags	No I am not willing at all	I am unwilling	I am undecided	I am willing	I am totally willing
	Verbal commitment	I am willing to bring my own reusable bag if there is a reward (e.g. a discount on the shopping)	No I am not willing at all	I am unwilling	I am undecided	I am willing	I am totally willing
	Knowledge of issue	I am aware of the impact plastic litter can have on the environment	No, not at all	I am a little aware	I am undecided	I am aware	I am absolutely aware
	Knowledge of issue	I am aware of the impact plastic litter can have on the human organism	No, not at all	I am a little aware	I am undecided	I am aware	I am absolutely aware
	Knowledge of issue	I am aware of the impact plastic litter can have on the marine environment	No, not at all	I am a little aware	I am undecided	I am aware	I am absolutely aware
	Personal responsibility	I think I am responsible to take care of the environment	I am not responsible at all	I am a bit responsible	I am moderately responsible	I am quite responsible	I am totally responsible
	Locus of control	I think my actions have an impact on the environment	No, not at all	Yes, they have a small impact	Yes, they have a moderate impact	Yes they have quite an impact	Yes, they have a huge impact

into more countries. There is evidence that the governments in each country played a major role in promoting the geographical spread of the industry since the mid-1960s (Chapman, 1992). The initiation of ethylene production in Chile started in 1970 with important participation of the government. Vergara and Brown (1988) mentioned that the petrochemical manufacturers were identified as "...a key to the future industrialization of developing countries".

The process of introduction of plastic bags to the market was accompanied by an evolution of the retailing sector and changes in market practices, focused on food packaging. By the early 1960s, Chile was characterized by a highly fragmented food retailing structure, with traditional retail outlets broken down into very specialized product stands and stores, also closely linked to packaging practices at that time: "Prepackaging of foods is in its infancy in Chile; and most products that are packaged at all are packaged in the retail store. Sugar, flour, and beans, for instance, are purchased by the retailer in bulk and weighed out for the consumer at the point of purchase, resulting in total flexibility in package size. But some industries (notably the producers of rice, spaghetti, and macaroni) have been pre-packaging their products, and the sugar refiners are planning to follow suit" (Bennett, 1966). With reference to shopping bags, Bennett (1966) offers the following description about a female customer: "She enters the store with her shopping list and her own shopping bag, or *bolsa*. She sends the store clerk scurrying all over the store for her purchases, many of which he has to weigh and price for her; she may ask for 200 g, 400 g, 750 g, or a kilogram of sugar, for instance".

According to the search for the founding year of each plastic bag factory, the first one was in 1968, very closely linked to the start-up of the petrochemical industry in Chile in 1970 (Chapman, 1992). It was possible to trace the starting year for 23 of 24 plastic bag producers. Since 1970, the number of factories increased, maintaining an average of five new firms per decade, but as of 2000 a slowing-down was observed (Fig. 1A).

Despite the fact that the first supermarket opened in Santiago already in 1957, the expansion of supermarkets in Chile took place in the 1970s and early 1980s; however, they were concentrated mainly in the large cities in areas with upper-income households (Faiguenbaum et al., 2002). During the 1990s, the number of supermarkets increased rapidly

at a rate of 4.5% per year, accompanied by a fast economic growth that allowed the supermarkets to occupy 62% of total food retailing in 2001. According to Faiguenbaum et al. (2002), "During the decade [1990], supermarkets also extended beyond the high-income areas into middle and even working-class neighborhoods, and into medium-sized cities and even rural towns." The history of large-scale plastic packaging and the expansion of plastic bags is closely linked to the spread of supermarkets.

3.1.2. Widespread use of SUPBs in Chile

The first decade of the 21st century was characterized by an important growth in the sector of packaging and plastic production. In 2002, 280 thousand tons of plastic packaging were produced within the country, with a production value of US\$ 560 million. By 2009 this number had increased to 380 thousand tons and US\$ 880 million, contributing 0.95% of the GDP (MMA, 2010). Within the subsector plastic packaging, films and bags accounted for 38% of the production in 2009, representing almost 145 thousand tons equivalent to US\$ 335 million (0.36% of GDP) (MMA, 2010).

The increased plastic production became a challenge for waste management systems and difficulties to develop accordingly, added to a limited recycling, caused an increase in environmental pollution by plastic bags (Horstmann, 2007). The supply of bags at no charge and the growing number of supermarkets and malls further increased the numbers of plastic bags in circulation, and therefore enhanced the risk of leakage to the environment, specifically in coastal areas with frequent wind events. A report on the abundance and composition of anthropogenic marine debris (AMD) in coastal waters off the Chilean coast during austral summer 2002 found that the observed AMD consisted mainly of plastic material (86.9%). Among the five distinguished categories, plastic bags contributed the majority (47.6%; Thiel et al., 2003). The proportions of the different AMD items were relatively similar between coastal waters and sandy beaches, with plastic and Styrofoam dominating, including shopping bags, wrappers, ropes and pieces of hard and soft plastic (>75%, Thiel et al., 2013).

During this decade of widespread use of SUPBs and other single-use plastic items, also several governmental institutions and NGOs became concerned about marine litter. For example, in 2001 the NGO

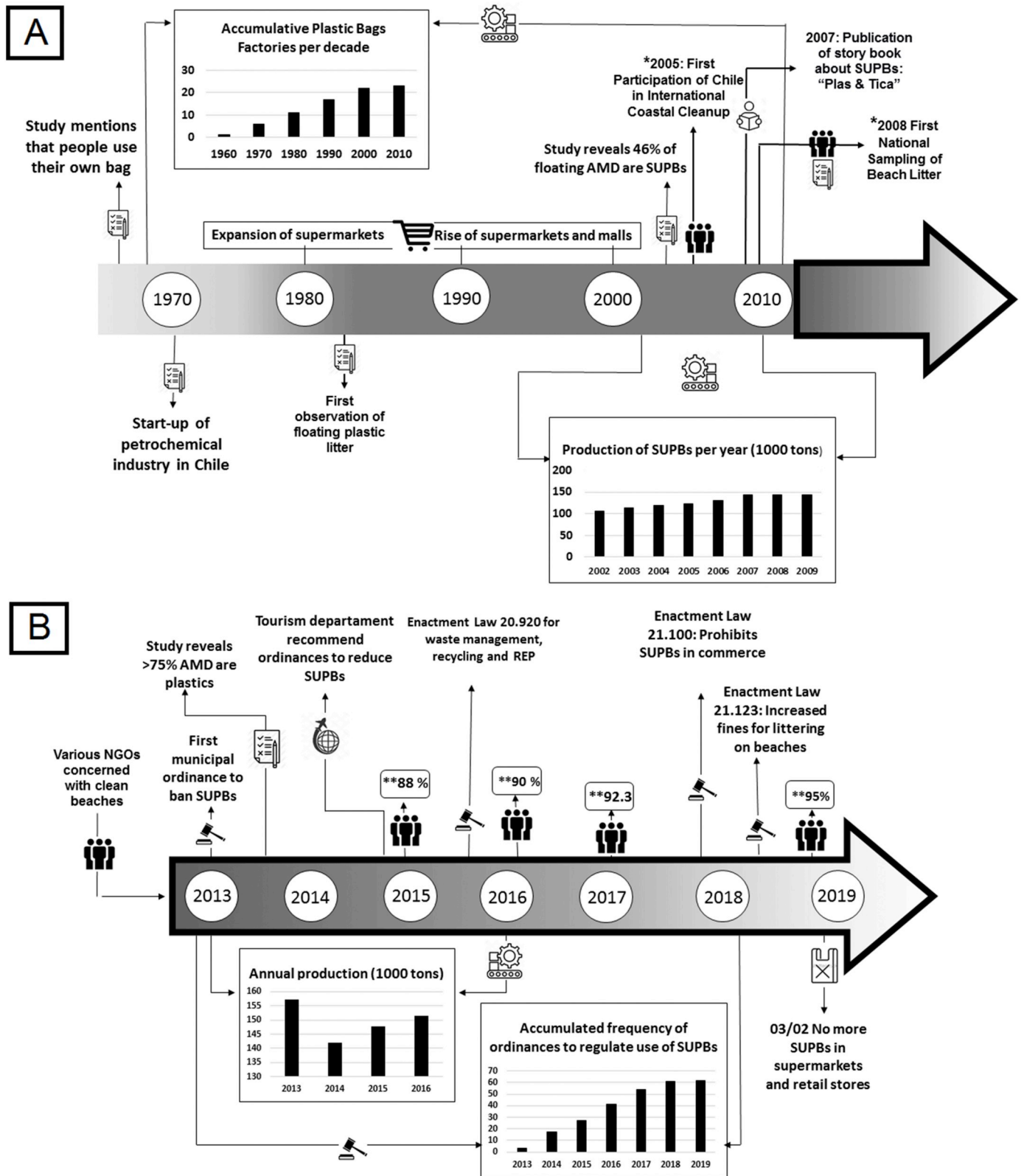


Fig. 1. (A) Introduction and rise of SUPBs in the Chilean market; (B) Demise of SUPBs in Chile. All data, events and initiatives only refer to Chile. *Initiatives started in 2005 and 2008, respectively, and continued year by year. **% of the population in agreement with a restriction of SUPBs according to the National Environmental Survey from the Environmental Ministry (MMA, 2014; MMA, 2015; MMA, 2016; MMA, 2018a). 2007: Publication of Story book about SUPBs: “Plas & Tika” by Nuñez (2007). AMD: Anthropogenic Marine Debris. For details see Tables S3, S4, S5, S6 and S7.

