The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	María Belén Argüelles
Project title	Urban Southern right whales: pattern use of Bahía Nueva and collision risk with ships in a traffic maritime area in Patagonia, Argentina.
RSG reference	21749-2
Reporting period	June 2017 – June 2018
Amount of grant	£5000
Your email address	belenarguelles@gmail.com
Date of this report	June 2018

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Continuing the monitoring of whales and ships in Bahía Nueva.				• 20 days from July to December of fieldwork were done. • Half of fieldwork was done using the hexacopter drone to study distribution and abundance patterns. • 7 days of field work was done using a research vessel to complement hexacopter data to study distribution and abundance patterns. • 3 days of field work were done to tag whales. • During whale season, a total of 78 transects were conducted inside Bahía Nueva, Golfo Nuevo in order to study distribution, abundance and behavior patterns of southern right whales (Figure 1). • Line transects were conducted to determine usage patterns of Bahía Nueva by whales and ships and consisted of the navigation of straight lines with a semi-rigid boat and with a drone (Figure 2). • The amount of whales and boats and how both of them use the area was determined. • Since 2013, a total of 1705 whales were sighted. • The number of ships in Bahía Nueva in the same period was 315. • Whales were classified as solitary individuals, mother with calf and mating groups. Other associations between whales were identified. • Surface activity was the most performed by whales, followed by travelling and resting. • 64.4% of the ships were nautical, 30.42% commercial and 5.18% corresponded to ships from the

				• Distribution maps showed that whales are distributed in all Bahía Nueva (Figure 3), whereas commercial ships used the route to enter to Puerto Madryn ports to navigate and nautical ships the southwest area of bay (Figure 4). • The distribution of whales varied per month (Figure 5). • Mother and calf were sighted most of the time in the north area of bay. • 3 days of field work were done to tag whales. • A new technology was used to improve raspiwhale (Figure 6) a non-invasive tag used for measuring temperature, pressure, 3-dimensional movements (speed, rotation, and pitch), sound and video recording in whales. It uses an open source microcomputer Raspberry pi and is attached to the whales via suction cups that are released from the whale by a programmable electronic system. • Raspiwhale placement maneuverer included the selection of the target whale, the approach to the whale at constant speed up to 3 or 4 m from it, and the positioning of rW1 on the
To evaluate the impact of whale watching activity				This objective was partially achieved because field work planned to evaluate the impact of whale watching activity directly from raspiwhale could not be done. Even it was possible to tag whales, it was difficult to coordinate whale watching boats performing its whale watching activity directly on whales tagged, which limited the number of samples available to statistical analyses. Although this objective was not fully achieved in this opportunity, it is partially achieved because we count on with information about whale watching activity obtained from direct observation. Whales respond in three different ways to boats: approaching to boat, being

				The variable that most influence whales response to boat was engines. If engines were turning on whales tended to avoid the boat, whereas when engines were turning off whales tended to approach the boat.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

Every year we have to deal with adverse weather conditions. Even whale season extends from May to December, the predominant winds difficult the access to the study area.

It was not possible to solve the problem for achieved objective 2, we expected to find no difficulties but the coordination with whale watching boats was a problem. Nevertheless, we made direct observations to deal with this problem.

3. Briefly describe the three most important outcomes of your project.

1. Risk maps showed the areas that are shared by whales and ships.
Whales are distributed mainly in three sites inside Golfo Nuevo, in Puerto Pirámides, El Doradillo and Puerto Madryn. Anthropic activities in Golfo Nuevo occurred in different ways and with different intensities. On one hand, El Doradillo is a natural protected area where has place coastal whale watching and the navigation is prohibited and there is a controlled navigation in Puerto Pirámides, where only whale watching activity is licensed. On the other hand, in Bahía Nueva there is a free nautical navigation and a controlled commercial navigation with a corridor for ships to enter Puerto Madyn port.

Navigation activities in Bahía Nueva are commercial and nautical. Commercial ships are associated with the two piers of the city and had a variable movement along the whale season, being fishing ships which more contributed with these variations due to it marked seasonal, with picks in September and October. Nautical navigation was mainly represented by diving activity (Figure 7).

2. Whale density estimation in Bahía Nueva was 4, 18 whales/km^2, similar to estimations in other areas of high whale concentration. On the other hand, whale estimation per transect indicated that whales density is similar inside Bahía Nueva. This suggests the importance of sampling deep waters areas in order to obtain more accurate estimates of the number of whales in Golfo Nuevo.

