

Potential impact of unregulated dolphin watching activities in Patagonia

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ABSTRACT

Since 1997, dolphin watching activities have increased in Patagonia, with dusky and Commerson's dolphins as the target species. To assess the impact of this activity, dolphin watching tours were monitored. For dusky dolphins, the number of tourists increased from 1,393 in 1997 to 1,840 in 2000. The encounter rate grew from 25% during 1999 to 90% in 2001. Most of the groups observed ranged from 50-100 animals. Data were recorded from both a commercial and a research boat. Dusky dolphins showed a short-term reaction to boats and feeding was the most affected behaviour. For Commerson's dolphins, the number of tourists increased from 532 in 1999 to 2,113 in 2001. The encounter rate averaged 95.58%. There is seasonality in the abundance of Commerson's dolphins in the area during the colder months (May-December), when schools are larger, than in the warmer months. Dolphins showed a short-term reaction to the presence of the boat, performing aerial displays which are otherwise rarely seen. The direct gross estimated income for the companies carrying out dolphin watching is around US\$60,000 per year. The activity has great potential to become an industry of its own. Nevertheless, the activity is at present undertaken on an irregular basis.

KEYWORDS: SHORT-TERM CHANGE; SOUTH AMERICA; WHALEWATCHING; DUSKY DOLPHIN; COMMERSON'S DOLPHIN

INTRODUCTION

Marine mammals have become a topic of interest for the scientific community and the general public over the last few decades (Jefferson *et al.*, 1993). This public interest has created a booming new 'whalewatching' industry – essentially a branch of tourism that allows people to observe great whales (and other cetaceans) in the wild. It provides employment and economic benefits for many local communities around the world and may also provide benefits to conservation through long-term public awareness of cetaceans and their environment (IFAW, 1995). Nevertheless, uncontrolled whalewatching may disturb whales and dolphins by changing their natural behaviour and movements, and potentially modifying their distribution, survival or reproduction (e.g. see Berrow and Holmes, 1999; Heckel *et al.*, 2001; Williams *et al.*, 2002).

In Argentina, the whalewatching industry has developed on the observation of southern right whales (*Eubalaena australis*) around Península Valdés in Chubut Province, and this has promoted an increase in ecotourism activities for more than 20 years (Rivarola *et al.*, 2001). The total income in the region has been estimated to be about 100 million US\$ per year in direct benefits (Barrera, 1997). During the 1990s, the annual number of visitors to Península Valdés increased from 80,000 to 150,000 of which 50,000 took whaling trips at Puerto Pirámide (OPT¹, unpublished data). The gross income of this sector was estimated for 1994 at 10.3 million US\$ (Rivarola *et al.*, 2001). The 'whale' season lasts from June to late December. During the summer months, the 'whaling fleet' remains unemployed and the tour operators use this time to repair and renew the boats.

Within this scenario of increasing numbers of tourists, some operators have begun to search for alternatives or new activities. The occasional sightings of dolphins have motivated dolphin watching tours. Currently, these activities are being carried out in Golfo Nuevo and Bahía Engaño near the mouth of the Chubut River (Fig. 1). These are mainly

based on two species: dusky (*Lagenorhynchus obscurus*) and Commerson's dolphins (*Cephalorhynchus commersonii*) which are both coastal species commonly seen in shallow waters of the Patagonian shelf (Goodall, 1994; Dans *et al.*, 1997).

A national decree protects marine mammals and other marine wildlife. At the provincial level, there are laws which protect marine mammals but also allow granting of permits for sighting trips, including whales and other marine mammals in the area. Although the law includes specific rules for whalewatching, operators rarely abide by the rules (Rivarola *et al.*, 2001); the Provincial Government lacks the capacity to control these activities. Dolphin watching tours are even less controlled. The rules promulgated for whales

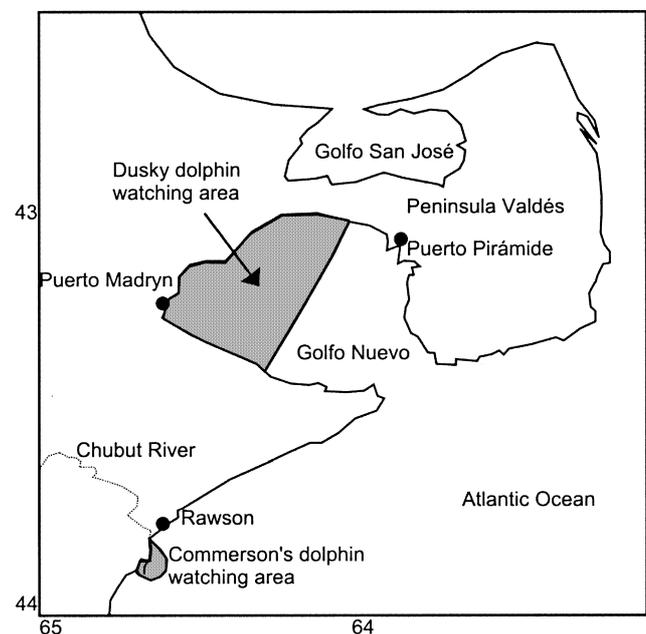


Fig. 1. Area where dolphin watching activities are conducted.

¹ Provincial Tourism Organisation.

are not applicable to dolphin watching operations, due to the different behaviour and character of the species of dolphins involved. This situation led to a request from the enforcement agency for scientific advice and an impact study by the Marine Mammal Laboratory².