Chinchimen was founded, which focuses on sea otters, but also has done campaigns for clean beaches since its beginning (www.chinchimen.org); many other NGOs and undocumented local groups have dedicated time and efforts to organize beach cleanups, stop the spread of single-use plastics, or implement recycling initiatives (Thiel et al., 2011). In 2005, the first Chilean participation in the International Coastal Cleanup is recorded, and since 2008 this initiative is being coordinated by the “General Administration of the Maritime Territory and Merchant Navy” (DIRECTEMAR, “Dirección General del Territorio Marítimo y de Marina Mercante”) of the Chilean Navy, with thousands of participants nationwide each year (<https://www.directemar.cl/directemar/intereses-maritimos/limpieza-de-playas>). The first national sampling of beach litter was conducted in 2008, and it has since been repeated in 2012 and 2016 (Hidalgo-Ruz et al., 2018), together with various other studies on environmental litter that have involved thousands of citizen scientists (e.g. Eastman et al., 2013; Rech et al., 2015).

3.1.3. The demise phase: regulation to reduce or ban SUPBs

During 2016 total plastic packaging production (including films and bags, bottles, jars, boxes and others) in Chile amounted to ~420 thousand tons, with a total production value of US\$ 1,030 million (CENEM, 2017). Production of films and bags slightly decreased from 2013 (157 thousand tons) to 2016 (151 thousand tons) (Fig. 1B). The study by CENEM (2017) further reveals that 30% of plastic bags are used by supermarkets and retail stores and 40% by the food industry, the latter of which likely is subsequently also expended in supermarkets to consumers.

In 2013, Pucón in southern-central Chile was the first municipality to ban plastic bags. Being the first municipality in Chile enacting a ban, the ordinance received a lot of media attention for the unprecedented and radical measure (Radio Cooperativa, 2014). Following this measure, between 2013 and 2018 a total of 62 municipalities (17.9% out of 346 municipalities in Chile) created their own local regulation to reduce the use of SUPBs (Fig. 1B). Of those 62 municipalities 27% currently include this regulation under an existing article within their general environmental ordinance, while the other 73% designated a special ordinance specifically to reduce the widespread use of SUPBs (Table S7). The strategies proposed by the different municipalities to achieve this goal were highly variable, but they were all built on direct communication with the local commerce and included a gradual plan for implementation.

In November 2014, two distributors of SUPBs consulted the Chilean Government Oversight Committee (CGR, “Contraloría General de la República”), questioning the legality of the municipal ordinances. After legal analysis, the CGR replied in favor of the distributors, highlighting that municipal ordinances cannot prohibit the constitutional right to develop an economic activity. Therefore, municipalities that had implemented ordinances to ban SUPBs had to adjust the legal language, subsequently promoting the reduction and call commerce to adhere to their plans to abolish SUPBs on a voluntary basis (CGR, 2014). Despite this initial drawback, municipalities throughout the country and from diverse socio-economic backgrounds (rural communities and large urban centers) continued to create ordinances to reduce SUPBs, implementing strategies and incentivizing local commerce to adhere to the policy by offering green labels and environmental education about the issue (La Tercera, 2017). Since 2015 a total of 45 municipalities created an ordinance to regulate the use of SUPBs, adding to the 17 municipalities that created the ordinance before the claim by distributors of SUPBs to the CGR in November 2014, which raised the total sum to 62 municipalities with ordinances to regulate the use of SUPBs until September 2019.

In parallel to the growing number of municipalities that implemented norms and strategies to reduce SUPBs, in October 2013 the national congress began the process to create the current law number 21.100, finally approved in August 2018, which prohibits the free service of SUPBs in the commerce for the entire country. Since 2013 the

proposed law passed through many changes, and the final enacted law responded to ten parliamentary motions, e.g. to apply the norm only to the Patagonian territory, or only to coastal municipalities because SUPBs are thought to be a particular threat to the marine environment. At incorporating all these changes, the final session of the Chilean congress finally approved a law with the power to ban SUPBs within a short period of time in the entire country (BCN, 2018a).

Subsequently, the Chilean Association of Plastic Producers questioned the legality to prohibit an economic activity, arguing about economic losses for industry and unemployment (Diario Constitucional, 2018); interestingly, the enormous opportunities for small-scale producers of reusable bags are not being taken into account. However, with the enactment of the law 21.100 the future of SUPBs in Chile has been sealed; since its approval in August 2018, the commerce (supermarkets and retail) had six months to adapt to the measure, reducing the handout of SUPBs at no charge to two plastic bags per client, and finally reduce it to zero on 3rd of February 2019. Medium and small companies have a time limit of two years to apply the same measure (BCN, 2018a).

Simultaneously to the process of ordinances and the law that regulates the use of SUPBs, other legislation or policies that contribute to reduce the risks for SUPBs to become environmental litter have been established. In 2010, the law 20.417 created the Chilean Environmental Ministry, and since then the number of environmental programs and laws has substantially increased at the national level (Bergamini and Pérez, 2015). Law 20.417 further requires municipalities to establish environmental departments, which typically includes waste management. The law also demands municipalities to propose and develop environmental programs, for example recycling programs. Additionally, before the prohibition of SUPBs in Chile by law 21.100, the law 20.417 awarded the faculty to municipalities to establish environmental ordinances (BCN, 2010), and consequently 62 municipalities have established regulations for the use of SUPBs within this legal framework. Also in 2015, the National Tourism Department created a manual of recommendations for the sustainable development of tourism, which likewise mentioned the regulation of SUPBs to benefit municipalities (SUBTURISMO, 2015). This was especially of interest for municipalities that base a large part of their income and economy on tourism.

In 2016, the law number 20.920 was approved, which established a framework for waste management, extended producer responsibility and the promotion of recycling. The law is founded on the preventive principle, which includes actions to change habits of use and consumption as an important strategy to avoid the generation of solid waste. Furthermore, it clearly established the responsibility for producers of solid materials to adequately manage any waste resulting of a product, i. e. until this waste is recycled or completely eliminated (BCN, 2016). Unfortunately, implementation of this law is still lagging behind.

Finally, in 2018 law number 21.123 was approved, establishing fines for littering or dumping garbage on beaches, at riversides and lakesides, in national parks and national reservoirs, and natural monuments or any other protected area (BCN, 2018b). While this new law appears very progressive, little is known about its effectiveness, regarding implementation and enforcement.

3.2. Mitigation project: participatory action plan - coastal community interested in reusable shopping bags

The collaborative stakeholder workshop took place in the county building of La Higuera on 12th of May 2014. A total of 31 participants (out of 51 invited) assisted. After a brief introduction about marine litter sources and impacts on marine ecosystems, each participant presented her/himself and shared an opinion on questions posed during the introduction. The first question asked about the main sources of marine litter, and the predominant responses were (i) lack of information and education, (ii) tourists and visitors leaving their litter, and (iii) a lack of regulations referring specifically to litter. Responses to the question about solutions were (i) environmental education at all levels (schools

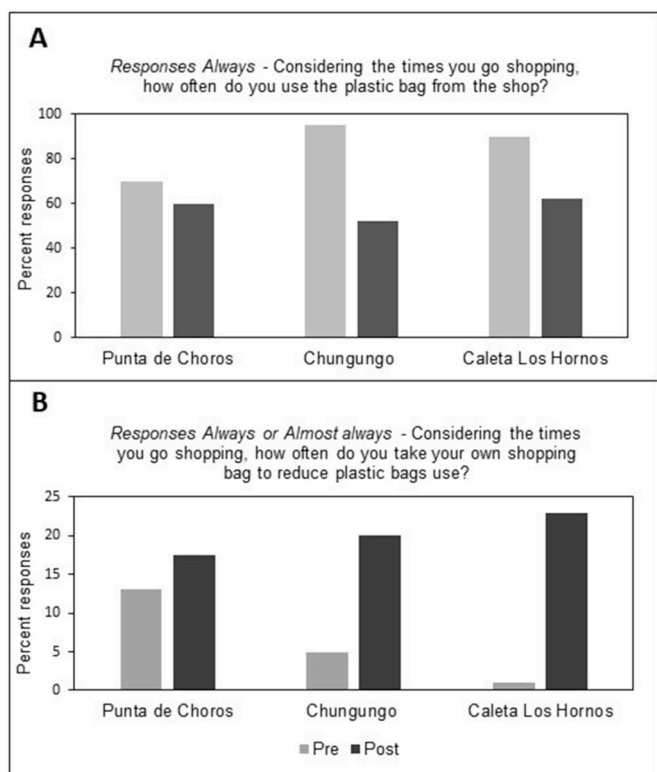


Fig. 2. (A) Percentage of responses “Always” to question 1 pre- and post-campaign: “Considering the times you go shopping, how often do you use the plastic bag from the shop?” (B) Percentage of responses “Always” or “Almost always” to question 8 pre- and post-campaign: “Considering the times you go shopping, how often do you take your own shopping bag to reduce plastic bags use?”

and communities), (ii) implementation of specific ordinances with inspection focused on tourists, and (iii) establishment of separate recycling points around the county. Based on these solutions participants voted for the following actions, to be implemented by the respective sectors: (1) tourism and commerce companies: support campaign for the use of reusable bags, (2) education: conduct educational workshops and award environmental prizes, and (3) municipal management and administration: develop and implement a litter-specific municipal ordinance.

