



# Whale-watching in Patagonia: What regulation scheme should be implemented when the socio-ecological system is changing?

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## ARTICLE INFO

### Keywords:

Whale-watching  
Patagonia  
Southern right whale  
Legal framework  
Tourist management

## ABSTRACT

Whale-watching began informally at Península Valdés in 1973. The activity primarily targeted southern right whales (*Eubalaena australis*). Since the early 1970s the number of people sailing out on whale-watching trips increased from several tourists a year to more than 100,000 in 2014. In this paper the fluctuations in the number of passengers, the biological changes and the socio-economic factors that influenced the development of the activity were reviewed. There are effectively four periods in the history of the development of whale-watching in Península Valdés. These periods correspond to international events, whilst some are related to domestic matters. The development of whale-watching regulations in relation to these events is also reviewed. Although the current whale-watching regulation scheme is appropriate, there are some aspects that could be improved by making the rules easier to be altered and modified, i.e., an adaptive management approach. As a case study the regulation prohibiting watching whale mothers with newborns, before August 31st every year, is examined, including the problems that boat operators face while attempting to comply with this regulation. Many of these problems arise due changes in the biological system (i.e. whale population growth).

## 1. Introduction

Globally, whale-watching has increased exponentially in recent decades [1,2]. Whale-watching has been defined as any activity involving sighting or listening any species of whale, dolphin or porpoise from the air, land or vessel tours with commercial purpose [3]. More than 13 million people travel around the world to experience whale-watching, spending more than US\$ 2.1 billion during 2008 [2]. In Latin America, each year, there are more than 885.000 whale-watchers that spent more than USD\$ 278 million [4]. This rapid rise in the level of whale-watching activity has led to many governments to pay attention to the way that whale-watching is conducted, and introduce management frameworks to reduce the impacts of the activity on targeted whales and their habitats. Managing whale-watching activities can be achieved by imposing a set of legal regulations for whale-watching practices, developing a set of voluntary guidelines, or an admixture of both [5]. Whale-watching is often considered as an economically profitable alternative to whaling, whilst generating awareness of, and commitment to, environmental conservation in tourists [6].

In Argentina, wildlife tourism, and in particular whale-watching,

has gained significant importance at the national level, but the real economic and social significance is generally noted at the provincial and local levels. Whale-watching started in Patagonia 40 years ago [7]. This location is known internationally as a whale-watching location due to activities carried out at Puerto Pirámides, in the Península Valdés Protected Area, in the Province of Chubut. More recently, whale-watching has started to develop in San Antonio Bay, Golfo San Matías, in the Province of Río Negro (Fig. 1). In both localities the target species of whale-watching activity is the southern right whale (SRW) *Eubalaena australis*.

The development of whale-watching in the region has had multiple root causes, including population growth, both of human settlements and whales, and changes in attitudes towards wildlife and conservation and a general blooming of worldwide nature-based tourism [8]. In this context, the provincial governments in Argentina tried to regulate the way that people interact with, and profit from, nature and especially the non-consumptive exploitation of marine mammals. These whale-watching regulations, at times, are established before a change in the activity takes place; but on other occasions, the regulations are reactive to changes in activities. In this paper the way in which whale-watching on SRW has developed in Península Valdés was reviewed. The timing,

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<http://dx.doi.org/10.1016/j.marpol.2016.11.010>

Received 15 July 2016; Received in revised form 8 November 2016; Accepted 8 November 2016  
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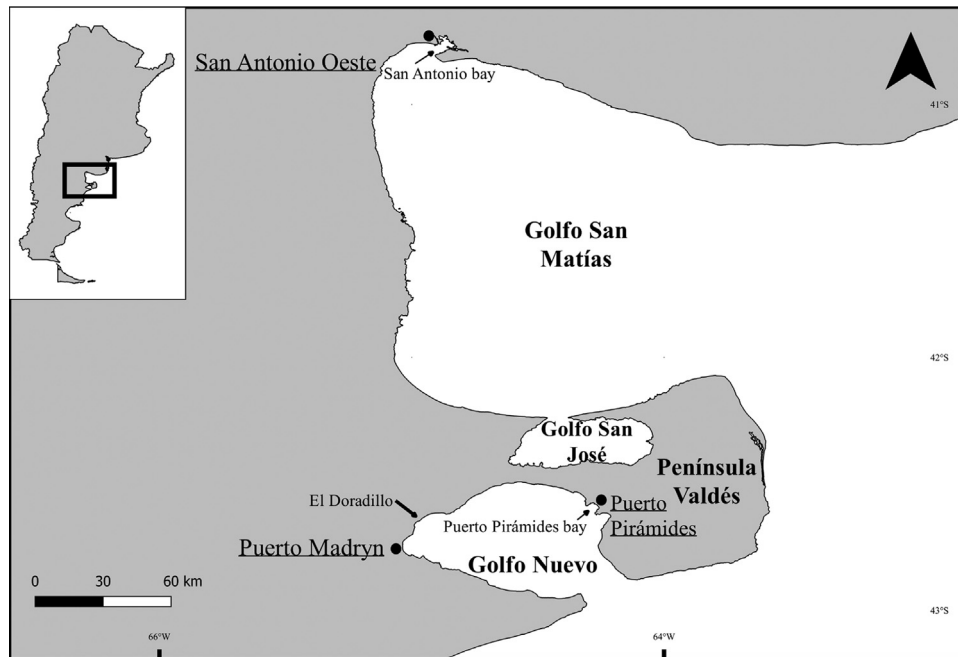


Fig. 1. Map of locations where the whale-watching of Southern right whales take place in Patagonia.

and the reason why, regulations were enacted and whether or not these regulations were adequate or changed (qualitatively or quantitatively) the way whale-watching activities were managed were considered. Also the way the activity was currently carried out and the level of compliance of the whale-watching operators with the current regulations was assessed.