3. Risk of collision between whales and ships are one of the main problems for whales nowadays. Risks of collision involve whales and ships in different ways. On one hand, the risk of collision with large vessels could affect the survival of the whales but could also pose a risk to the crew because the boat could drift. On the

other hand, a risk of collision with small boats may have greater effects on people than on whales. In Bahía Nueva, 30% of whale observations were made in superposition with the route used for commercial vessels to enter Puerto Madryn ports (Figure 8). In this area whales perform long dives.

4. Whales associations reported indicate that whales are not asocial animals. By contrary, whales could present some kind of lasting bond. When whales are associated, depending on the number of whales in a group, whales respond different to boat presence. Thus, the individual risks are greater.

5. A spatial model to predict whale's abundance in Bahía Nueva was performed. The model indicated that whales are distributed in all Bahía Nueva and identified areas of high concentration of whales (Figure 9).

6. A new non-invasive tag to study whales was developed. Rw is the first tag in the world created using the technology of an open source computer. Rw is attached to the whales via suction cups. This system is non-invasive and does not harm the whales unlike other satellite tracking systems.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

Local community was involved actively during the whale season by providing information about their activities. Local community is benefitted in different ways. On one hand, the community involved in nautical activities is benefitted through the knowledge of how whales behave in presence of small vessels (windsurf boards, kayaks, sailboats) and in where sites of the bay whales are distributed more frequently. On the other hand, the community involved in commercial activities is benefitted through the knowledge of which is the site near the bay where whales dive. What is more, whale watching agencies are benefitted trough the knowledge of the effects that the activity has on whales and, Tourism Ministry of Chubut Province is benefitted with this information in order to improve management actions. On October 4th 2017, we organised the Workshop Whales Urbans: "Building dialogue networks for the shared use of space between whales and people" (Figure 10), in which I presented some results of my investigations. The objective of the workshop was to rethink together the possible preventive measures that should be adopted by the actors involved directly in the use of Golfo Nuevo in order to avoid a collision and thus to ensure both the protection of the whales and the people in the area. Strategies and work methodologies were discussed to minimize the risks in the areas of shared use between whales and people.

5. Are there any plans to continue this work?

Yes, there are many plans to continue and improve this work. We have been doing this project since 2013 and we will continue improving it. Our plans for the future are very similar to the ones from last year, as in to continue this research boat-based and adding new technology to study whales' distribution using

drones and to develop new skills of raspiwhale. The next steps are to focus this project on obtain indicators of the impact of the environment on southern right whales. These impacts can be both natural, and those produced by human activities. Southern right whale is a key species for the region because it is considered as an indicator of the health of the ecosystems. On the other hand, in the Península Valdés area, the main breeding area, whales constitute an important resource for tourism. Six companies make approaches with boats from June to December, and may have some effect on the animals. The emphasis will be put on the development of non-invasive devices that allow the measurement of physiological and behavioral parameters in whales. This will allow improving the management and use of a key resource for region. Whale watching tourism is one of the main economic resources of Chubut Province. Puerto Madryn is the city with the largest contribution of direct services to tourism (hotels, transportation, restaurants, guides, etc.) and the economy and development of the town of Puerto Pirámides depends heavily on the whale watching tourism activity. This scenario of continuous increase of tourist influx indicates, on one hand, the importance of the species for the regional economy, and on the other hand, that the activity reached a level of development such that it deserves to be considered a potential factor of impact on the resource. This project will allow the derivation of specific management actions. We will focus to improve scientific information, increase the public's awareness and achieve political decisions in order to safeguard the whales in the region.

6. How do you plan to share the results of your work with others?

The results of this research were shared to presentations at congress, scientific papers that are in preparation, notes in local and national newspapers, magazines and radios, reports presented to Dirección de Fauna y Flora Silvestre y Ministerio de Turismo, Subsecretaría de Conservación y Áreas Protegidas de Chubut, presentations in CENPAT abierto (our research centre every year open its doors to receive the local community to know what we are doing). Figures 10-15.