Each group developed and shared an action plan for the proposed solution, and based on these suggestions the plenary decided to generate and distribute fabric bags in order to reduce the use of SUPBs. It was further agreed that the intervention campaign would look for support from the tourism companies and local commerce, and involve local schools in the project to comply with the educational solutions identified. The main activities of the action plan were the following: (i) invite the local commerce and touristic companies to adhere to the campaign for reducing SUPBs, (ii) incorporate the local schools through an educative marine litter workshop and a drawing contest to design the image for the fabric bags, and (iii) produce and distribute fabric bags to

Table 2
Locality and intervention effect on **Total score of survey** (two-way ANOVA; n = 257; matched-pairs are excluded from post-campaign survey sample).

	SS	df	MS	F	p
Intervention	1229.44	1	1229.44	35.70	<0.001
Locality	71.06	2	35.53	1.03	0.358
Intervention * Locality	212.46	2	106.23	3.084	0.048
Error	8646.44	251	34.45		

SS: Type III Sum of Squares; df: Degrees of freedom; MS: Mean square; F: F ratio; p: Significance at 95% confidence level.

Table 3
Intervention effect (Survey) on ranked pre- and post-campaign domain resulting scores for each locality (independent sample Mann-Whitney Test; matched-pairs are excluded from post-campaign survey sample).

U	Punta de Choros (n = 63)		Chungungo (n = 70)		Caleta Los Hornos (n = 124)	
	p	U	p	U	p	U
Current behavior	321.0	0.015	288.50	0.000	1050.00	0.000
Behavioral intention by verbal commitment	449.0	0.521	299.00	0.000	1443.50	0.000
Behavioral intention by other predictor variables	469.0	0.716	545.50	0.013	1714.50	0.010

the community.

The descriptive statistical analysis (Table S8) about the effect of the intervention campaign shows positive changes in the use of plastic bags and reusable bags (Fig. 2). Not surprisingly, the percentage of surveyed people owning a reusable shopping bag increased in all localities between the pre- and post-campaign survey: from 17% to 27% in Punta de Choros, from 22% to 30% in Chungungo and from 42% to 54% in Caleta Los Hornos. Moreover, after the campaign in all localities (i) fewer participants used plastic shopping bags offered by the shops (Fig. 2A), and (ii) more participants used their own reusable shopping bag to reduce plastic bag (Fig. 2B) (Table S8).

For the inferential statistical analysis, the only set of data that presented a normal distribution was Total score, and therefore parametric tests were only performed on this dataset. The results of the two-way ANOVA (excluding matched-pairs from the post-campaign survey dataset) showed that both the intervention (difference between pre- and post-campaign survey scores) and the interaction of locality and intervention had a significant effect on the total survey score, while locality (association to an MPA) had no significant effect (Table 2).

On the other hand, the dataset of the resulting scores of each domain showed a skewed distribution, i.e. comparatively low scores for self-reported behavior, and high scores for behavioral intention (predicted by verbal commitment and by other variables). Consequently, the non-parametric Kruskal-Wallis test for independent samples (excluding matched-pairs of the post-campaign survey) indicated that there were no significant differences for the resulting scores for any of the domains: Current behavior (H = 1.47; p = 0.480), behavioral intention predicted by verbal commitment (H = 0.19; p = 0.911), or behavioral intention predicted by other variables (H = 0.33; p = 0.849) among the localities (MPA effect). In the case of the differences between ranked pre- and post-campaign (intervention effect) domain scores for each locality, significance (Mann-Whitney test excluding matched-pairs from the post-campaign survey dataset) was found for every domain in Chungungo and Caleta Los Hornos. However, in Punta de Choros, only the behavior

Table 4
Intervention effect (Survey) on matched-pairs sample (n = 29) resulting scores (repeated sample analyses).

Domain	M (SD) before intervention	M (SD) after intervention	Z	t	p
Current behavior	8.8 (3.04)	12.0 (3.4)	-3.88		0.000
Behavioral intention by verbal commitment	17.0 (3.04)	18.7 (2.5)	-2.81		0.005
Behavioral intention by other predictor variables	17.6 (2.58)	18.5 (1.9)	-1.90		0.058
Total score	47.5 (6.78)	49.2 (6.0)		-1.33	0.195

M: Mean; Z: Standardized Test statistic Z score for Wilcoxon Signed Ranks Test; t: Paired t-test statistic; p: Significance at 95% confidence level.

domain showed significant differences (Table 3).

When testing for the difference between pre- and post-campaign survey (intervention effect) on matched-pair samples, the scores showed a significant change for self-reported behavior and behavioral intention domains, while locus of control and overall Total score showed no significant differences (Table 4).

3.3. Consumer survey: people's perceptions of SUPBs and ordinances to regulate SUPBs

During the 20 days of the survey in austral summer of 2018, a total of 536 people filled out the questionnaire. Fourteen participants were excluded from the analysis because they did not fulfil the requirements (they did not fill out the questionnaire completely, were too young [<18 years] or did not agree to the informed consent), which left a sample of $N = 522$ (375 female, 145 male, 2 other). The participants' ages ranged from 18 to 76 (average \pm standard deviation: 33.8 ± 11.2). Socio-demographic results are shown in Table S9. The variable "Policies" at the time of the survey resulted in 228 participants that live in a municipality with a local ordinance for SUPBs (they rated the measure as moderately effective; average \pm standard deviation: 3.00 ± 1.05 , out of a total score of 5), 210 in a municipality without and 84 did not know if there exists a local regulation.

In order to test for statistically significant differences between two groups, the municipalities with and without a regulation, a Kruskal-Wallis test was performed since the data were not normally distributed. For the tested variables, we found a significant difference between the two groups for the current behavior domain ($\chi^2(2) = 13.357$, $p = 0.001258$) and for the Total Score ($\chi^2(2) = 14.067$, $p = 0.0008816$). All other domains did not differ significantly between the municipalities with and without a regulation.

- a) **Current Behavior:** The self-reported daily use of plastic bags was generally low (average \pm standard deviation: 1.38 ± 0.59), which belongs to the category within the range of 1 or less SUPBs per day. The responses to the question asking about using a new plastic bag every time one goes shopping (2.83 ± 1.05) belongs to the category "Occasionally". Furthermore 90.4% reported to be aware of the planned law to control plastic bags in the coastal areas of Chile.
- b) **Knowledge of impacts:** The self-reported level of awareness about the impact of SUPB on the environment is within the category "Absolutely aware" (4.71 ± 0.63), "Aware" about impacts on humans (4.36 ± 1.0), and "Absolutely aware" about impacts on marine animals (4.72 ± 0.67).
- c) **Perceived locus of control:** The perceived responsibility for the environment was quite high among the survey participants (4.02 ± 1.01), corresponding to the category "I am quite responsible".
- d) **Personal responsibility:** The scores measuring the perceived impact on the environment is also high among the survey participants "Yes, my actions have quite an impact" (4.21 ± 1.03).
- e) **Verbal commitment:** The verbal commitment was high in general (over 4.5). The mean scores for the variables measuring the willingness to change their use, reduce their use and to bring own reusable bags to go grocery shopping were consistently high (4.76 ± 0.59), which correspond to the category "Totally willing". The willingness related to policies shows that the overall willingness to pay for a plastic bag in the supermarket was low (2.30 ± 1.54). On the other hand, the willingness to change if there would be an incentive like a discount in the supermarket was high (4.51 ± 1.10).