## 2. Methods

Published information on the biology and population trends of the SRW in the Península Valdés area was reviewed. Data were also collected from historical records on the development of SRW whale-watching activities in Puerto Pirámides (Province of Chubut) from its inception. The sources consulted included the owners of whale-watching companies; the official records held by the Tourism Office and previously published information. Rules, guidelines and regulations that govern whale-watching activity were also collated. Access to the official number of passengers that sailed for whale-watching trips in Puerto Pirámides, was granted to the researchers. All these data were combined and divided into significant periods, mainly related to fluctuations in the number of passengers taking trips. Four distinct periods were identified, and linear models were fitted to highlight trends in the number of passengers for three of these periods [9].

In order to investigate compliance with regulations by the whale-watching companies, the crews of all of the operating companies were interviewed. At least two random members of the crew from each company were interviewed face-to-face (from October 2015 to January 2016). Fourteen interviews were conducted; all of them gave their explicit permission to be interviewed and recorded. The interviews were carried out individually and lasted approximately 30 min. The questionnaire had 11 open-ended questions and each member of the crew was encouraged to elaborate their answer [10]. Most of the questions required the estimation of percentages and two of the questions investigated perception of those interviewed on the whale-watching activity and changes in regulations. Categories for the percentages were established *a posteriori* and descriptive statistics on the frequency of the answer were calculated [10].

## 3. Results and discussion

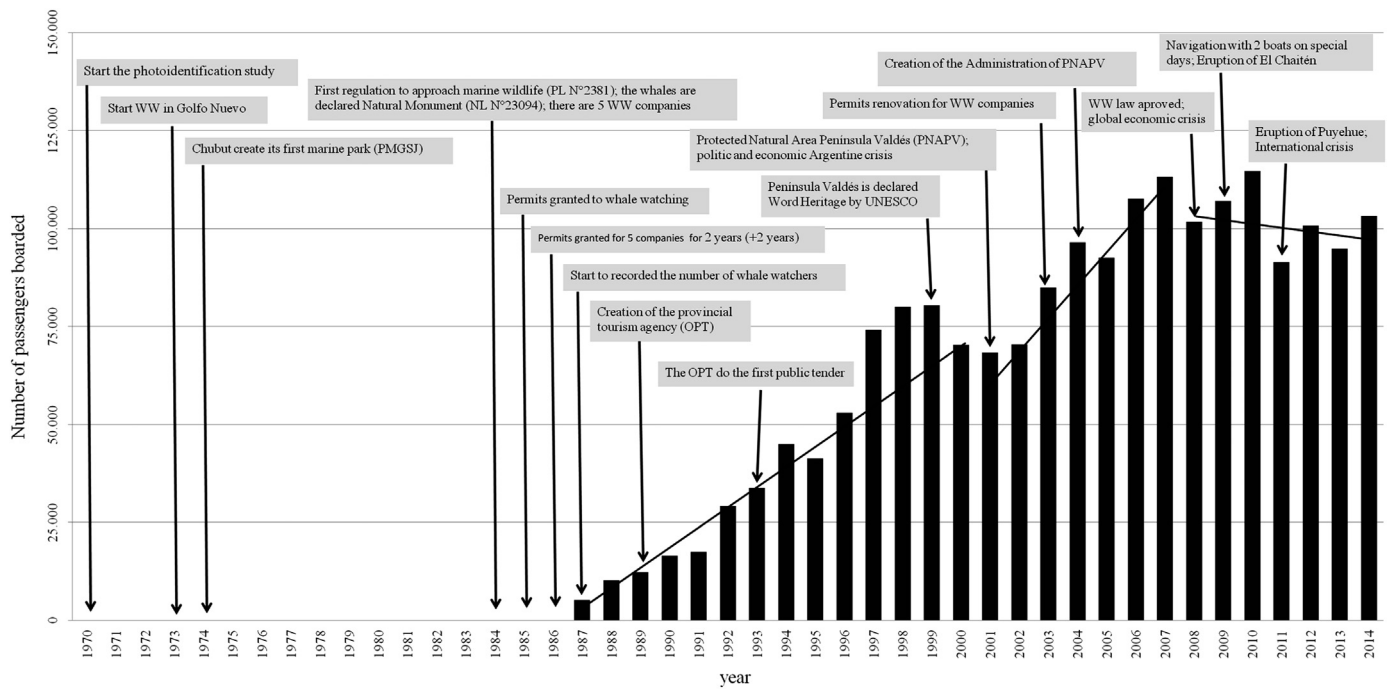
### 3.1. Historic development

#### 3.1.1. Early seventies: dawn of whale-watching in Patagonia

**3.1.1.1. Southern right whale biology.** Southern right whales arrive at Península Valdés every year between May and December, typically peaking in their abundance in September [11]. In this area, the whales are found nearshore, and it is possible to watch breeding groups, solitary individuals and as the season progresses, mothers with calves. In the early 1970s, southern right whales were seen nearshore the outer ridge of Península Valdés and in Golfo San José (Fig. 1), a bay used by this species to mate and give birth. By this time, the global population of SRW was threatened, driven to near extinction by commercial whalers [12]. Although, by 1971, births of SRW were recorded in the Península Valdés area, it was not until 1973 that some mothers were recorded spending the whole breeding season in the Golfo Nuevo with their calves (Fig. 1).