Prior to this study there was no available information on the extent and operational procedures of the dolphin watching boats in either area. Moreover, there is a lack of information regarding local abundance, seasonal changes, habitat use and behavioural ecology for both species (Goodall, 1994; Dans *et al.*, 1997). These dolphin species have been studied in the context of interactions with fisheries; they are the main species incidentally caught in different fishing gear along the Patagonian coast (Crespo *et al.*, 1997; Dans *et al.*, 1997; 1999; Koen Alonso *et al.*, 1998). During the 1970s, background studies of feeding behaviour, group size and daily movement patterns of dusky dolphins were conducted in Golfo San José, Península Valdés (Würsig and Würsig, 1980). However, there is still a lack of knowledge on dolphin ecology at the small scale. This means that even though there is a good estimate of abundance at a regional level, the residence of the local dolphin schools, the interchange of individuals between them and the seasonal pattern of movements are not known.

Within this context, the objective of the research was to evaluate the potential impact of watching activities on dolphin populations by analysing the development and trend of the economic activity in the region and by obtaining preliminary information of short-term responses of dolphins to boats. To achieve these objectives the following factors were considered: (1) the characteristics of the operations and their inter-annual changes and trend; (2) the characteristics of the animals or groups of animals to be watched and potentially to be disturbed; and (3) behavioural responses of the animals to boat approaches.

MATERIALS AND METHODS

Commercial activity survey

Information concerning commercial activity included data from 1997 up to 2001. Data were gathered during commercial trips operating in Golfo Nuevo and Bahía Engaño, from specially designed forms distributed among operators. Data included: departure time, encounter time and position, species, number of dolphins, time at the end of the sighting and arrival time to the harbour. The number of tourists was obtained from the logbooks declared to the National Coast Guard. Observers were placed on board commercial trips whenever possible. A sighting trip was considered successful if at least one dolphin was seen from the boat.

Ecological aspects of dolphin species and behavioural responses

Data concerning the size and composition of dolphin schools were obtained from commercial trips accompanied by researchers, from research trips and from observations from land. The behaviour and the social structure of both species are different and so the methodology for gathering behavioural data or impact response was adapted to each specific case and the logistics available. The studies on Commerson's dolphins started before those on dusky dolphins, therefore the database is larger for the former species.

For dusky dolphins in Golfo Nuevo (Fig. 1), surveys were performed on commercial trips and from an independent research boat. Observation from cliffs was not possible as dolphins were not close enough for recording detailed data. The data gathered from the research boat was the same information taken by observers or operators on commercial trips. These trips were conducted from January to May 2001. Whenever a group of dolphins was detected, the predominant activity (the activity in which most of the animals in the group were engaged) was primarily assigned at a distance greater than 200m, before the boat approached. The group activity was categorised as either: feeding, travelling, resting, milling (or slow zigzag swimming) or socialising. The size of the group was assigned to one of the following categories: 1-10, 11-20, 21-50, 51-70, 71-100, 100-150 and more than 150. Mother and calf pairs were counted and groups were determined as mothers and calves (M/C), adults and juveniles (A+J, when several individuals of 3/4 of adult size were seen) and mixed (M, a combination of mothers and calves, juveniles and adults). A group was considered as those animals moving together, sometimes engaged in the same activity and separated from other groups at a distance larger than the diameter of the area they were occupying. When more than one group was found, a different form was completed for each group. When the commercial boat performed more than one trip per day, the groups found in each trip were considered different, and thus independent observations. This consideration was made on the basis that it took at least one hour between the arrival and the new departure of the boat. The predominant activity was reassigned after the commercial boat approached the group to 50m or less. In the case of the research boat, the distance remained almost constant at 100m. From these data, the frequency of change for each one of the categories of activity was calculated and compared using a contingency table.

The activities of Commerson's dolphins were studied at Bahía Engaño (Fig. 1). Daily pattern and group size were studied from cliff-tops. A scan sampling protocol was applied (Lehner, 1998) and scans were performed every half hour with a Bushnell spotting scope 60 × 15-40. A group was defined as those dolphins associated closely and engaged in similar activities (Shane *et al.*, 1986). A school was considered to be composed of several groups. Presence of aerial displays was also recorded. When the commercial boat was present, the number of dolphins interacting with the boat was recorded (an eye-estimated area of about 50m in diameter around the boat was considered) and the activity and displays were also recorded within this area. From the boat, behaviour was categorised as: feeding, resting, travelling and socialising. The activity was first assigned when dolphins were detected over a 100m distance. Once dolphins were closer to the boat, the activity was reassigned. The size of the school was assigned to categories from 1-5, 6-10, 11-20, 20-50, 50-100 and over 100 dolphins.

RESULTS AND DISCUSSION

Development and trend of dolphin watching activities

In both areas of interest, dolphin watching activities began at almost the same time in 1997. However, the basis for the development and the potential impact of the activity showed slight differences.

A total of six companies are currently allowed to operate for southern right whale watching from Puerto Pirámide (Golfo Nuevo) from June to December. Five of them continue operating from Puerto Pirámide outside the whale season, and are allowed to carry out wildlife marine tours.

² Laboratorio de Mamíferos Marinos, Centro Nacional Patagónico (CONICET).

These companies approach dolphin groups occasionally. When dolphins are detected, the operator communicates the sighting position to the others so sometimes there are several boats around the same group of dolphins. During the summer months, one company moves to Puerto Madryn to undertake dolphin watching tours. Although dusky dolphins are the main target, other species like bottlenose (*Tursiops truncatus*) and common dolphins (*Delphinus delphis*) can be seen associated with dusky dolphins. There are no permits specifically allowing for dolphin watching and thus the activity is neither regulated nor controlled. The companies operate under the general marine tours permits.