- Notes in local newspaper Diario Jornada. http://www.diariojornada.com.ar/212788/sociedad/madryn_investigan_la_inter accion_entre_las_ballenas_y_los_barcos/.
- Notes in local newspaper Diario de Madryn.
- Notes in local newspaper Diario El Chubut. http://www.elchubut.com.ar/nota/2018-5-28-22-56-0-investigan-la-interaccion-entre-ballenas-de-puerto-madryn-y-los-barcos.
- Interview to CONICET. http://www.conicet.gov.ar/que-tan-bueno-es-que-las- ballenas-se-acerquen-a-los-barcos-turisticos/.http://www.cenpat-conicet.gob.ar/investigan-la-interaccion-entre-las-ballenas-de-puerto-madryn-y-los-barcos/.
- Website www.ideaspi.com.
- http://www.dicyt.com/viewNews.php?newsId=38882.
- http://www.elpopular.com.ar/multimedia/?n=114417.
- https://twitter.com/lu17com/status/999374790140940288.
- https://www.facebook.com/radio3cadenapatagoniaoficial/posts/81817022503 8874.

- https://inngeniar-estudios.blogspot.com/?view=classic.
- http://bio-ciencia.blogspot.com/.
- https://www.adnsur.com.ar/2018/05/investigan-la-interaccion-las-ballenas-madryn-los-barcos/.
- https://lu17.com/tambien-es-noticia/investigan-la-interaccion-entre-las-ballenas-de-puerto-madryn-y-los-barcos.
- http://larocka1029.com/2018/05/29/investigan-la-interaccion-entre-ballenas-de-puerto-madryn-y-los-barcos/.
- Participation in CENPAT abierto.
- Participation in Semana de la Creatividad e Innovación.
- Participation in 1° Jornadas de Tecnología Marina.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

The Rufford Foundation grant was used for 1-year period (one whale season). The whale season extends from April to December. We have been doing this project since 2013, and the 2nd RSG was used for 2017 season.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. Exchange rate: 1 Sterling Pound = 19 Argentine Pesos

Item	Budgeted Amount	Actual Amount	Difference	Comments
Hexacopter drone	£1660	£2264	£604	there was an increase in drone price
Batteries SCD	£120	£0	£0	it was not necessary to buy batteries
Viatic nautical personal (£200/day per 10 days £2000)	£2000	£2000	£0	no comments
Canon boat and pickup (£2/day per 10 days £20)	£20	£20	£0	no comments
Fuel ground transportation (£30/day per 10 days £300)	£300	£300	£0	no comments
Fuel boat transportation (£70/day per 10 days £700)	£700	£700	£0	no comments
Food for assistants at field (£20/day per 10 days £200)	£200	£200	£0	no comments
Total	£5000	**£5484**	-£484	

9. Looking ahead, what do you feel are the important next steps?

It is important to continue scientific research in Bahía Nueva regarding interactions between whales and anthropic activities. The next steps are:

- Continue the monitoring of interactions between whales and ships in order to organise nautical and commercial activities in the area.
- Improve raspiwhale to other uses.
- Obtain physiological and behavioural parameters in order to evaluate the health status of whales.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

We have sent an update of our project to The Rufford Foundation and we used The Rufford Foundation Logo on all the posters and oral presentations in Congress and informative talks. The support of the Rufford Small Grants will be mentioned in the papers in preparation.