**3.1.1.2. Whale-watching.** Since its inception, whale-watching in Puerto Pirámides was performed by only a few companies. Most of the owners of these companies claimed that they started their activities in the early 1970s, albeit only taking a few people on trips each year. If we are to pin point the specific year whale-watching started in Patagonia, it could be considered 1973, because some local people who owned small boats started to sail with 2 or 3 tourists per trip to watch the whales ([http://www.hydrosport.com.ar/nosotros\\_449.html](http://www.hydrosport.com.ar/nosotros_449.html)). By 1974, however, an aluminum factory was sited in Puerto Madryn, a 6000 inhabitant town at the very end of Golfo Nuevo. This factory started to bring new immigrants into the region. The level of whale-watching activity increased steadily from 1973 to 1986, albeit at a slow pace; although there is no official information on whale-watching tourism for this period. Only in 1987 did the government start to record the statistics on the number of tourists involved in this activity (Fig. 2).

**3.1.1.3. Regulatory framework.** In the early years of whale-watching



**Fig. 2.** Timeline showing the annual number of passengers boarded for whale-watching in Peninsula Valdés and some of the major milestones on the development of the activity. Lines crossing the bars represent the linear models explained in Table 1. Number of passengers - source: Secretaría de Turismo y Áreas Protegidas de la provincia de Chubut.

in the region, there were no laws or regulations for its management. Some national laws for the general protection of whales and other marine mammals were the only legal instruments serving as a framework for this activity. These included Argentina’s ratification of the “Convention for the Regulation of Whaling” (London 1937), the protocol amending the same (London 1938) (National Decree No 3162); the superceding “International Convention for the Regulation of Whaling” (ICRW) and its accompanying regulations (Washington 1946) (National Decree No 281). It was in 1946 that the ICRW gave rise to the International Whaling Commission (IWC) with the purpose to “ensure the proper conservation of whale stocks and thus making possible the orderly development of the whaling industry” (<https://iwc.int/iwcmain-es>). In 1958, National Decree No. 281 led to Argentina joining, and participating in the IWC, in 1960.

At the provincial level, in 1974, local authorities in Chubut created the provincial marine park of Golfo San José (*via* Provincial Law No. 1238), aiming to protect its fauna and flora. This was part of a trend for establishing coastal protected areas, which started in 1967 when the first provincial Protected Areas were established to allow tourists observe south American sea lions (*Otaria flavescens*) in a rookery near Puerto Madryn, and the southern elephant seal (*Mirounga leonina*) at Península Valdés (Provincial Law No. 697). This trend combined both interest in developing tourism in the region, and conservation efforts to protect threatened species and their habitats.

**3.1.2. Eighties and nineties: setting the rules for an increasing demand**

**3.1.2.1. Southern right whale biology.** During the 1980s the population of SWR in Península Valdés started to increase, mainly due to the ban of the hunting in 1937, ratified later by the moratorium on commercial whaling imposed by the IWC in 1986 [13]. By 1980, the female breeding proportion of the population was estimated to be 168 individuals [14]. By 1990, the same population segment was estimated to have doubled (to 328 breeding females). The rate of increase was considered to be 7% *per annum*, which was an extremely high rate, especially when considering the life history of the species [14]. The

estimated total population size for the species in the Southern hemisphere, in 1997, was 7500 animals, of which 1600 were mature females (encompassing 547 from Argentina). During this period, the whales experienced a shift in their distribution in the region of Península Valdés: during the early eighties they were encountered mainly on the outer coast of this and in Golfo San José; by 1990 they remained in Golfo San José but abandoned the outer coast, moving inside Golfo Nuevo [15]. By 1997, a new area of high density of whales was detected 15 km north of Puerto Madryn along a beach known as El Doradillo (Fig. 1). El Doradillo became one of areas with the highest density of whales, with as many as 6.5 whales/km<sup>2</sup> by 1999 [16].

**3.1.2.2. Whale-watching.** By 1984, local entrepreneurs had set up most of the whale-watching companies that still exist today. By that time, 5 companies were operating from Puerto Pirámides. In 1987, the provincial authorities started to record the number of tourists that participated in whale-watching trips, with a recorded 5214 people for that particular year [17]. From then onwards the number of tourists taking whale-watching trips increased considerably. Argentina’s return to democratic governance, coupled with the increasing importance that the provincial government gave to the promotion of the nature-based tourism allowed a period of economic growth for local entrepreneurs. From 1987 to 2000 the demand for whale-watching increased at a rate of 6275 people/yr (Table 1).

**Table 1**

Linear regressions for the number of tourist that had taken whale-watching trips to see southern right whales in Puerto Pirámides. Period (time) is the independent variable, a (est) is the estimated intercept and b (est) is the slope. P is the associated p value for the significance of the regression at a significance level of 0.05.