Golfo Nuevo

During the first dusky dolphin watching season (January-March 1997) a total number of 80 trips occurred with 18 successful trips (less than 25%). During the 2000 summer season, a total number of 105 trips occurred between January 11 and April 29 with 60% successful trips. Between one and three trips were carried out each day (mean 1.65 trips/day). The trips lasted on average 2:40h and the time spent searching prior to the first sighting averaged 1:04h (SD=00:45h). The boat spent a mean of 00:56h (SD=00:26h) with dolphins. For the 2001 season, the rate of success reached about 90% of the performed trips. The encounters in this season were much shorter (00:25h; SD=00:26h) but the number of trips per day slightly increased to 1.93 trips/day.

Searches targeted flocks of birds and, if dolphins were present, then slowly approached the main group. Depending on the weather conditions and the activity of the dolphins, operators turned off the engine and allowed some passengers to enter the water. If dolphins showed a high level of activity and aerial displays, operators induced dolphins to bow ride by moving the boat faster. Although the first trip of each day was used to find the dolphins, and then the same location was revisited during the next trip, there is no evidence to support an assumption that the same group was approached. The hypothesis that an early detected group would be impacted or disturbed during a whole day, additionally that the individuals disturbed every day are the same, requires further investigation.

Regarding the economic profile of the activity, 1,393 passengers undertook dolphin watching trips in the 1997 season, increasing to 1,840 in 2000. Although the boat has a capacity for 50 passengers, the mean number of passengers per trip was 17.5 in the 2000 season. The activity reached a peak during February, with the highest number of passengers and sighting success (Table 1). Through the summer season of 2001, the boat was out of operation due to technical problems for several periods, therefore not enabling comparisons between years. During the last two years, the cost of the trip was about US\$20 per person and the direct annual income could be estimated at US\$30,000 in 2000.

In Golfo Nuevo, the main advantage for the operating companies is that the initial investment has been made and they only have to change their searching methods to a new target species. The fact that a relatively long time is needed to find dolphins may represent a limitation for the number of boats operating for dusky dolphins. The operators from Puerto Pirámide seem to be less willing to spend many hours at sea searching for dolphins than the one from Puerto Madryn. However, this situation may change in the near future if the season could be extended to cover the whole year, thereby allowing operators to gain experience in detecting dolphins. During summer 2000 (15 December-15 March), 67,700 tourists came to Puerto Madryn and 43,188

Table 1

Information about passengers, trips and sighting success during dolphin-watching activities in the area surrounding Puerto Madryn during January-April 2000. The trips were carried out by only one commercial boat.

	Total	Jan.	Feb.	Mar.	Apr.
Passengers	1840	524	786	394	136
Trips	105	30	43	24	8
Mean number of passengers/trip	17.52	17.47	18.28	16.42	17
Mean number of trips/day	1.65	1.7	2.05	1.26	1.33
Trips with researchers on board	48 (46%)	6 (20%)	28 (65.1%)	14 (58.3%)	0
Trips with sightings	63 (60%)	15 (50%)	33 (76.7%)	14 (58.3%)	1 (12.5%)

visited Península Valdés (Secretaría de Turismo de Puerto Madryn³, unpublished data). The sighting success is high enough to sell the activity to the tourists that come to the area during the summer. As dolphins can still be found during the whale season, the attractiveness of whalewatching tours may be improved by adding such other wildlife components. All these factors could lead to an increase in the searching and watching effort and thus in the level of potential impact on dolphins.

Bahía Engaño

Commerson's dolphin watching started at Bahía Engaño at the same time as dusky dolphin watching in Golfo Nuevo. In contrast to Golfo Nuevo, there were no tourism trips for general wildlife observation. From spring 1997 to March 1998, one boat performed sporadic dolphin watching trips, but no data are available and the authorities gave no permit for that period. Since October 1998, a company was explicitly authorised for dolphin watching tours. As the departure time was dependent on the tide and as the boat had a small capacity, a new permit was granted for a second company. Consequently, two companies operated between April and September 2000. There was a difference in the number of trips between the years for October, November and December (One way ANOVA; $p < 0.05$) as well as in the number of passengers (One way ANOVA; $p < 0.001$). The number of trips performed in each month was around 14 during 1998 and 1999, and 21 during 2000 (Fig. 2). The number of passengers increased from October 2000 when a boat operated with a higher capacity (up to 48 passengers) and was not constrained by tide conditions. At Bahía Engaño, the operators usually find the Commerson's dolphins between 1 and 5 n.miles from the coast, to the south of the river mouth. The rate of successful sighting trips was 95.6%. The mean length of the trips from departure to arrival was 1:06h, (SD = 0:19h, $n = 269$). The mean time actually spent with dolphins was 0:40h (SD = 0:18h, $n = 249$), and the mean time searching for them was 0:13h (SD = 0:14h, $n = 257$). There are significant differences in the time spent looking for dolphins from May to December and from January to April (Mann-Whitney U test; $p < 0.001$) with the mean search time for the former months of 9 mins and for the latter 23 mins.

Commerson's dolphin watching activities in Bahía Engaño began five years ago based on occasional sightings of dolphins. This activity has changed from occasional to directed searching effort for dolphins. The season for Commerson's dolphin watching coincides with the right

³ Puerto Madryn Tourism Secretariat.