4. Discussion

4.1. Spreading of ordinances along Chile and translation into national law

The spread of norms and policies related to SUPBs followed some surprising and unprecedented patterns around the world. The beginning

of the policies to reduce use of SUPBs around the 1990s lies in health, hygienic and safety reasons mainly in Asian and African countries, since SUPBs in the environment may create breeding grounds for malaria-carrying mosquitoes and clog the sewage system. Thus, concerns about SUPBs in the environment first arose in the global south, and the initiative actually started there and then spread to countries in the northern hemisphere for environmental reasons (Clapp and Swanston, 2009). In South America there was only one case of policies and regulations for SUPBs preceding the local ordinances in Chile, namely the ban implemented in Buenos Aires, Argentina in 2012 (Jakovcevic et al., 2014; Xanthos and Walker, 2017). In fact, currently Chile is the only country in South America to ban the use of SUPBs on the national level; other initiatives in the region come from Colombia, which prohibited thin plastic bags and added a pricing mechanism for thicker bags. Colombia further plans to reduce the use of SUPBs by 80% by 2020 (Paya, 2016; Nielsen et al., 2019). There are also bans and taxes in some communities and regions in Argentina and Brazil (Nielsen et al., 2019).

It is important to note that numerous studies have explored a plethora of strategies to regulate SUPBs, including government-imposed bans, fees, taxes or other measures (Convery et al., 2007; Dikgang et al., 2012; Thomas et al., 2016; Paya, 2016; Martinho et al., 2017; Nielsen et al., 2019). The patterns and drivers of those policies have also been studied (Clapp and Swanston, 2009; Knoblauch et al., 2018), but few studies have examined the historical context of the introduction of plastic shopping bags into local markets and how society was involved in that process. Herein we documented that supermarkets played an important role during the rise of SUPBs in Chile, and consequently they are also identified as key actors during the demise phase. Comparing the Chilean scenario with the context of other countries in Latin America and in other regions of the world helps to understand the strength and pitfalls of this informal coalition approach.

The origin of the Chilean policy was based on the concerns of environmental pollution caused by SUPBs on roads, in rivers, lakes and marine environments. A number of scientific studies (many of them based on collaboration with citizen scientists) published during the past decade showed the widespread problem of plastic pollution in Chilean aquatic environments (Bravo et al., 2009; Hinojosa and Thiel, 2009; Hidalgo-Ruz and Thiel, 2013; Rech et al., 2015; Hidalgo-Ruz et al., 2018; Honorato-Zimmer et al., 2019), and the national media regularly shared these scientific findings with their audience (e.g. La Tercera, 2013; El desconcierto, 2018; Oasis, 2018; La Tercera, 2019). Consequently, people in Chile were generally well informed about this problem (e.g. Eastman et al., 2013), and thus, more than hygiene or health reason, in Chile it was the environmental awareness among the general public that contributed to the broad and non-formal alliance behind the national SUPB ban.

The growing environmental awareness was closely accompanied by new policies, and two findings from a study by Clapp and Swanston (2009) deserve to be discussed due to the similarity described at the global level: in line with the worldwide cascading effect of spreading the norms and policies to ban SUPBs, the enactment of the first ordinance in Pucón represented the very first initial step of norm adaption after which multiple municipalities adopted similar ordinances in rapid succession. The worldwide spread is the result of a non-networked, locally specific set of initiatives and campaigns and concerns, rather than a globally coordinated effort (Clapp and Swanston, 2009). Similarly, in Chile there was no coordinated campaign at the beginning, but with the spreading of scientific information and the growing number of municipal regulations a multitude of local movements, such as the example of the mitigation action plan in La Higuera, were initiated.

The spreading of local movements (further fueled by social media engagement about plastic pollution) contributed to the support and agreement to regulate the use of SUPBs among the Chilean population, until reaching 95% of approval (DESUC, 2018). This general public support facilitated the enactment of the national law in August 2018. At the same time, the consumer survey during austral summer 2018

showed that over 90% of the population was aware of a project to implement a law regulating the use of SUPBs in Chile (question 25, Table S2), which underscores the broad social concern just before the enactment of the law. Nevertheless, it is essential to be aware of the bias associated with the results of the consumer survey, with >70% of responses from people with university education, and >70% (375 of 522) of responses coming from women (Table S9). The tendency of women being more concerned about the environment and specifically more supportive about SUPB regulations has been documented previously (Daniels et al., 2012; Muralidharan and Sheehan, 2017). In this line, it might be helpful to consider gender differences when making green advertising efforts, and rather than treat consumers as a uniform market segment it could be more effective to target them differentially by gender or socio-economic level (Meinzen-Dick et al., 2014; Muralidharan and Sheehan, 2017).

Even though plastic bag related ordinances became common among the municipalities (comparable to other regulations for parking lots, goods of public use, level of noise and others; FIMA, 2009), there are only few cases in Chile of a cascading effect where municipal ordinances progressed to become national law.

4.2. Drivers of SUPB regulations

A similarity between the first municipalities that created ordinances to regulate the use of SUPBs is that tourism is one of their most important economic activities and most of them are located in the austral regions of Chile. Coincidentally, the national tourism department has recommended to enact ordinances to regulate the use of SUPBs as a way to promote sustainable tourism. The interaction between tourism and coastline litter is bidirectional: on one side there is a negative impact caused by tourism due to the littering by shoreline visitors, as was recognized by the community during the participative action plan for La Higuera, and also by several studies about beach litter along the Chilean coast (Bravo et al., 2009; Hidalgo-Ruz et al., 2018). In other areas of the world, the marine debris pollution has also been linked to visitors (e.g., Wilson and Verlis, 2017). The interaction between tourism and litter pollution also goes the other way around, as the low attractiveness of a littered coastline has implications for tourism with possible economic consequences (Ballance et al., 2000; Schuhmann, 2011; Kiessling et al., 2017). Presence or absence of litter has been demonstrated to influence the decision of tourists to choose a beach to visit (Williams et al., 2016). This represents an opportunity for touristic places to take actions and develop a sustainable tourism that promotes initiatives to reduce the plastic litter problem.

The importance of tourism in the history of the regulations for SUPBs is also observable in the beginning of law 21.100 in 2013: a first motion in parliament to regulate the use of SUPBs was expected to cover only the Patagonian territory, an area with high touristic activity (adventure tourism with outdoor activities and interaction with natural environments), which can influence the interest from government and local communities to protect the environment (Feifan Xie and Schneider, 2004). However, in the mitigation project in La Higuera the people from all three localities showed similar pro-environmental behavior and responded similarly to the intervention. Therefore, according to our results, the presence of a beneficial MPA (touristic area) does not seem to influence PEB. Whether other contextual factors favor PEB (besides a protected area) should be studied in future research.

The increasing enactment of municipal plastic bag ordinances continuously engaged more people and some of the early supporters transformed to direct actors in social campaigns. Social media campaigns, such as the #ChileSinPlásticos (Chile Without Plastics) by Greenpeace (Greenpeace Chile, 2018), and #ChaoBolsasPlásticas (Bye Bye Plastic Bags) by the Environmental Ministry played a major role in this process, and distributed an important amount of background information (infographics and posters) among the public to raise awareness about the plastic pollution problem (MMA, 2018b). Moreover, scientific studies showing that a large proportion of marine litter

originates from beach visitors or from rivers received media attention, and contributed to increasing awareness among the population (e.g., La Tercera, 2018a; La Tercera, 2018b). The relatively large number of scientific studies (e.g. Bravo et al., 2009; Hidalgo-Ruz and Thiel, 2013; Rech et al., 2015; Honorato-Zimmer et al., 2019), better availability of information about the problem, and the growing public concerns have motivated some companies (including large retailers) to show an environmentally friendly image (America Retail, 2017). This dynamic and non-coordinated assemblage of stakeholders contributed to the high environmental awareness and engaging among the general public, which welcomed the legal initiatives to ban SUPBs in Chile.

Coming from within the community, the bottom-up approach has the advantage that a diverse and informal coalition of actors, each with different methods, resources and ideologies, provides a broad basis supporting a common goal, e.g. to create effective measures to reduce plastic pollution (Vince and Hardesty, 2017). It is widely evidenced that education is fundamental in changing community behavior, and that informed and engaged consumer communities also have the power to influence plastic markets (Duckett and Repaci, 2015; Vince and Hardesty, 2017). Since the early 1990s, bottom-up coalitions have been implemented in many different countries, promoting local actions in the fight against plastic pollution. For example, in Bangladesh local groups have called for measures to prevent SUPB pollution (Clapp and Swanston, 2009; Xanthos and Walker, 2017; Dauvergne, 2018b), in the UK community actions led to towns free of plastic bags (Ritch et al., 2009), and in Australia citizen science engagement of the community resulted in behavioral change and removal of plastics from beaches (Vince and Hardesty, 2017). More recently, bottom-up campaigns united consumer communities against cosmetic product microbeads in many different countries, primarily in Europe and the USA, but also in Latin America (Dauvergne, 2018a).

In the Chilean case the initiative for the law comes not only from the general public, but the increasing number of other countries banning or taxing SUPBs also eased the development of the national law. Additionally, the increasing demand for better protection of the oceans from UN and the OECD report about the potential for an ocean economy to address global challenges (OECD, 2016) might have contributed towards more effective national legislation in Chile.