Period	Model parameter		
	a (est)	b (est)	p
1987–2000	–12,469,624.3	6275.52	3.8e–8***
2001–2007	–15,398,549.0	7729.07	2.1e–4***
2008–2014	2,520,781.5	–1202.79	0.456

**3.1.2.3. Regulatory framework.** As noted above, the settlement of an aluminum plant in Puerto Madryn, in 1974, led to a wave of immigration into the city. Puerto Madryn, the biggest city at the shore of Golfo Nuevo, grew from approximately 6000 inhabitants in 1970, to an estimated 45,000 in 1991 [18]. This increase in the local population, the increasing presence of whales in the gulfs, and increasing number of visitors led the provincial government to enact Law No. 2381 (then Law XI-4) in 1984, in order to regulate whale-watching interactions and protect the breeding grounds of the SRW. The law stated that “all activity of approach and / or persecution, sailing, swimming and diving with any marine mammal species and their offspring are forbidden on the coast and sea of provincial jurisdiction throughout the calendar year” [literal translation]. The law included all marine mammal species, but was mainly aimed at protecting whales. Also, the law mentioned the possibility of granting special permits to perform some of these activities albeit under the control of the corresponding enforcement authority and assuming compliance with the principles of the enacted law. Meanwhile, at the national level, Law No. 23094 declared that the SRW was declared a “Natural Monument”, the highest rank of protection a species can achieve in Argentina (it bans any activity with the species in national waters, requiring special permits otherwise granted by the enforcement authority). However, the province of Chubut did not adhere to this national law. The following year, the previous provincial law (No. 2381) was amended by Law No. 2618, which enabled the enforcement authority to grant special whale-watching permits.

In July 1986, *via* Provincial Decree No. 916 (and its subsequent amending Decree No. 1127/91), the “Provincial Registry of Companies Providers of Excursion Service for Whale Watching” [literal translation] was created, which permitted the issuance of a maximum of 5 licenses for whale-watching operators in Golfo Nuevo. The law establishes that permits would be granted for two seasons, through a public bidding process and these could be renewed for two additional years. Also these decrees created the “Provincial Register of Guides Specialized in Transport People to Watch the Whales” [literal translation] a registry for skippers that approved courses on the biology of whales and specialized in maneuvering among them, known locally as “whaler guides” [literal translation]. The whale-watching permits were only granted to whale-watching companies that operated from Puerto Pirámides, regardless the fact that the greatest concentration of whales was near the city of Puerto Madryn, in El Doradillo [19]. This was a political decision to concentrate all the whale-watching activity in a single port in the region. It recognized investments into establishing whale-watching made by local entrepreneurs and, moreover, it technically made it easier to manage operators and monitor that regulations were complied with.

During the early 90s, several regulations were made, albeit not regarding the way whale-watching activity should be carried out with the whales, but instead regulating the activity itself, setting up a more formal framework for the commercial activity. By 1993, the government held the first public bidding for permits (Res. 045/93-OPT<sup>1</sup>) granting three licenses. Later, two additional permits were granted *via* a new bidding process. This later was declared null and void however, and a new decree (508/94 OPT) directly granted three new permits, increasing the number of permitted companies from 5 to 6.

An important event for the whale-watching industry, which was related to the greater importance that the provincial government gave to tourism, was that in 1999 the Committee of World Heritage of UNESCO decided to incorporate the Península Valdés in the World Heritage site list under criterion IV (ID No. 937) giving special

attention to the fact that a large number of marine mammal species bred in the area, such as southern right whales, southern elephant seals and South American sea lions, amongst others.

### 3.1.3. The millennium and the ties to the global economy

**3.1.3.1. Southern right whale biology.** By the year 2000, the number of SRW in the Península Valdés was steadily increasing [20]. The whales were present in the area from April to December and the rate of increase by the year 2005 was steady at 7%/yr. [16]. The whales continued to show a clumped distribution inside the gulfs (Golfo Nuevo and Golfo San José), and El Doradillo remained as an area of high density, with most individuals remaining close to the shore. During the years 2005 and 2007, there were the first clues of an increasing mortality rate in the area [21]. Interestingly, also by that time, an increase in the presence of SRW was detected in other locations along the coast of Patagonia, such as Bahía San Antonio in Río Negro [22].

**3.1.3.2. Whale-watching.** As the global whale-watching industry was growing in the early 2000s [1], Argentina was on the verge of a social, political and economic crisis that directly impacted tourism demand, from both domestic and international sources. Also, the demand was affected by the events of September 11th, 2001 when the international tourism market shrank [23]. These events, not related to the whale-watching industry itself, had an impact on the number of whale-watchers visiting Península Valdés for at least two years (Fig. 2).

Associated with the internal economic crisis in Argentina, the country devaluated its currency threefold during 2002, and from that moment the international tourism demand started to increase linearly with a rate of growth of whale-watchers of 7729 people/yr, until 2007 (Table 1). During this period, the conditions for the activity in Patagonia were relatively stable, and this stability allowed significant changes in the way the owners of the whale-watching companies performed their activity. They started to become more established businesses rather than entrepreneurial start-up companies, and owners negotiated with the provincial government for some improvement in their business conditions, to provide some stability for them and for their employees. By the year 2003, the six companies renewed their permits for 5 more years. Also, by 2005, they started to demand the implementation of whale-watching conduct of code, as a consequence of discussions held during the First International Meeting of Whale Watching Operators held in Puerto Madryn in 2005 [24]. Another consequence of this meeting was the creation of the International Whale Watchers Association. During the years 2006 and 2007, the Argentinian whale-watching community worked together with other stakeholders, and the government, to review and change local regulations for whale-watching.