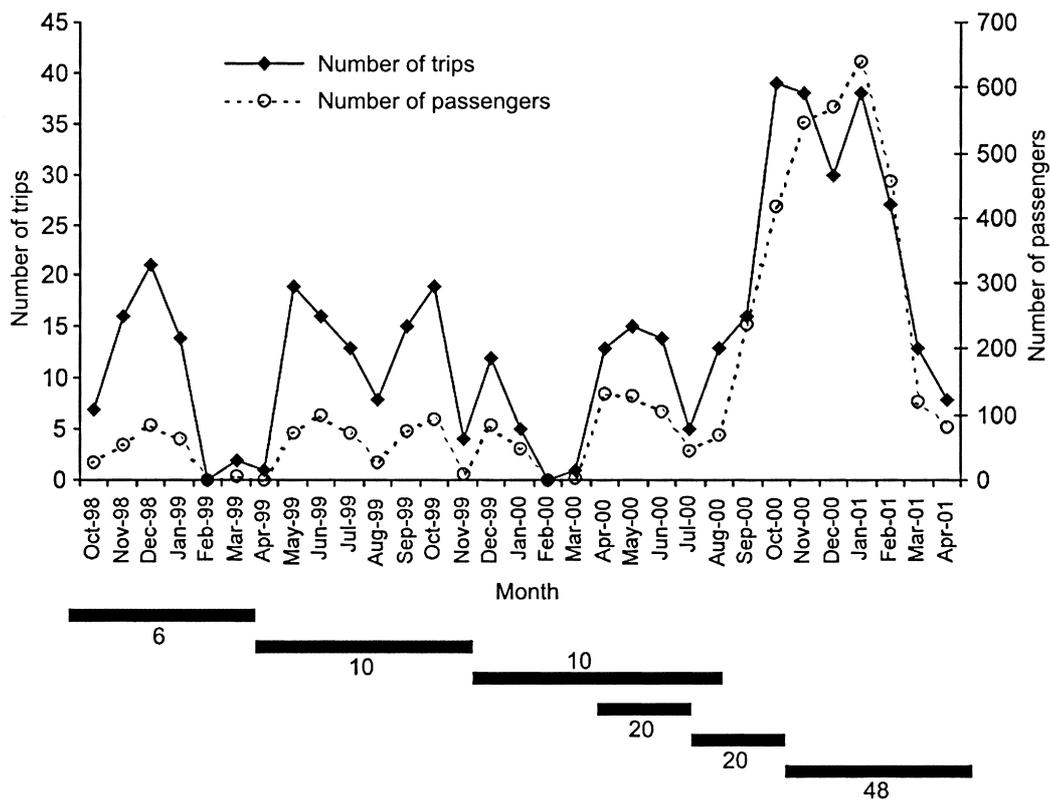


Fig. 2. Number of trips performed ($n = 442$) and number of passengers that sailed from Rawson (Bahía Engaño) for Commerson's dolphin watching between October 1998 and April 2001. The black bars indicate operational period and carrying capacity of the boats used during this period.

whale season. Most of the tourists coming to watch whales stay at Puerto Madryn or other cities less than 100km from Rawson, where the Commerson's dolphin watching could therefore be considered a new additional activity. The number of tourists engaging in dolphin watching at Rawson could be potentially close to 75,000, the number of tourists that visit the area from June to December. It is clear that the current capacity of the operations at this harbour is not enough for this hypothetical demand, leading to the possibility of the incorporation of new companies and therefore an increase in the number of boats. During 1999 the activity was deemed not profitable enough to continue. However, during the 2000 season the scenario changed, as a new operator worked with travel agencies.

If the boats performing trips from both localities were 80% full during the next few years, an estimated US\$ 200,000 per year could be the direct income for the dolphin watching industry.

Short-term responses of dusky dolphins

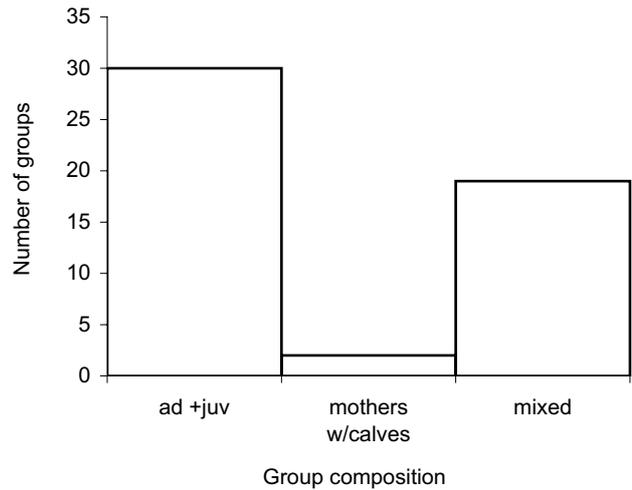
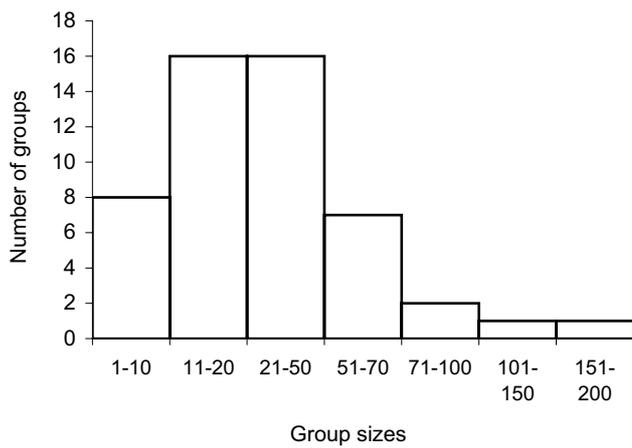
During summer 2001, 97 groups were sighted from the commercial vessel and 51 from the research vessel. The commercial vessel operated from 11 January to 3 March while the research vessel operated from 13 February to 5 May. Group sizes varied from small groups of 1-10 animals up to groups of 200 animals, with 20-50 animals the most common group size. Groups comprising more than 150 individuals were seen only from the research vessel, while smaller groups were seen more frequently from the commercial vessel (Fig. 3). However, during the period when both vessels operated at the same time, the differences in the frequencies of group size observed were not statistically significant (χ^2 test; $p = 0.057$) (Fig. 4a). Group composition also showed differences among vessels. Most of the groups observed were composed of adults and