4.3. Pro-environmental behavior: lessons learned and future strategies

Our results about current behavior and behavioral intentions towards PEB offer insights about how the use of SUPBs and the public perception about the issue evolved over time and across the country. There is high awareness about the negative impacts of SUPBs among the general public in Chile and many people consider it timely to establish regulations, and are willing to take actions. Comparing our results on PEB related to SUPBs with experiences from other ban or fee schemes used to reduce or abolish SUPBs can offer a glimpse into the future for single-use plastic reduction in Chile. Many different countries, including Bangladesh, India, Morocco, and some states in the USA, Australia and Canada, among others, have completely banned SUPBs; the reasons for electing ban schemes seems to be related to the facility in implementation and enforcement (Clapp and Swanston, 2009; Xanthos and Walker, 2017). On the other hand, strategies that charge for SUPBs have also succeeded, as shown by the extremely successful case in Ireland in 2002 where the use of SUPBs was reduced by 90% after introducing a fee (Convery et al., 2007). In other countries like South Africa the implementation of a plastic bag fee in 2003 had an initial success of 90% reduction in plastic bags, but over time the effectiveness waned, and customers got accustomed to paying the fee (Dikgang et al., 2012; O'Brien and Thondhlana, 2019). Among the Chilean public there was little support for fees on SUPBs, and thus, the national ban established in 2018 might indeed be a more effective policy.

It is known that measures such as awareness campaigns increase the acceptability of environmental regulations (Martinho et al., 2017). The

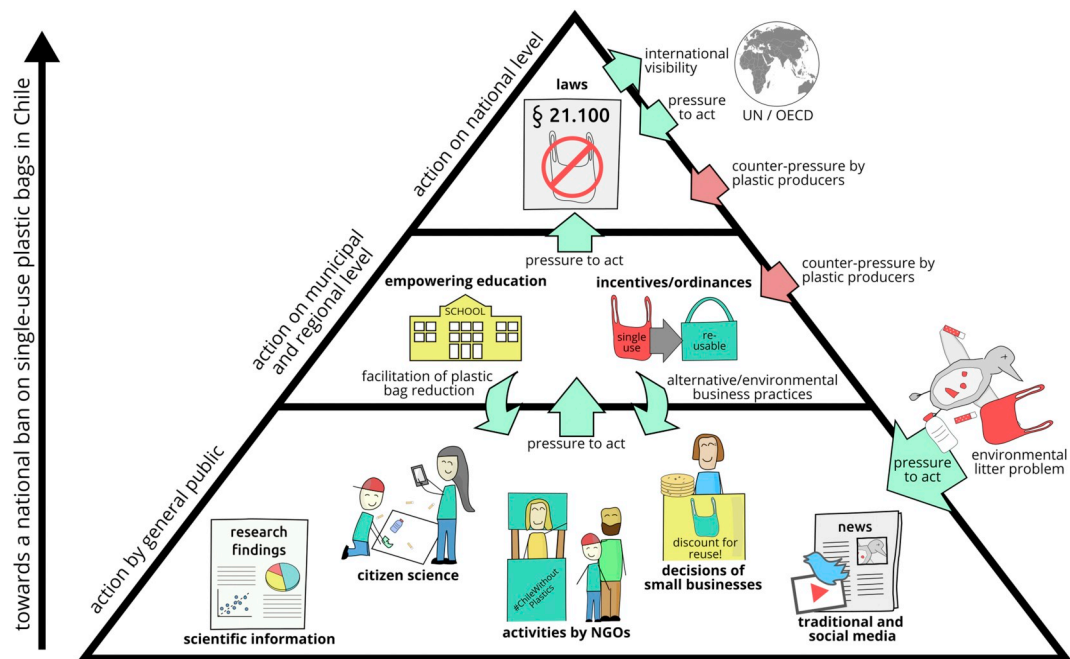


Fig. 3. Schematic overview of bottom-up events that illustrate the informal alliance that helped to generate the broad public support, which is considered instrumental to reach the national ban on SUPBs in Chile.

results of the La Higuera case study in 2014 suggest that the intervention was in general successful and could be a first step towards a significant behavioral change, which together with other bottom-up initiatives set the ground for PEB supported by adequate environmental policies. Thus, while there already seems to be a relatively broad acceptance of the new measures among the Chilean people, continuous education and information will be useful to strengthen the effectiveness of the SUPB regulations and of any other environmental regulation.

The implications are likely to go beyond the regulatory level due to the potential positive behavior spillover from socio-environmental interventions that have gained the interest of policymakers as a cost-effective and non-intrusive way to change undesired consumer behaviors (Thomas et al., 2016). According to Thøgersen and Ölander (2003), when a person shows PEB in one area, it will feel an uncomfortable inconsistency if it does inadequately in related environmental areas, and after performing a positive behavior, people can develop more skills and efficacy to enhance other related behaviors (Thøgersen and Schrader, 2012). Thus, the positive experience with the national ban of SUPBs might also be extended to other areas of environmental concern.

5. Conclusions

The demise of SUPBs in Chile was promoted by the consolidation of an informal and uncoordinated alliance of different sectors, including science, media, general public, government agencies, schools and universities (Fig. 3). The increasing number of international and national scientific studies, nationally organized beach cleanups, local recycling initiatives, and the regular reporting in the media most likely contributed to the widespread environmental awareness and the willingness to engage in PEB among the Chilean people. The spreading of municipal ordinances to reduce SUPBs started in 2013 and it was accompanied by many local actions throughout the entire country, as here exemplified by the mitigation project in La Higuera in 2014. This process was also supported by the growing public concern about plastic pollution, as highlighted by the consumer survey in 2018, which showed that over 95% of the respondents were aware of the impacts that plastic litter can have on the marine environment. In brief, during the decade 2010–2019, actions from different sectors within the Chilean society have contributed to a bottom-up approach, creating the favorable scenario that culminated in

several policies to reduce plastic pollution (Fig. 3).

Based on the historic perspective documented herein, we consider that the growing public concern about plastic pollution in Chile has been built on the foundation of an informal coalition that includes science, media, general public, government agencies, schools and universities. This very diverse alliance of actors has been successful in sharing knowledge, fostering awareness, creating alternatives, and promoting national legislation, achieving a combination of strategies, similar as has been recommended by Steg and Vlek (2009). This integral bottom-up approach could serve as a model not only for the prevention of plastic pollution, but possibly also for solving other pressing environmental problems. Whether current and upcoming legislation leads to the required and profound changes in consumer behavior will have to be shown in future studies, but the first steps have been made.

Declaration of competing interest

We declare that we have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ocecoaman.2019.105079>.

References

- Aguilera, M.A., Aburto, J.A., Bravo, L., Broitman, B.R., García, R.A., Gaymer, C.F., Gelcich, S., López, B.A., Montecino, V., Pauchard, A., Ramos, M., Rutllant, J.A.,