**3.1.3.3. Regulatory framework.** Two years after the declaration of Península Valdés as a World Heritage site by UNESCO, a new protection scheme was established in the area. In the year 2000, the Península Valdés Natural Protected Area (ANPPV) was established (*via* Provincial Law No. 4722, then Law XI-20), which included several small protected areas scattered on the coast of the peninsula and the Golfo San José provincial marine park. This bigger protected area was considered to be an IUCN category VI “Protected Area with Managed Resources” [25]. The enforcement authority for the protected area was the OPT (established *via* Provincial Decree No. 1814/00). This was ratified by the Provincial Congress and a Management Plan was adjoined to the law *via* an Annex. Later the same year, the “Administration of the ANPPV” (AANPPV) was established (operating formally from 2004). This body was responsible for management of, and implementing conservation policy related to, the

<sup>1</sup> OPT: Organismo Provincial de Turismo (Provincial Tourism Agency).



ANPPV, as set by the provincial government.

From its inception, academics, researchers and conservation NGOs were all involved with development of the whale-watching in the area [24]. Within the AANPPV, the “Advisory Committee for the Service of Whale Watching” [literal translation] (the body, created in 2001 via Provincial Resolution No. 113/01, to integrate various governmental and non-governmental institutions, and whale-watching companies) operated as a platform to organize a series of meetings between the different stakeholders, with meetings held from 2004 onwards. These “workshops” were aimed to develop formal regulations leading to a bill that would enshrine whale-watching guidelines in a legal instrument, and finally give stability to the whale-watching industry. These meetings were held both in Puerto Madryn and Puerto Pirámides, and the process, started in 2004, finished in 2007 with a draft of a potential law. This bill was passed in 2008, and in that same year it became Provincial Law No. 5714 (then Law No. XI-44). This law regulates whale-watching operator's approaches to SRWs, sets a tax to be paid by whale-watching service providers and the destination of the income of these taxes. This money goes to the maintenance of a Protected Areas Conservation System, to support some provincial areas which are not economically viable; also part of the money is used for research and conservation projects within ANPPV. Also the law regulated the number and duration of whale-watching permits, setting a minimum of six years duration for the permits. Regulatory Decree No. 167/08 and its subsequent amendments (Decree No. 1310/09 and No. 530/11) set regulations the aforementioned law, establishing the “Patagonian Whale Watching Technique” and “Code of Good Practice” guidelines. These two codes of conduct were mainly developed by the whale-watching company owners, whaler guides along with conservation NGOs; this is the best way to ensure local uptake by a code of conduct [26]. The overall process was lead and overseen by the government. The “Patagonian Whale Watching Technique” establishes, amongst other strictures, that each company should only operate a single boat with a capacity of no more than 70 passengers. The guidelines also establish a minimum of 90 min for each trip, in order to avoid rush the observation of the whales, ensuring some quality standard. Also it establish the speed, direction of approach to whale groups, the distance to which boats can approach (according to the type of whale or group sighted) and maneuvers that are prohibited (e.g. pursuing an individual, splitting up a group, etc). Also, it sets temporal restrictions on which types of group can be approached, for example, mothers with calves cannot be approached before August 31st each year. On the other hand, the “Code of Good Practice” is more aimed towards tourists, and highlights codes of practice and emphasizes ways they can collaborate to improve the sustainability of whale-watching such as watching that tour guides abide by the respective laws and the code of conduct ([Online Supplementary material](#)).

### 3.1.4. Increasing number of whales and stability for the industry after 2008

**3.1.4.1. Southern right whale biology.** At the end of the 2000s, changes in the distribution of the right whales were detected. By the early 2000s, the different types of whale groups were evenly distributed near the shore, but by the year 2010 a significantly higher proportion of mothers with calves were close to the shore, whilst the solitary individuals and mating groups were located further offshore in deeper waters [16]. During this period new mortality whale events were described; most of the dead animals were calves of that breeding season [21]. Also, from 2007, the annual rate of the population increase (the recruitment rate) had steadily declining, reaching 3.5% a year in 2014 [20]. For the first time the observed changes could be attributed to a probable cause: it was hypothesized that there was a density dependent regulation process [20], i.e., the Península Valdés

area may be reaching its carrying capacity as far as whales were concerned. It is possible that the relocation of the solitary individuals and mating groups into deeper waters [16], the increased mortality of newborns [21], the decrease of the population's recruitment rate [20], and the new locations where the whales are being sighted (San Antonio Bay) [22], may be all linked to the same process.

**3.1.4.2. Whale-watching.** In 2008, the international economic crisis, added to outbreak of the Swine Flu (H1N1), impacted tourism with a decrease of 10% with respect to 2007 tourist numbers [27]. From 2008, to date, whale-watcher numbers have oscillated around an average of 100,000 tourists per year. During this period, two regional natural events are thought to have had influence on the number of tourists arriving at Puerto Pirámides: in 2009 the eruption of Chilean volcano El Chaitén; and in 2011 the eruption of Argentine volcano Puyehue. The eruptions of the volcanoes lasted for several months and impacted the regular operation of airports of the region, resulting in the cancellation of many bookings in those years eruptions occurred [27].

As a consequence of these events, there is a large variation in the number of tourists during this period. Even so, however, the activity has now reached a plateau, and from 2008 to 2014 tourist numbers have been relatively stable ([Table 1](#)). This stability was previously noted by Fazio et al. [28].

**3.1.4.3. Regulatory framework.** From 2008, to date, there have been only two minor amendments to Decree No. 167/08: the simultaneous sailing of two boats, operated by each company, was permitted on specific days (Decree No. 1310/09), and the term “Mother and calf” was redefined in the glossary of the law (Decree No. 530/11). With small number of changes made in the laws over the past few years, one could infer that the legal framework is adequate for the current circumstances of the whale-watching industry. The number of tourist seems to have reached a plateau; to increase the number of tourist undertaking whale-watching activities, the regulatory conditions would need to be changed (i.e., allowing more companies to operate, or making sailing possible from the port of Puerto Madryn).