juveniles but mixed groups were seen more frequently from the research boat (Fig. 3). However, for the period that both vessels were operating, there were no significant differences in group composition (χ^2 test; $p = 0.303$) (Fig. 4b). Therefore, the differences observed could be explained by seasonal variation in group sizes and dynamics. Group sizes would increase at the same time that there is a trend to form mixed groups, where all the age and sex classes are together towards the end of the summer.

A behavioural state or activity could be assigned to 48 groups from the commercial boat and 33 aboard the research vessel. The main activity of the groups before the commercial vessel approached was feeding, followed by travelling and socialising (Fig. 5). This could be related to the fact that the dolphins are associated with flocks of birds when they are feeding cooperatively. These flocks are visible hundreds of meters away, and are sought after by the captain of the commercial vessel to locate dolphins. From the research boat, although researchers carried out random transects, feeding was also the most important behaviour recorded before approach, followed by travelling. Resting was not seen prior to approach by the commercial boat, but was the third behavioural state before approaching with the research vessel; but no statistical inference can be drawn due to the small sample size.

When comparing the activities before and after the approach, it is noteworthy that from both vessels there is a decrease in feeding and an increase in travelling (χ^2 test; $p = 0.003$). From the commercial boat, dolphins were recorded changing their behaviour from feeding to travelling (McNemar; $p = 0.041$). This activity shifting was not significant for the research vessel (McNemar; $p = 0.445$), perhaps because of the more careful approach performed by this vessel and the constant 100m distance maintained by it. There are no differences in the amount of changes in activity

a) Research vessel



b) Commercial vessel

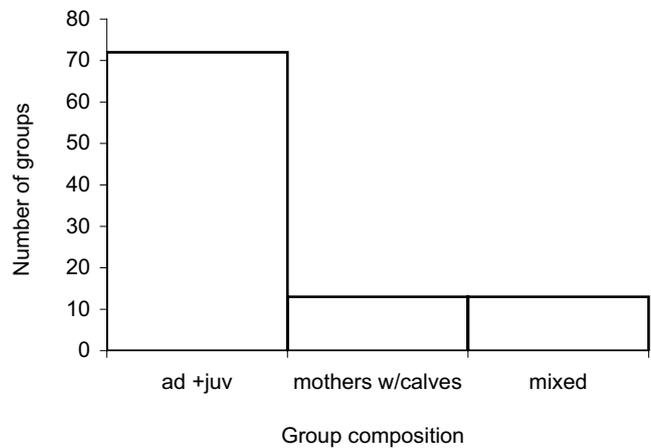
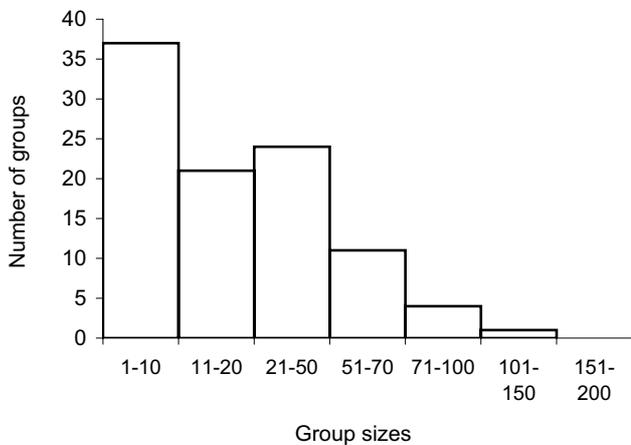


Fig. 3. Frequency of group sizes and composition of dusky dolphins watched from the research vessel ($n = 51$, upper) and from the commercial vessel ($n = 97$, lower) during 2001.

between the commercial and research vessels (χ^2 test; $p = 0.961$). Feeding is the most affected activity by the approach of the boat. Almost half of the times that the dolphins were found feeding, they changed their behaviour (Fig. 6).

Further analysis is required of the time taken by the dolphins to resume feeding. Sequences of travelling and feeding were seen, with shorter periods of time feeding when the groups were smaller (M. Degradi, pers. comm.). Würsig (1980) also observed that when the number of dolphins feeding altogether did not increase, feeding did not last long. This suggests that the effect of the boat on the aggregation of the groups of dolphins, as well as the time that the boat stays with the dolphins may preclude longer feeding bouts. The time the boat stayed with each group of dolphins was around 00:56h in 2000 and 00:25h in 2001. The time spent with dolphins is at the moment strongly influenced by the number of tourists waiting ashore to take the trip. However, it is only one of the variables to take into account for further analysis and to incorporate into the development of legislation aimed at ensuring sustainable minimal impact ecotourism.