Figures

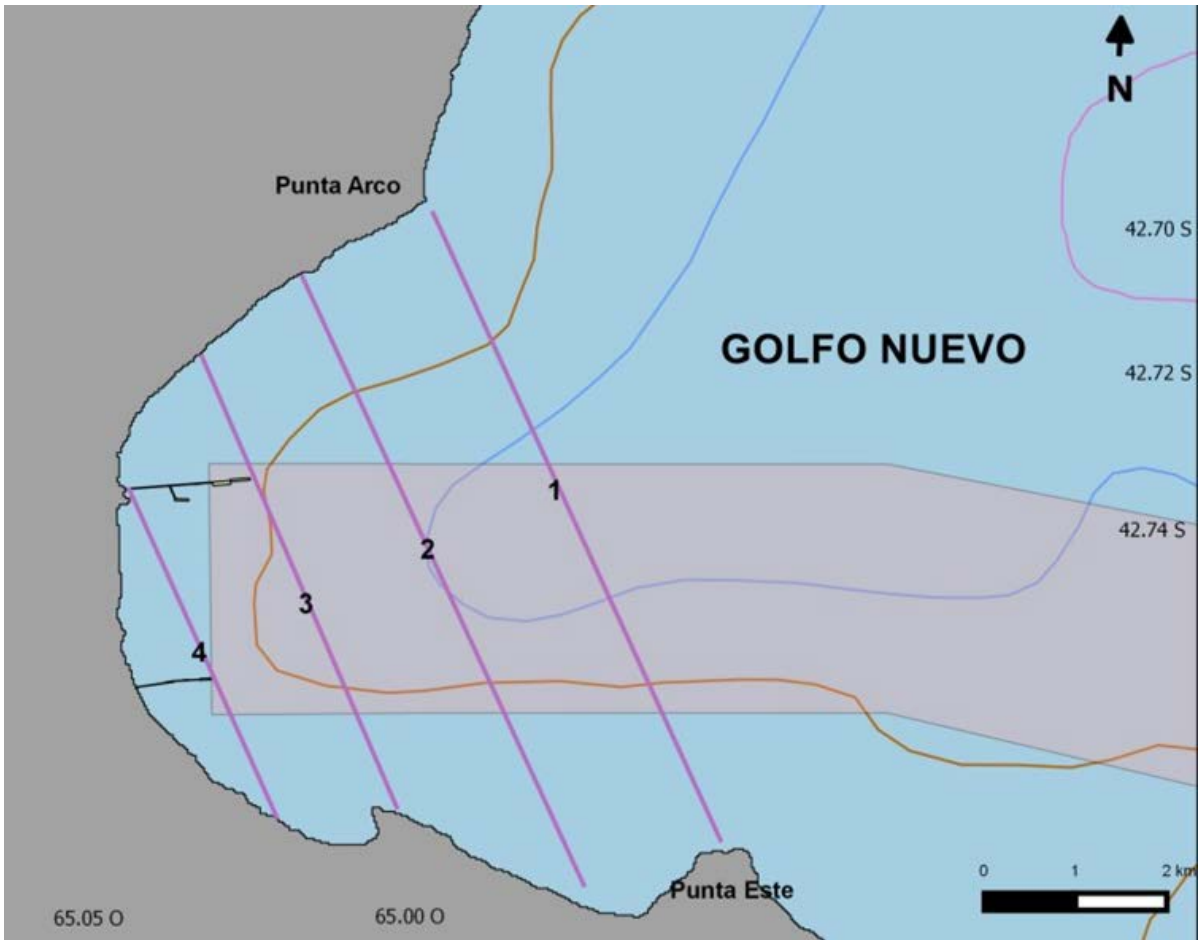

Figure 1. Study area Bahía Nueva, Golfo Nuevo

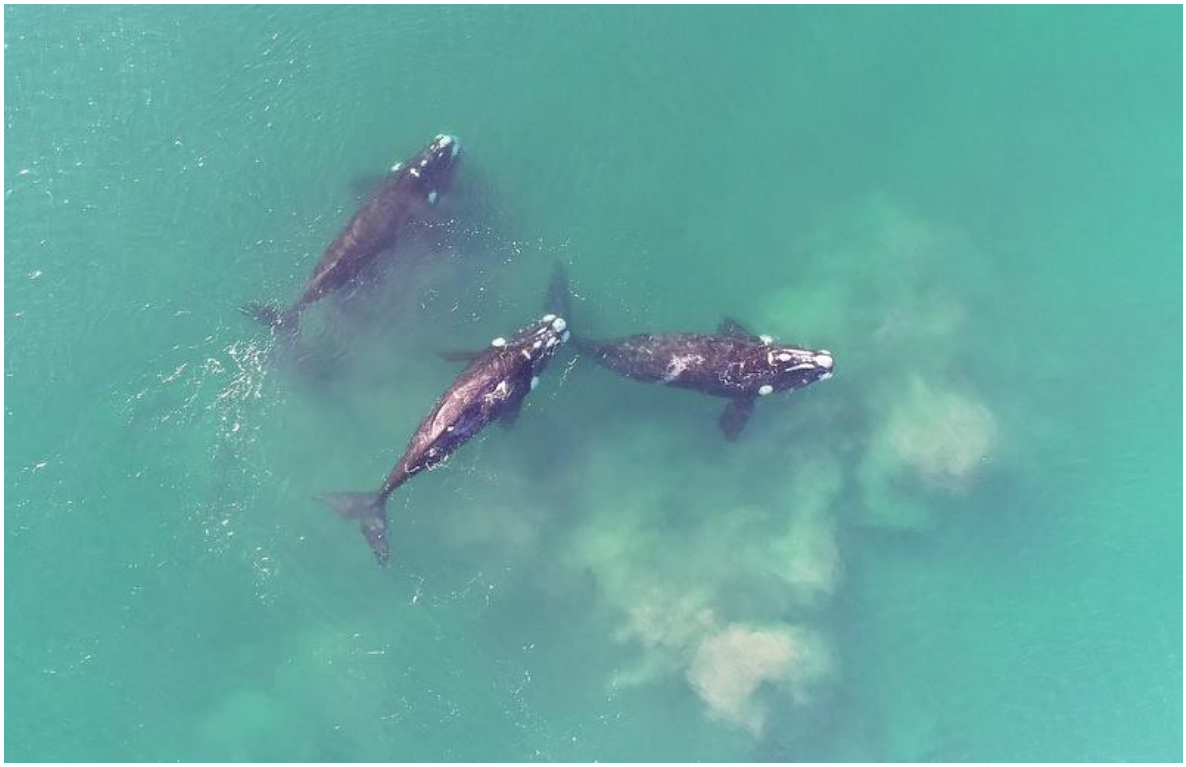