- Sáez, C.A., Valdivia, N., Thiel, M., 2019. Chile: environmental status and future perspectives. In: Sheppard, C. (Ed.), *World Seas: an Environmental Evaluation*, London, pp. 673–702.
- Ajzen, I., 1991. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* 50, 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T). (Accessed 22 November 2019).
- Ajzen, I., Fishbein, M., 1980. *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall, Englewood Cliffs, N.J.
- Akama, J.S., Lant, C.L., Burnett, G.W., 1995. Conflicting attitudes toward state wildlife conservation programs in Kenya. *Soc. Nat. Resour.* 8, 133–144. <https://doi.org/10.1080/08941929509380907>.
- America Retail, 2017. Chile: Tiendas Paris elimina de forma definitiva la entrega de bolsas plásticas. <https://www.america-retail.com/chile/chile-tiendas-paris-elimina-de-forma-definitiva-la-entrega-de-bolsas-plasticas/>. (Accessed 22 November 2019).
- Ballance, A., Ryan, P.G., Turpie, J.K., 2000. How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. *South Afr. J. Sci.* 96, 210–213. https://journals.co.za/content/sajsci/96/5/AJA00382353_8975. (Accessed 22 November 2019).
- Biblioteca del Congreso Nacional (BCN), 2010. Ley 20.417: Crea el Ministerio, el Servicio de Evaluación Ambiental y la Superintendencia del Medio Ambiente. <https://www.leychile.cl/Navegar?idNorma=1010459>. (Accessed 22 November 2019).
- Biblioteca del Congreso Nacional (BCN), 2016. Ley 20.920: Establece marco para la gestión de residuos, la responsabilidad extendida del productor y fomento al reciclaje. <https://www.leychile.cl/Navegar?idNorma=1090894>. (Accessed 22 November 2019).
- Biblioteca del Congreso Nacional (BCN), 2017. Ley 21.033: Crea la XVI Región de Ñuble y las provincias de Diguillín, Punilla e Itata. <https://www.leychile.cl/Navegar?idNorma=1107597>. (Accessed 22 November 2019).
- Biblioteca del Congreso Nacional (BCN), 2018. Ley 21.100: Prohíbe la entrega de bolsas plásticas de comercio en todo el territorio Nacional. <https://www.leychile.cl/Navegar?idNorma=1121380>. (Accessed 22 November 2019).
- Biblioteca del Congreso Nacional (BCN), 2018. Ley 21.123: Modifica el Código Penal y tipifica como falta el ensuciar, arrojar o abandonar basura, materiales o desechos de cualquier índole en playas, riberas de ríos o de lagos, parques nacionales, reservas nacionales, monumentos naturales o en otras áreas de conservación de la biodiversidad declaradas bajo protección oficial. <https://www.leychile.cl/Navegar?idNorma=1126481>. (Accessed 22 November 2019).
- Bennett, P.D., 1966. Retailing evolution or revolution in Chile? *J. Mark.* 30, 38–41. <https://doi.org/10.1177/002224296603000310>.
- Bergamini, K., Pérez, C., 2015. Audit and environmental compliance in Chile: main advances, challenges and pending tasks. *Eure* 41, 267–277. <https://doi.org/10.4067/S0250-71612015000400013>.
- Bernstein, S., 2001. *The Compromise of Liberal Environmentalism*. Columbia University Press, New York.
- Bonaiuto, M., Carrus, G., Martorella, H., Bonnes, M., 2002. Local identity processes and environmental attitudes in land use changes: the case of natural protected areas. *J. Econ. Psychol.* 23, 631–653. [https://doi.org/10.1016/S0167-4870\(02\)00121-6](https://doi.org/10.1016/S0167-4870(02)00121-6).
- Bravo, M., Gallardo, M.A., Luna-Jorquera, G., Núñez, P., Vásquez, N., Thiel, M., 2009. Anthropogenic debris on beaches in the SE Pacific (Chile): results from a national survey supported by volunteers. *Mar. Pollut. Bull.* 58, 1718–1726. <https://doi.org/10.1016/j.marpolbul.2009.06.017>.
- Brito, E., Pasquali, C., 2006. Comportamientos y actitudes asociados a la disposición de la basura en áreas urbanas no planificadas. *Interciencia* 31, 338–344. <https://dialnet.unirioja.es/servlet/articulo?sessionid=66AEB25DCDBB7F4E8C3C4138CB1AA8F5.dialnet01?codigo=2116522>. (Accessed 22 November 2019).
- Cárcamo, P.F., Garay-Flühmann, R., Squeo, F.A., Gaymer, C.F., 2014. Using stakeholders' perspective of ecosystem services and biodiversity features to plan a marine protected area. *Environ. Sci. Policy* 40, 116–131. <https://doi.org/10.1016/j.envsci.2014.03.003>.
- Centro de Envases y Embalajes de Chile (CENEM), 2017. Anuario Estadístico CENEM 2017. https://issuu.com/denisepichara/docs/anuario_cenem_edirekta_2017. (Accessed 22 November 2019).
- Chapman, K., 1992. Agents of change in the internationalization of the petrochemical industry. *Geoforum* 23, 13–27. [https://doi.org/10.1016/0016-7185\(92\)90033-Z](https://doi.org/10.1016/0016-7185(92)90033-Z).
- Clapp, J., Swanson, L., 2009. Doing away with plastic shopping bags: international patterns of norm emergence and policy implementation. *Environ. Pol.* 18, 315–332. <https://doi.org/10.1080/09644010902823717>.
- Comisión Chilena del Cobre (COCHILCO), 2019. Gross domestic product by economic activity. at Current Prices. <http://www.cochilco.cl:4040/boletin-web/pages/tabla13/buscar.jsf>. (Accessed 22 November 2019).
- Contraloría General de la República (CGR), 2014. Dictamen 86870. <https://www.contraloria.cl/mesaprueba/842577F8004BAD41/0/5E001E80E06F931E84257D8F00555C18>. (Accessed 22 November 2019).
- Convery, F., McDonnell, S., Ferreira, S., 2007. The most popular tax in Europe? Lessons from the Irish plastic bags levy. *Environ. Resour. Econ.* 38, 1–11. <https://doi.org/10.1007/s10640-006-9059-2>.
- Coq-Huelva, D., Ríos, S., 2010. Structural change of the manufacturing industry in Chile: 1979–2004. *Rev. Econ. Mund.* 26, 27–51. <https://www.sem-wes.org/en/node/904>. (Accessed 22 November 2019).
- Daniels, D.P., Krosnick, J.A., Tichy, M.P., Tompson, T., 2012. Public opinion on environmental policy in the United States. In: Kraft, M.E., Kamieniecki, S. (Eds.), *The Oxford Handbook of U.S. Environmental Policy*. Oxford University Press, New York.
- Danner, U.N., Aarts, H., De Vries, N.K., 2008. Habit vs. intention in the prediction of future behaviour: the role of frequency, context stability and mental accessibility of past behaviour. *Br. J. Soc. Psychol.* 47, 245–265. <https://doi.org/10.1348/014466607X230876>.
- Dauvergne, P., 2018a. Why is the global governance of plastic failing the oceans? *Glob. Environ. Chang.* 51, 22–31. <https://doi.org/10.1016/j.gloenvcha.2018.05.002>.
- Dauvergne, P., 2018b. The power of environmental norms: marine plastic pollution and the politics of microbeads. *Environ. Pol.* 27, 579–597. <https://doi.org/10.1080/09644016.2018.1449090>.
- De Young, R., 1993. Changing behavior and making it stick: the conceptualization and management of conservation behavior. *Environ. Behav.* 25, 485–505. <https://doi.org/10.1177/0013916593253003>.
- Diario Constitucional, 2018. Tribunal Constitucional deberá pronunciarse respecto de constitucionalidad de proyecto que prohíbe las bolsas plásticas. <https://www.diariconstitucional.cl/noticias/controles-obligatorios/2018/06/27/tc-debera-pronunciarse-respecto-de-constitucionalidad-de-proyecto-que-prohibe-las-bolsas-plasticas/>. (Accessed 22 November 2019).
- Dikgang, J., Leiman, A., Visser, M., 2012. Analysis of the plastic bag levy in South Africa. *Resour. Conserv. Recycl.* 66, 59–65. <https://doi.org/10.1016/j.resconrec.2012.06.009>.
- Dirección de Estudios Sociales (DESUC), 2018. Informe Final: Encuesta Nacional de Medio Ambiente 2018. Instituto de Sociología, Universidad Católica de Chile. <https://mma.gob.cl/wp-content/uploads/2018/03/Informe-Final-Encuesta-Nacional-de-Medio-Ambiente-2018.pdf>. (Accessed 22 November 2019).
- Duckett, P.E., Repaci, V., 2015. Marine plastic pollution: using community science to address a global problem. *Mar. Freshw. Res.* 66, 665–673. <http://www.publish.csiro.au/mf/MF14087>.
- Eastman, L.B., Núñez, P., Crettier, B., Thiel, M., 2013. Identification of self-reported user behavior, education level, and preferences to reduce littering on beaches – a survey from the SE Pacific. *Ocean Coast Manag.* 78, 18–24. <https://doi.org/10.1016/j.ocecoaman.2013.02.014>.
- El desconcierto, 2018. Playas de Antofagasta tienen mas de 10 unidades de basura por metro cuadrado. <https://www.eldesconcierto.cl/new/2018/02/12/playas-de-antofagasta-tienen-mas-de-10-unidades-de-basura-por-metro-cuadrado/>. (Accessed 22 November 2019).
- Faiguénbaum, S., Berdegué, J.A., Reardon, T., 2002. The rapid rise of supermarkets in Chile: effects on dairy, vegetable, and beef chains. *Dev. Policy Rev.* 20, 459–471. <https://doi.org/10.1111/1467-7679.00183>.
- Feifan Xie, P., Schneider, P.P., 2004. Challenges and opportunities for adventure tourism: the case of Patagonia, Chile. *Tour. Recreat. Res.* 29, 57–65. <https://doi.org/10.1080/02508281.2004.11081431>.
- Fiscalía del Medio Ambiente (FIMA), 2009. Ordenanzas Municipales en Materia Ambiental. <http://www.fima.cl/site/wp-content/uploads/2009/08/Ordenanzas-Municipales-en-materia-ambiental-Gabriel-Araya.pdf>. (Accessed 22 November 2019).
- Gall, S.C., Thompson, R.C., 2015. The impact of debris on marine life. *Mar. Pollut. Bull.* 92, 170–179. <https://doi.org/10.1016/j.marpolbul.2014.12.041>.
- Geyer, R., Jambeck, J.R., Law, K.L., 2017. Production, use, and fate of all plastics ever made. *Science Advances* 3, e1700782. <https://doi.org/10.1126/sciadv.1700782>.
- Greenpeace Chile, 2018. Plásticos, tema del año 2018. <https://www.greenpeace.org/chile/issues/contaminacion/921/plasticos-tema-del-ano-2018/>. (Accessed 22 November 2019).
- Hanna, D., Dempster, M., 2012. *Psychology Statistics for Dummies*. John Wiley & Sons Inc, Chichester, West Sussex.
- Hardesty, B.D., Good, T.P., Wilcox, C., 2015. Novel methods, new results and science-based solutions to tackle marine debris impacts on wildlife. *Ocean Coast Manag.* 115, 4–9. <https://doi.org/10.1016/j.ocecoaman.2015.04.004>.
- Hernández Sampieri, R., Fernández Collado, C., Baptista Lucio, P., 2014. *Metodología de la Investigación*, sixth ed. McGraw-Hill Interamericana Editores, México.
- Hidalgo-Ruz, V., Thiel, M., 2013. Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): a study supported by a citizen science project. *Mar. Environ. Res.* 87, 12–18.
- Hidalgo-Ruz, V., Honorato-Zimmer, D., Gatta-Rosemary, M., Nuñez, P., Hinojosa, I.A., Thiel, M., 2018. Spatio-temporal variation of anthropogenic marine debris on Chilean beaches. *Mar. Pollut. Bull.* 126, 516–524. <https://doi.org/10.1016/j.marpolbul.2017.11.014>.
- Hines, J.M., Hungerford, H.R., Tomera, A.N., 1987. Analysis and synthesis of research on responsible environmental behavior: a meta-analysis. *J. Environ. Educ.* 18 (2), 1–8.
- Hinojosa, I.A., Thiel, M., 2009. Floating marine debris in fjords, gulfs and channels of southern Chile. *Mar. Pollut. Bull.* 58, 341–350. <https://doi.org/10.1016/j.marpolbul.2008.10.020>.
- Holmes, C.M., 2003. The influence of protected area outreach on conservation attitudes and resource use patterns: a case study from western Tanzania. *Oryx* 37, 305–315. <https://doi.org/10.1017/S0030605303000565>.
- Honorato-Zimmer, D., Kruse, K., Knickmeier, K., Weinmann, A., Hinojosa, I.A., Thiel, M., 2019. Inter-hemispherical shoreline surveys of anthropogenic marine debris—A binational citizen science project with schoolchildren. *Mar. Pollut. Bull.* 138, 464–473. <https://doi.org/10.1016/j.marpolbul.2018.11.048>.
- Horstmann, J., 2007. Baseline Study on Marine Debris and Municipal Waste Management in Chiloe-Corcovado, Southern Chile. <http://cybertesis.uach.cl/tesis/uach/2007/egh819b/doc/egh819b.pdf>. (Accessed 22 November 2019).
- Instituto Nacional de Estadísticas de Chile (INE), 2014. Encuesta mensual a establecimientos de alojamiento turístico, año 2014. <https://www.sernatur.cl/wp-content/uploads/2019/02/Informe-estadisticas-EAT-2014.pdf>. (Accessed 22 November 2019).
- Instituto Nacional de Estadísticas de Chile (INE), 2018. Síntesis de resultados Censo 2017. <http://www.censo2017.cl/descargas/home/sintesis-de-resultados-censo2017.pdf>. (Accessed 22 November 2019).