Residence pattern, school size and short-term reaction to the boat by Commerson's dolphins

Commerson's dolphins are present in the area throughout the year although there are seasonal changes in abundance, with the highest occurrence during the months with the colder

surface water temperature (May-December) and the lowest numbers during the summertime, when surface water temperature increases to over 15°C (Brownell and Donovan, 1988; Goodall, 1994; unpublished data). The time required to find the dolphins during the summer is also higher (Fig. 7). From the boat, usually only one school of dolphins is sighted per trip. This school is often composed of small groups comprising two or three dolphins (*sensu* Shane *et al.*, 1986) distributed over a wide area. The modal school size between 20-50 animals, although aggregations over 100 dolphins have been recorded. During the colder months, the most frequent school size was between 20-50 animals while during the summer it was smaller, evenly distributed between 5 and 20 animals (Fig. 8). There were significant differences in the size of the school between the colder and the warmer months (Mann Whitney U test, $p < 0.001$).

The relative frequency of the behavioural states recorded from the boat is shown in Fig. 9. The behaviour of dolphins changed after the boat approached (χ^2 test; $p < 0.001$). Most of the times the animals were found resting, and the frequency of this behavioural state remained unaltered regardless of the presence of the boat (57%). The other important behaviour found before approach was travelling. The boat was usually sailing when dolphins were first sighted. Most of the times that travelling was recorded, the direction of the travel was toward the boat (87%). Once dolphins were around the boat it slowed, possibly leading to

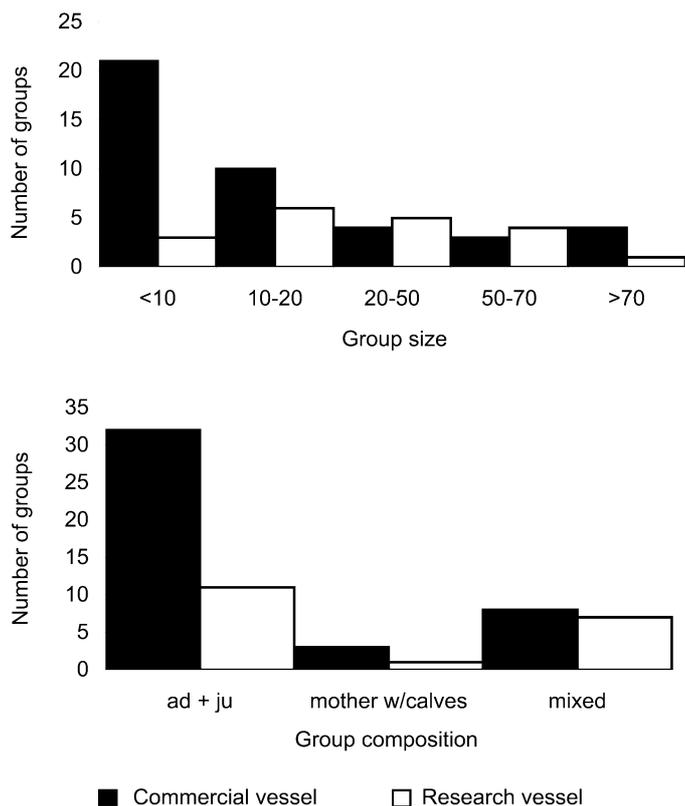


Fig. 4. Comparison of group sizes (upper) and group composition (lower) watched from the research vessel and the commercial vessel during the same period.

the reduced records of travelling during the interaction. Socialising also remained at the same level before and during the interaction. Finally, feeding was the behaviour that was recorded the least before the boat approached; however, when dolphins were around the boat the relative frequency of feeding increased. Dolphins changed their behaviour from travelling to feeding (McNemar; $p < 0.001$), from travelling to socialisation (McNemar; $p = 0.001$) and from travelling to resting (McNemar; $p < 0.001$) more often than the other way around. Dolphins changed their behaviour from resting to feeding more often than the inverse (McNemar; $p < 0.001$). Dolphins did not change their behaviour towards either direction when feeding and socialisation (McNemar; $p = 0.063$) or resting and socialisation (McNemar; $p = 0.547$) were analysed. The fact that dolphins presented a higher travelling frequency before approach than during the sighting could be explained if the distance at which dolphins are sighted and recorded as 'before' (100m) is not far enough to consider that the group has not been affected by the boat. Being so, and knowing that dolphins are attracted to the motorboats (Goodall, 1994), it is possible that this travelling is already an altered behaviour. When the boat is drifting the dolphins seem to perform their activities around it, including an increase in feeding.

As known for other Cephalorhynchus species, these dolphins aggregate in many small groups scattered in a wide area (Brownell and Donovan, 1988). Coscarella *et al.* (2000) reported the mean number of dolphins (sighted from the cliff) in a group (*sensu* Shane *et al.*, 1986) was 1.64 individuals (SD = 1.21; $n = 1585$). The modal school size is between 20-50 dolphins for the colder months and 1-5 dolphins during the summer. There are no significant differences in the school size recorded from the cliff and the boat (Mann Whitney U test; $p = 0.28$). The information

gathered from cliff-tops on behaviours displayed by dolphins showed evidence of a short-term behavioural reaction towards the boat (Fig. 10). The behaviours were clumped into two categories: groups displaying leaps at least by one dolphin and groups without leaps. The proportion of groups leaping in the vicinity of the boat (50m radius) was significantly higher than the proportion of groups away from the boat (more than 50m) or with no boats in the area (χ^2