## 3.2. The regulation scheme and the inflexibility of the rules

The whale-watching management regime implemented in Chubut was established via some broad laws, which have been in place for several years, with these complemented by some decrees which have “tweaked” the management framework. The laws tend to be more conservative, and tend to change very little over time, while the decrees are more flexible, but also can require some time before they can be updated. These decrees were amended several times adapting their content to arising conditions, and strengthening security aspects for tourists. However, as was stated previously, the ecosystem in which the activity takes place is dynamic and there may be a delay between changes occurring in the biological system and reactionary changes in the regulations to accommodate these biological changes. This is why it often takes too much time between the detection of an emerging problem, and the ability for regulations to adequately adapt to this change, creating conflicts between the owners of the whale-watching companies, the whaler guides, the enforcement authority, the tourists, and the conservationists. This is a situation where even though the changes in the biological and the socio-economic systems are very slow (in the span of years) the regulations that are often reactive to these changes, are modified at even at slower rate. The inertia of the system precludes the authorities rapidly reacting to changes, and these are often resisted by the people performing the activity, making the implementation of adaptive management difficult.

### 3.3. When laws become outdated

The increasing number of SRW in the area, and their changes in distribution, has rendered some rules that were set to govern the whale-watching industry partially obsolete. The most evident example is the case of the whale-watching trips targeting mother-calf pairs. Whaler guides and owners of the companies, thinking of the welfare of the newborn whale calves, considered that it was necessary to designate a period when interaction with mother-calf pairs was prohibited, until such a time that the calves born during the season were grown enough to be able to interact with whale-watching vessels safely. In 2008, approaching mother-calf pairs was banned until August 31st every year, a time by which most of the calves were already born [18]. Historically, and up to the time this restriction was set, solitary individuals and breeding groups were the most likely whale groups to be sighted near the shore at the beginning of the whale-watching season. By the time the calves were big enough, and thus less vulnerable, mating groups and solitary individuals were already diminishing their presence in the nearshore area. This temporal restriction was proposed by the whaler guides and owners of the companies themselves (see Section 3.1.3). Soon after, the term “mother-calf” was redefined to specifically refer to those whales with offspring born during the current season. This was necessary, as calves from the previous breeding season were present in the area with their mothers, and it was deemed that those groups could be approached safely. Prior to this amendment, the rule did not make a difference between newborns and yearlings.

As the years passed by, and the distribution of the different types of whale groups changed near to the shore [13], this rule has been harder to comply with. The rule has been identified as a “problem” by the whaler guides given the high abundance of mother-calf pairs near the main whale-watching area, and the corresponding low abundance of other type of groups in the past few years. This specific restriction means that operators have to travel greater distances, away from the shelter of the coast, and spend more time at sea looking for groups of whales it is allowable to watch. Meanwhile, vessels sailing from the port have to pass by many pairs of mothers with calves inside Puerto Pirámides Bay while transiting to offshore waters (Fig. 1).

### 3.4. The conflict between abiding by the whale-watching rules and satisfying tourist expectations

On any given day during the peak of the season, in Puerto Pirámides, there are up to 1600 passengers on whale-watching trips, but this number increase during “long weekend” holidays or the day after the port is closed due to bad weather (Secretaría de Turismo, pers. com.). The area where the boats normally travel to is near the bay of Puerto Pirámides (Fig. 1) which is very close to the shore and protected from the winds [20]. The whale-watching permits allow the boats to travel to a much larger area, but for the sake of the tourists comfort, the speed of transit and the running cost of the excursion, most of the trips are done in the vicinity of Puerto Pirámides Bay [20]. However, as noted above, the bay is an area preferred by mother-calf pairs, and they are present in a higher proportion when compared with other type of whale groups. It is difficult for the whale-watching operators to find solitary whales or breeding groups, which they are permitted to watch, in a reasonable time. For this reason, *via* radio communication, the skippers of different companies keep in touch, informing each other where there is an appropriate whale for watching, facilitating their search. However, by doing this the same individual whale, or breeding group, may be receive much more whale-watching activity exposure. This situation is exacerbated towards the end of season, when the only whales in the area may be a few mother-calf pairs, which may receive intense whale-watching exposure for several consecutive days [28]. In some cases, these exposed calves may ones that were born by the end of August, and whale-watching activity disrupting the behavior of these

newborns may have a major impact (e.g., preventing crucial periods of nursing) [29]. This situation means that sometimes the operators contravene regulations in order to satisfy the demand both of their passenger and the companies’ owners. In view of this, the crews of the whale-watching vessels were interviewed, in order to ascertain an estimate of how often they estimate break the current regulations.