Figure 2. Drone image of whales in Bahía Nueva.

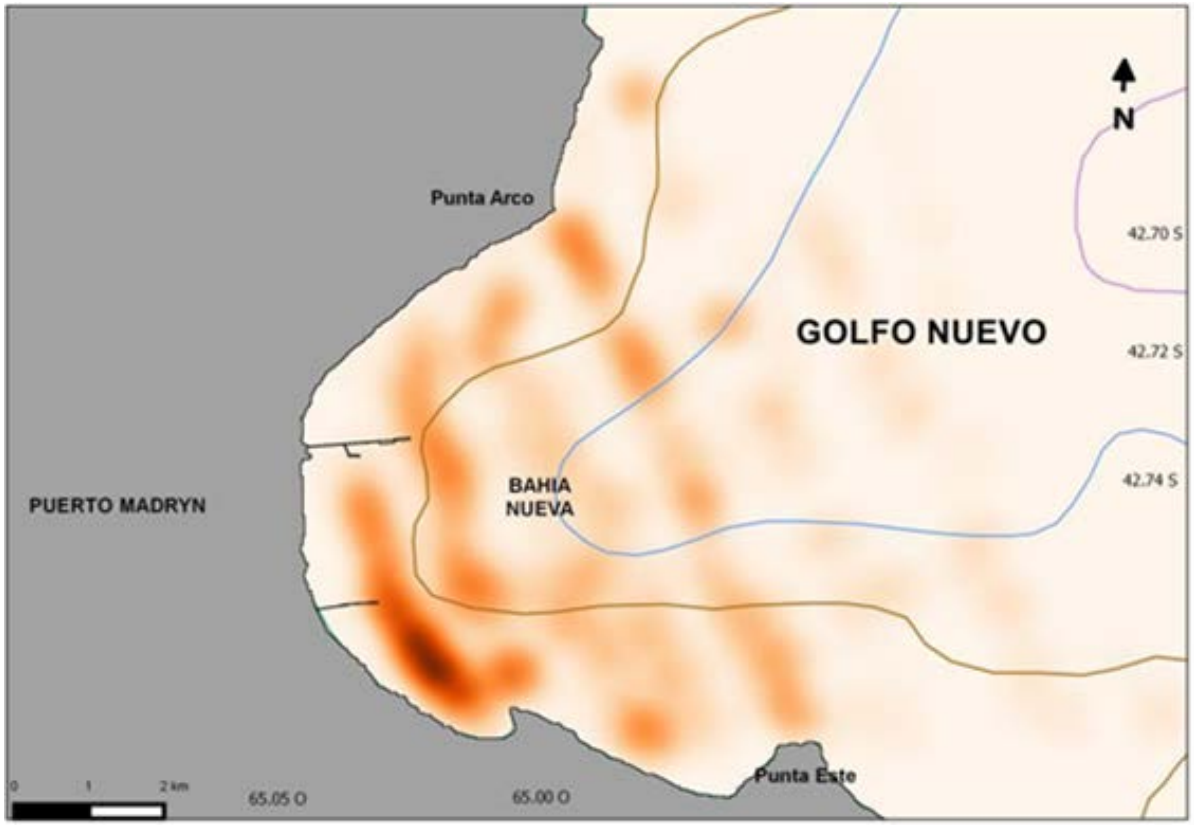

Figure 3. Whale's distribution in Bahía Nueva.