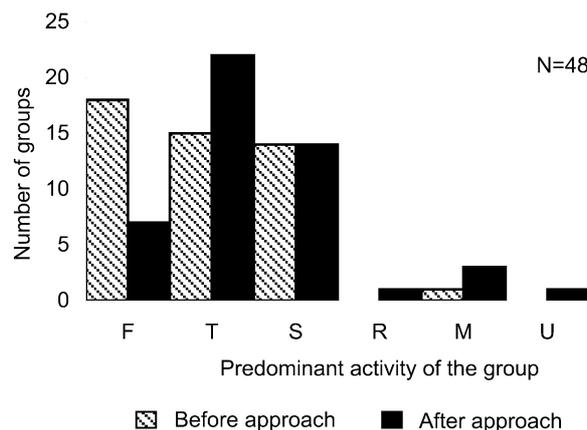
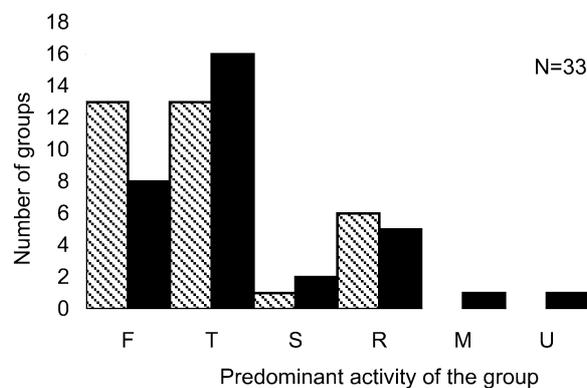


Fig. 5. Behavioural state of the dusky dolphins groups before (over 200m) and after approach by the commercial boat (upper) and the research vessel (lower).

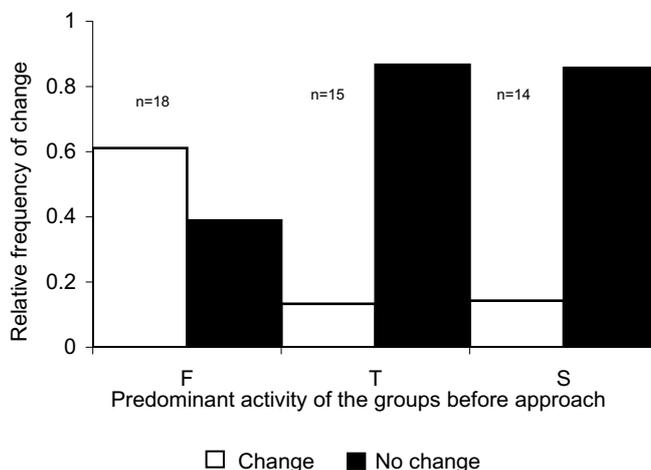


Fig. 6. Frequency of changes in activity classified upon the previous behavioural state. Data were gathered from the commercial vessel for dusky dolphin.

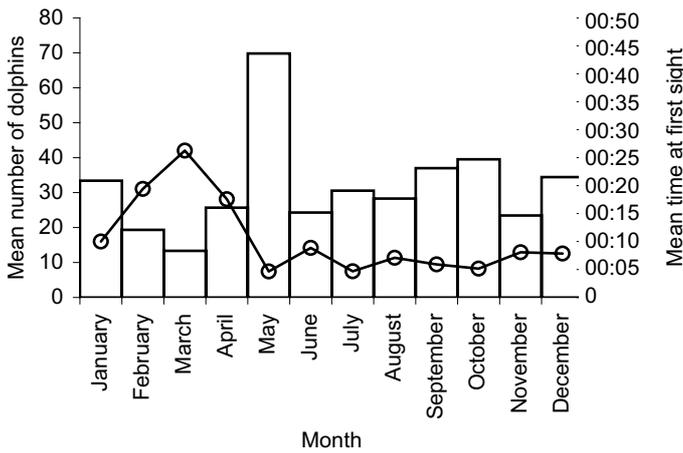


Fig. 7. Mean number of Commerson's dolphins watched from the boat during commercial trips (bars) and mean time spent searching for them (solid line) ($n = 442$).

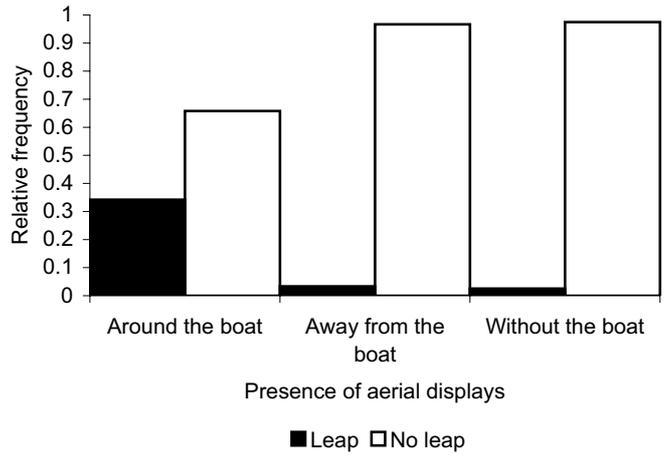


Fig. 10. Proportion of leaps recorded from cliff-tops by Commerson's dolphins around the boat, away from it and without the presence of any boats.

proportion test; $p < 0.001$; Zar, 1996). This suggests that dolphins surrounding the boat are more likely to leap than those animals away from it. No differences were found between the proportion of groups leaping when the boat is absent from the area and when dolphins are more than 50m from the boat (Table 2). Leaps are present during the interaction with the boat; however, this high activity reaction

Table 2

Multiple comparison between proportions of leaps recorded from cliff-tops. Proportion of recorded leaps from dolphins around the boat (about 50m away) are higher than those recorded in the absence of a boat in the area or for dolphins away from the boat.