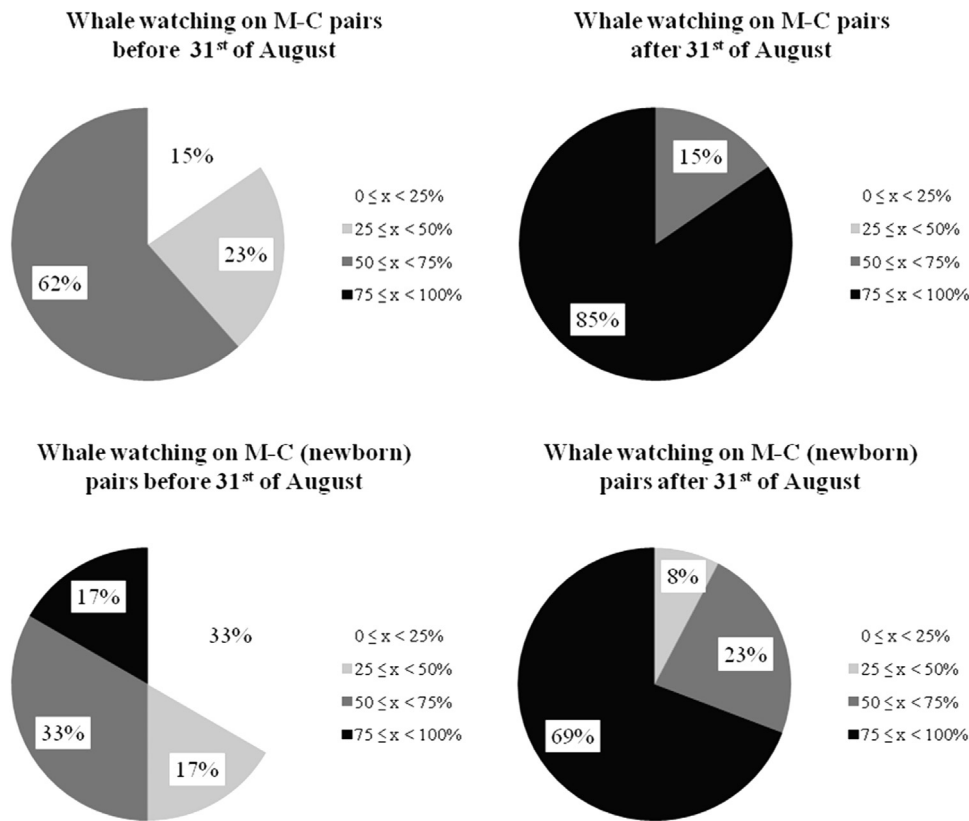
### 3.5. Breaking the law is the common feature: perceptions of whale-watching crews

The 14 whaler guides interviewed account for the 50% of the guides that worked during the 2015 season. Most of them had more than 10 years’ experience (some of them with more than 20 years) working onboard the whale-watching vessels. Of these 14 whaler guides, 9 had taken the course that enable them to act as whaler guide more than 10 years ago, and 7 of them had worked on a whale-watching vessels prior to taking the training course (this is probably because the training course is run infrequently and irregularly).

The goal was to understand the crews’ perception regarding how well they think they comply with the current regulations with respect to the category of whale group they tend to approach (prior to August 31st prohibition on approaching mother-calf pairs). All of the guides were aware of the whale-watching law (Provincial Law No. 5714 and its regulatory decrees No. 167 and No. 530). The results of the surveys indicate that 62% of the whaler guides estimated that between 50% and 75% of sightings made before August 31st targeted mother-calf pair. Twenty-three percent of the guides stated that between 25% and 50% of the groups they approached were mother-calf pairs, and only 15% of whaler guides stated that less than 25% of approached groups were such pairs. After August 31st the percentage of sightings made on such groups, increased to between 75% and 100% for 85% of the whaler guides, and the rest (15%) stated that they approached mother-calf pairs for between 50% and 75% of whale-watching encounters. Moreover, when whaler guides were asked to comment only on encounters made with mother-calf pairs where the calf was born during the season before August 31st, responses of the guides varied. One third of the whaler guides stated that those encounters composed less than 25% of the total encounters; another third perceived that it was between 25% and 50% of total encounters. Of the rest, 17% stated that between 50% and 75% of trips targeted mothers with calves and the remaining 17% stated that the proportion was between 75% and 100% of total encounters (Fig. 3).

With these results, one might suspect at least three possible scenarios: 1) there may be errors in percentage estimation as guides were not duly paying attention to the proportions of mother-calf pairs, or misestimated proportions; 2) because approaching mother-calf pairs is a violation of the whale-watching regulation some guides may purposefully have under estimated the proportions of such mother-calf pairs approached; 3) the fact that in some cases members of the same company, independently had a similar perception of the proportion of the mother-calf pairs approached, suggests that the estimates are likely valid in these cases, and could indicate a difference between companies in their approaches to mother-calf pairs. It is possible that the high rate of stated non-compliance may be due to operators trying to meet the demands [30](actual or perceived) of tourists. What is clear is that all whaler guides stated that some percentage of groups targeted by whale-watching vessels were on mothers with calves (before August 31st) meaning that to a greater or lesser degree, all of them violated regulations at some point. Over two-thirds of interviewees (69%) stated that the percentage of encounters of mothers with calves born during that season, increased after August 31st, with encountered group percentages varying between 75% and 100%; 23% of the guides stated that they approached mothers with newborn calves for between 50% and 75% of encounters, and the remainder of whaler guides (8%) stated that the proportion of encounters was between 25% and 50%.

Also whaler guides agreed that by August 31st, at least 50% of the



**Fig. 3.** Results whale-watching crew member interviews relating to compliance with regulations. Upper panels: percentage of whale-watching trips performed on mother-calf pairs regardless of whether the calf was a newborn or a yearling before (left) and after (right) August 31st. Lower panels: percentage of whale-watching trips performed before (left) and after (right) August 31st on mother-calf pairs where the calf was a newborn.

calves have already been born (almost a third of the guides thought that by this time 80% or more of the calves had been born). The beliefs of the whaler guides coincides with observations from aerial surveys that show a clear increase in the number of calves after August [16] and, considering the models implemented in 2015 by Crespo et al. [20], this 50% may be an underestimation.