- Infield, M., 1988. Attitudes of a rural community towards conservation and a local conservation area in Natal, South Africa. *Biol. Conserv.* 45, 21–46. [https://doi.org/10.1016/0006-3207\(88\)90050-X](https://doi.org/10.1016/0006-3207(88)90050-X).
- Jakovcevic, A., Steg, L., Mazzeo, N., Caballero, R., Franco, P., Putrino, N., Favara, J., 2014. Charges for plastic bags: motivational and behavioral effects. *J. Environ. Psychol.* 40, 372–380. <https://doi.org/10.1016/j.jenvp.2014.09.004>.
- Kiessling, T., Salas, S., Mutafoglu, K., Thiel, M., 2017. Who cares about dirty beaches? Evaluating environmental awareness and action on coastal litter in Chile. *Ocean Coast Manag.* 137, 82–95. <https://doi.org/10.1016/j.ocecoaman.2016.11.029>.
- Knoblauch, D., Mederake, L., Stein, U., 2018. Developing countries in the lead - what drives the diffusion of plastic bag policies? *Sustainability* 10, 1994. <https://doi.org/10.3390/su10061994>.
- Kollmuss, A., Agyeman, J., 2002. Mind the Gap: Why Do People Act Environmentally and What Are the Barriers to Pro-Environmental Behavior? *Environ. Educ. Res.* 8, 239–260. <https://doi.org/10.1080/13504620220145401>.
- La Tercera, . Detectives científicos rastrear la basura en las playas de Chile. <https://www.latercera.com/noticia/detectives-cientificos-rastrear-la-basura-en-las-playas-de-chile/>. (Accessed 22 November 2019).
- La Tercera, 2017. Chile consume más de 3.400 millones de bolsas plásticas al año y 51 comunas han regulado su uso. <https://www.latercera.com/noticia/chile-consume-mas-3-400-millones-bolsas-al-ano-51-comunas-regulado-uso/>. (Accessed 22 November 2019).
- La Tercera, 2018a. Plástico y cigarrillos son la principal basura en el país. <https://www.latercera.com/tendencias/noticia/plastico-cigarros-la-principal-basura-las-playas-del-pais/49713/>. (Accessed 22 November 2019).
- La Tercera, 2018b. Basura es la inquietud ambiental que más crece en Chile entre 2016 y 2018. <https://www.latercera.com/tendencias/noticia/basura-la-inquietud-ambiental-mas-crece-chile-2016-2018/71633/>. (Accessed 22 November 2019).
- La Tercera, 2019. Basura en las playas: ¿Por qué 18 millones de chilenos ensucian más que 82 millones de alemanes? <https://www.latercera.com/que-pasa/noticia/basura-las-playas-18-millones-chilenos-ensucian-mas-82-millones-alemanes/507768/>. (Accessed 22 November 2019).
- Martinho, G., Balaia, N., Pires, A., 2017. The Portuguese plastic carrier bag tax: the effects on consumers' behavior. *Waste Manag.* 61, 3–12. <https://doi.org/10.1016/j.wasman.2017.01.023>.
- Meinzen-Dick, R., Kovarik, C., Quisumbing, A.R., 2014. Gender and sustainability. *Annu. Rev. Environ. Resour.* 39, 29–55. <https://doi.org/10.1146/annurev-environ-101813-013240>.
- Mendenhall, E., 2018. Oceans of plastic: a research agenda to propel policy development. *Mar. Policy* 96, 291–298. <https://doi.org/10.1016/j.marpol.2018.05.005>.
- Miethke, S., Reichle, S., Armijo, E., Ferdana, Z., Sotomayor, L., Chatwin, A., Ramírez, B., De Andrade, R., 2007. Coastal and marine conservation priorities in Chile. In: Chatwin, A. (Ed.), *Priorities for Coastal and Marine Conservation in South America. The Nature Conservancy, Arlington, Virginia*, pp. 25–29.
- Miloslavich, P., Klein, E., Díaz, J.M., Hernández, C.E., Bigatti, G., Campos, L., Artigas, F., Castillo, J., Penchaszadeh, P.E., Neill, P.E., Carranza, A., Retana, M.V., Díaz de Astarloa, J.M., Lewis, M., Yorio, P., Piriz, M.L., Rodríguez, D., Yoneshiguel, Valentin, Y., Gamboa, L., Martín, A., 2011. Marine biodiversity in the Atlantic and Pacific coasts of south America: knowledge and gaps. *PLoS One* 6, e14631. <https://doi.org/10.1371/journal.pone.0014631>.
- Ministerio de Medio Ambiente de Chile (MMA), 2010. Diagnóstico producción, importación y distribución de envases y embalajes y el manejo de los residuos de envases y embalajes. <https://es.scribd.com/document/304492048/Diagnostico-Envases-Embalajes-2010>. (Accessed 22 November 2019).
- Ministerio de Medio Ambiente de Chile (MMA), 2014. Primera Encuesta Nacional de Medio Ambiente: Opiniones, Comportamientos y Preocupaciones. https://mma.gob.cl/wp-content/uploads/2015/05/Informe-Final-Primera-Encuesta-Nacional-de-Medio-Ambiente_Final.pdf. (Accessed 22 November 2019).
- Ministerio de Medio Ambiente de Chile (MMA), 2015. Encuesta Nacional de Medio Ambiente 2015. <https://mma.gob.cl/wp-content/uploads/2018/01/Informe-Final-Encuesta-Nacional-de-Medio-Ambiente-2015.pdf>. (Accessed 13 November 2019).
- Ministerio de Medio Ambiente de Chile (MMA), 2016. Encuesta Nacional de Medio Ambiente y cambio climático 2016. https://mma.gob.cl/wp-content/uploads/2018/01/Informe-Final_2016.pdf. (Accessed 22 November 2019).
- Ministerio de Medio Ambiente de Chile (MMA), 2018. Resultados encuesta nacional de medio ambiente y cambio climático 2017-2018. <https://mma.gob.cl/wp-content/uploads/2018/03/Presentacion-Encuesta-Nacional-de-Medio-Ambiente-2018.pdf>. (Accessed 22 November 2019).
- Ministerio de Medio Ambiente de Chile (MMA), 2018. Autoridades invitan a la comunidad a decir "Chao Bolsas Plásticas". <https://mma.gob.cl/autoridades-invita-na-a-la-comunidad-a-decir-chao-bolsas-plasticas/>. (Accessed 22 November 2019).
- Muralidharan, S., Sheehan, K., 2017. The role of guilt in influencing sustainable pro-environmental behaviors among shoppers. *J. Advert. Res.* 58, 349–362. <https://doi.org/10.2501/JAR-2017-029>.
- Nielsen, T.D., Holmberg, K., Stripple, J., 2019. Need a bag? A review of public policies on plastic carrier bags – where, how and to what effect? *Waste Manag.* 87, 428–440. <https://doi.org/10.1016/j.wasman.2019.02.025>.
- Nkwachukwu, O.I., Chima, C.H., Ikenna, A.O., Albert, L., 2013. Focus on potential environmental issues on plastic world towards a sustainable plastic recycling in developing countries. *Int. J. Ind. Chem.* 4, 34. <https://doi.org/10.1186/2228-5547-4-34>.
- Núñez, P., 2007. Bolsas Plas y Tika. Universidad Católica del Norte, Coquimbo, Chile. <http://www.cientificosdelabasura.cl/archivo/documento/documento/7/Bolsas%20Plas%20y%20Tika.pdf>. (Accessed 22 November 2019).