	Difference	SE	q	$q_{0.05, \infty, 3}$	Significance
Around boat vs. without boat	26.834	3.274	8.195	3.314	Significant
Around boat vs. away from boat	25.383	3.385	7.499	3.314	Significant
Away from boat vs. without boat	1.451	0.929	1.563	3.314	Not significant

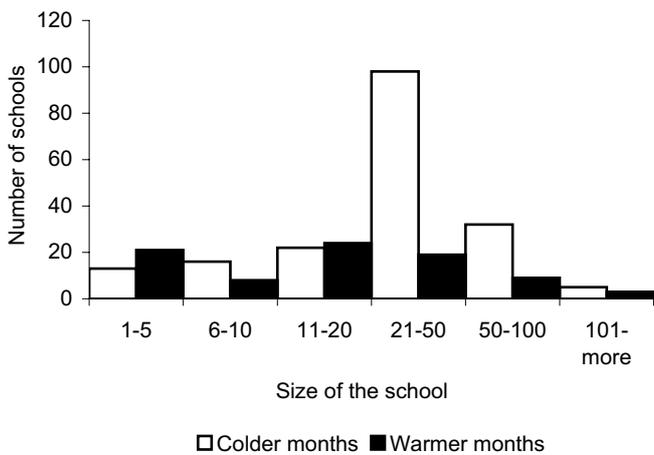


Fig. 8. Size of the school recorded from boat for Commerson's dolphins in Bahía Engaño ($n = 270$).

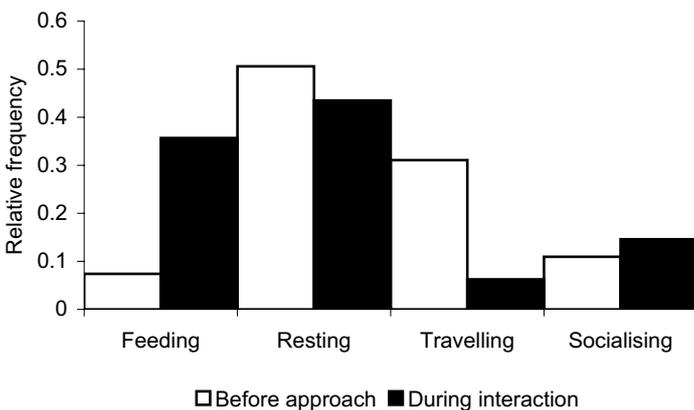


Fig. 9. Behavioural state of Commerson's dolphins before and during the approach from the commercial boat in Bahía Engaño.

seems to only last for very short periods and, later, the dolphins appear to resume their 'natural' behaviour. However, further research is needed to test this hypothesis.

The information presented here suggests that Commerson's dolphins react to the presence of the boat, but once the dolphins are around the drifting boat, they carry out activities that are usually not expected in a stressful situation. This could be interpreted as a sign that the dolphins (at this level of activity) are not severely affected by boats.

Management and perspectives

Tourism is becoming one of the most important economic activities in Patagonia. New investments are being made every year, mainly in ecotourism. Within this context, the provincial government is promoting the development of tourism related activities. The dolphin watching trips in Patagonia are now beginning to be considered as a part of the tourist attractions of the region. The activity in Chubut Province is growing rapidly enough to be considered as a potential threat to dolphin populations if it is not adequately regulated and is therefore something that requires monitoring in the near future. For dusky dolphins, these activities are considered as complementary to the capital invested in the whalewatching industry already established in the region. However, Commerson's dolphin watching is a new income for the city of Rawson and may eventually draw this city into the established economic tourist circuit.

The data presented here indicates that this activity must be regulated by a set of rules independent of those developed for right whales, addressing the behavioural differences of each species. Some precautionary rules have been proposed by the Marine Mammal Laboratory to the OPT (available

from the author), although the final legislation must be based on additional studies. At the present time the enforcement authority has the facility to easily change the conditions of the operators' licenses. Depending on the decisions taken by the management agency, this activity may become a truly sustainable economic utilisation of dolphins.

ACKNOWLEDGEMENTS

This study was funded by the National Research Council (CONICET-PIP 0742/98) and the Agencia Nacional de Promoción Científica y Tecnológica (01-04030 A). Facilities were provided by Centro Nacional Patagónico (CONICET) and Fundación Patagonia Natural. The Government of Chubut Province and Rawson City provided useful help and the permission to carry out the study. The tour operators David Peralta — (Servicios Náuticos Rawson SRL), Gustavo Gonzáles (Toninas Adventure) and Rafael Benegas (HydroSport SRL) provided invaluable collaboration and patience. The field assistants (Mariana Degratti, Griselda Garaffo, Nancy Mora and Parissa Yazdi) helped to collect and download data. Bárbara Berón Vera improved a preliminary version of the manuscript. Finally, thanks are also given to both reviewers (Dr V. Peddemors and Dr S. Berrow) who made important and useful comments that enhanced the expression of the ideas. Finally, special thanks to Greg Donovan who improved the language far beyond his editorial duties.

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Date received: January 2002.

Date accepted: July 2002.