In order to be able to validate the answers on the percentages of calves born during the season, and those born the previous one, the whaler guides were asked to describe the features that they use to differentiate calves of less, or more than, one year. The most cited identifying criterion was that the overall size of the calf relative to the size of its mother (less to ¾ the size of the mother) or estimated length in meters (3 m to 6–7 m) indicated a calf born in the current season. These characteristics are a fairly good indicator of calf age [31].

From the results is clear that all the whaler guides knew of the current regulations and all of them were knowledgeable enough to identify a newborn whale calf based on several features. Thus, non-compliance with the regulations and watching newborn calves before the August 31st is not due to a lack of operator knowledge, but due to other circumstances. A recurring comment from whaler guides in interviews was that “if there are other types of individuals, or group of individuals, within the area, we would try to avoid mothers with small calves regardless of the date.”

Whaler guides were also asked if they wanted the current whale-watching regulations to be amended. Eighty-five percent of them said that they would change the date restriction for when vessels can start approaching mothers with calves of the current season. Some suggestions obtained included changing the restriction date and/or to make the regulated date more flexible. This response from guides has more to do with perceptions of providing a more satisfying experience for tourists rather than for the welfare of the whales.

During harsh weather, the area utilized by whale-watching vessels

is reduced to the small bay adjacent to Puerto Pirámides (Fig. 1) where there are few individuals (most of the time only mothers with calves). In such weather conditions this kind of group is the boat operator's choice. On the other hand, the interviewees reported that independently of the size of the area utilized by whale-watching vessels, sometimes mothers with smaller calves have a “positive” behavioral response to the presence of boats (approaching to the vessels) and others mothers with larger calves may have a “negative” response towards the whale-watching boats. Some guides suggested that time spent with whales and approach distances should be at the boat operator's discretion. A repeated comment of interviewees was to regularly evaluate boat operators and their compliance with the regulations, but for this to be done there should be ultimately be regular training courses for whaler guides, that aim to improve awareness of the whales' welfare. Regarding the elimination, or modification, of the temporal restriction for approaching mothers and newborns, half of interviewees stated that this would not influence their activities, whilst the remainder stated that it might make whale-watching easier, because they would not require to sail long distances to find solitary individuals. However, at least 14% of the guides stressed the importance of the existing rules and the established criteria. Almost three-quarters of respondents replied that removing the restriction on approaching mothers with newborns (before August 31st) would not affect the whales as long as boats remained at a reasonable distance and attempted to minimize disturbance to the animals.

One recurring statement, made by five interviewees, was that, at least in their perception, 2015 had been very different from the previous years and that before August 31st the percentage of whales with calves in the area was extremely high. The consequence of this was that, despite the regulations prohibiting approaches, approximately the 80% of the whale-watching encounters approached mothers with newborns. Despite this perception, the total number of calves and the



timing of the births were not different from previous years (LAMAMA<sup>2</sup> unpublished information). If the perception of the whaler guides is, in fact, accurate, it might be a consequence of a change in the distribution of the whales within the gulfs.

#### 4. Conclusions

##### 4.1. Facing challenges: adaptive management and coordinated legislation

While there is a strong and coherent legal body that regulates whale-watching in the Península Valdés region, the process via which regulations are enacted is slow and inefficient. The system is not able to adapt to the changing behavioral ecology of the SRW population, even despite the slowly changing nature of the latter. The management framework has the tool by which the process could be made more effective (i.e., the Advisory Committee for the Service of Whale Watching of the AANPPV) but it is seldom used to make such adaptive management actions. Data gathering on the SRW population should be continued, but also the socioeconomic aspects of whale-watching should be monitored in order to detect changes in the market and tourism patterns which might be important for managers to consider. This information should then be used when developing regulations, ideally whilst achieving consensus with the stakeholders as to the way activities should be carried out. The results of the interviews with whale-watching whaler guides demonstrates the need to partially modify the current regulations, so that whale-watching trips can be conducted without breaking the law, whilst providing a satisfying product for tourists, and simultaneously protecting the target species.

Additionally, although outside the scope of this paper, we cannot overstate the importance of having a coherent and coordinated legal structure that is the same across different coastal provinces as it is likely that the same whales that visit the coast of Chubut are the same looking for new areas [15,18]. A unified, logical, rigorous and adaptable whale-watching management regime that is justifiable in terms of science, conservation and the typical operating practices of whale-watching companies will help to maintain the growth of the Argentinian southern right whale populations and the economic benefits they bring to the human populations of coastal communities.

#### Acknowledgements

This study was funded by the National Research Council by a doctoral fellow awarded to BAC. Additional funding was providing by the Consejo Federal de Inversiones (2014–2015): Basis for sustainable development of tourism sightings of Southern Right Whales in the San Matías Gulf (Río Negro); by APCyT Proyect (PICT-2012): Multiscale and multidisciplinary study of the distribution and habitat use of marine mammals in Northpatagonian gulfs, and by Secretaría de Turismo y Áreas Protegidas de la Provincia de Chubut (2013–2015): Abundance estimation and population monitoring of Southern Right Whale *Eubalaena australis*. We would like to thank to all the personnel of the whale-watching companies in Puerto Pirámides, to Administration of the ANPPV and Secretaría de Turismo y Áreas Protegidas de la Provincia de Chubut. Thank you to E.C.M Parsons for the thorough review of the manuscript.

#### Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2016.11.010.

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