- O'Brien, J., Thondhlana, G., 2019. Plastic bag use in South Africa: perceptions, practices and potential intervention strategies. *Waste Manag.* 84, 320–328. <https://doi.org/10.1016/j.wasman.2018.11.051>.
- Oasis, 2018. La principal contaminación de las playas de Chile es plástico y cigarrillos. <https://oasisfm.cl/oasisfm/la-principal-contaminacion-de-las-playas-de-chile-es-plastico-y-cigarros/2018-01-29/112101.html>. (Accessed 22 November 2019).
- Organization for Economic Cooperation and Development (OECD), 2016. *OECD Tourism Trends and Policies 2016*. OECD Publishing, Paris. <https://doi.org/10.1787/tour-2016-en>.
- Paya, C., 2016. An integrated system of waste management in a developing country case study: Santiago de Cali, Colombia. <http://hdl.handle.net/10012/10271>. (Accessed 22 November 2019).
- Radio Cooperativa, 2014. Municipalidad de Pucón prohíbe las bolsas plásticas. <https://www.cooperativa.cl/noticias/pais/medioambiente/municipalidad-de-pucon-prohibe-las-bolsas-plasticas/2014-12-03/173006.html>. (Accessed 22 November 2019).
- Rech, S., Macaya-Caquilpán, V., Pantoja, J.F., Rivadeneira, M.M., Jofre Madariaga, D., Thiel, M., 2014. Rivers as sources of marine litter – a study from the SE Pacific. *Mar. Pollut. Bull.* 82, 66–75. <https://doi.org/10.1016/j.marpolbul.2014.03.019>.
- Rech, S., Macaya-Caquilpán, V., Pantoja, J.F., Rivadeneira, M.M., Kroeger Campodónico, C., Thiel, M., 2015. Sampling of riverine litter with citizen scientists – findings and recommendations. *Environ. Monit. Assess.* 187, 335. <https://doi.org/10.1007/s10661-015-4473-y>.
- Ritch, E., Brennan, C., MacLeod, C., 2009. Plastic bag politics: modifying consumer behaviour for sustainable development. *Int. J. Consum. Stud.* 33, 168–174. <https://doi.org/10.1111/j.1470-6431.2009.00749.x>.
- Schuhmann, P.W., 2011. Tourist perceptions of beach cleanliness in Barbados: implications for return visitation. *Études Caribéennes* 19. <https://doi.org/10.4000/etudescaribeennes.5251>.
- Schultz, P.W., 1999. Changing behavior with normative feedback interventions: a field experiment on curbside recycling. *Basic Appl. Soc. Psychol.* 21, 25–36. https://doi.org/10.1207/s15324834basp2101_3.
- Steg, L., Vlek, C., 2009. Encouraging pro-environmental behaviour: an integrative review and research agenda. *J. Environ. Psychol.* 29, 309–317. <https://doi.org/10.1016/j.jenvp.2008.10.004>.
- Steg, L., Van den Berg, A.E., De Groot, J., 2018. In: Steg, L., De Groot, J. (Eds.), *Environmental Psychology: History, Scope, and Methods*. Environmental Psychology, Hoboken, NJ, pp. 1–11.
- Stern, P.C., 1999. Information, incentives, and proenvironmental consumer behavior. *J. Consum. Policy* 22, 461–478. <https://doi.org/10.1023/A:1006211709570>.
- Subsecretaría de Turismo (SUBTURISMO), 2015. Manual de ordenanzas municipales para el desarrollo turístico sustentable. <http://www.subturismo.gob.cl/wp-content/uploads/2015/06/Manual-de-Ordenanzas-Municipales.pdf>. (Accessed 22 November 2019).
- Thiel, M., Hinojosa, I., Vásquez, N., Macaya, E., 2003. Floating marine debris in coastal waters of the SE-Pacific (Chile). *Mar. Pollut. Bull.* 46, 224–231. [https://doi.org/10.1016/S0025-326X\(02\)00365-X](https://doi.org/10.1016/S0025-326X(02)00365-X).
- Thiel, M., Bravo, M., Hinojosa, I.A., Luna, G., Miranda, L., Núñez, P., Pacheco, A.S., Vásquez, N., 2011. Anthropogenic litter in the SE Pacific: an overview of the problem and possible solutions. *J. Integr. Coast. Zone Management* 11, 115–134. <https://doi.org/10.5894/rgci207>.
- Thiel, M., Hinojosa, I.A., Miranda, L., Pantoja, J.F., Rivadeneira, M.M., Vásquez, N., 2013. Anthropogenic marine debris in the coastal environment: a multi-year comparison between coastal waters and local shores. *Mar. Pollut. Bull.* 71, 307–316. <https://doi.org/10.1016/j.marpolbul.2013.01.005>.
- Thøgersen, J., Ølander, F., 2003. Spillover of environment-friendly consumer behaviour. *J. Environ. Psychol.* 23, 225–236. [https://doi.org/10.1016/S0272-4944\(03\)00018-5](https://doi.org/10.1016/S0272-4944(03)00018-5).
- Thøgersen, J., Schrader, U., 2012. From knowledge to action—new paths towards sustainable consumption. *J. Consum. Policy* 35, 1–5. <https://doi.org/10.1007/s10603-012-9188-7>.
- Thomas, G.O., Poortinga, W., Sautkina, E., 2016. The Welsh single-use carrier bag charge and behavioural spillover. *J. Environ. Psychol.* 47, 126–135. <https://doi.org/10.1016/j.jenvp.2016.05.008>.
- Tobias, R., Brügger, A., Mosler, H.J., 2009. Developing strategies for waste reduction by means of tailored interventions in Santiago de Cuba. *Environ. Behav.* 41, 836–865. <https://doi.org/10.1177/0013916509338004>.
- Vergara, W., Brown, D., 1988. *The New Face of the World Petrochemical Sector: Implications for Developing Countries*. The World Bank, Washington, DC. World Bank Technical Paper 84.
- Vince, J., Hardesty, B.D., 2017. Plastic pollution challenges in marine and coastal environments: from local to global governance. *Restor. Ecol.* 25, 123–128. <https://doi.org/10.1111/rec.12388>.
- Williams, A.T., Rangel-Buitrago, N.G., Anfuso, G., Cervantes, O., Botero, C.M., 2016. Litter impacts on scenery and tourism on the Colombian north Caribbean coast. *Tour. Manag.* 55, 209–224. <https://doi.org/10.1016/j.tourman.2016.02.008>.
- Wilson, S.P., Verlis, K.M., 2017. The ugly face of tourism: marine debris pollution linked to visitation in the southern great barrier reef, Australia. *Mar. Pollut. Bull.* 117, 239–246. <https://doi.org/10.1016/j.marpolbul.2017.01.036>.
- Xanthos, D., Walker, T.R., 2017. International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): a review. *Mar. Pollut. Bull.* 118, 17–26. <https://doi.org/10.1016/j.marpolbul.2017.02.048>.
- Zamano, E., 2009. Design of an Operational and Commercial Strategy for the Internationalization of a Pipeline Factory and PVC Fitting. Thesis to Obtain the Degree of MSc in Management for the Globalization. University of Chile. <http://repositorio.uchile.cl/bitstream/handle/2250/102078/Diseno-de-una-estrategia-de-operacion-y-comercial-para-la-internacionalizacion.pdf?sequence=4>. (Accessed 22 November 2019).