Figure 4. Ships distribution in Bahía Nueva. Left commercial ships, right nautical ships.

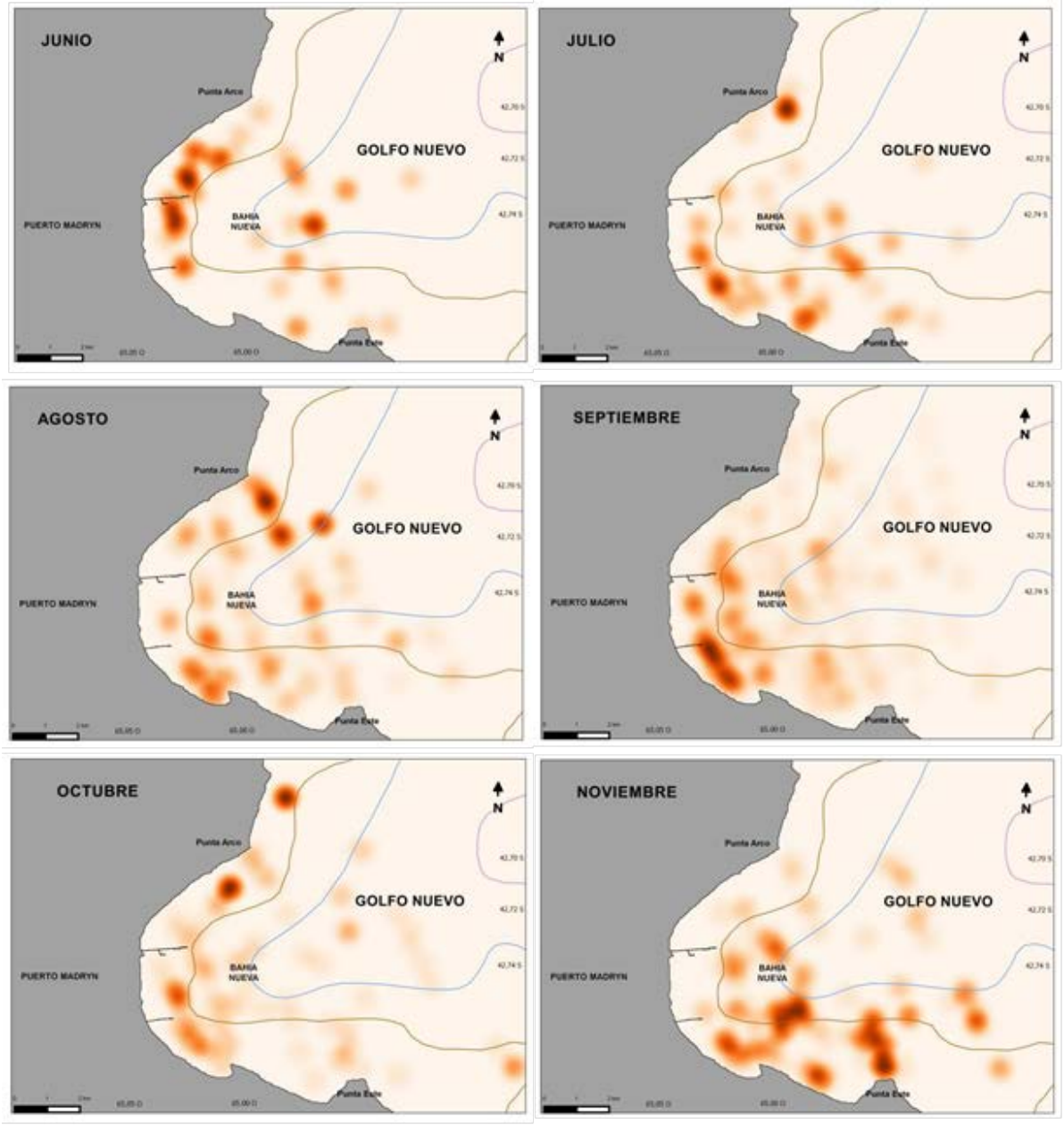

Figure 5. Distribution of whales per month.

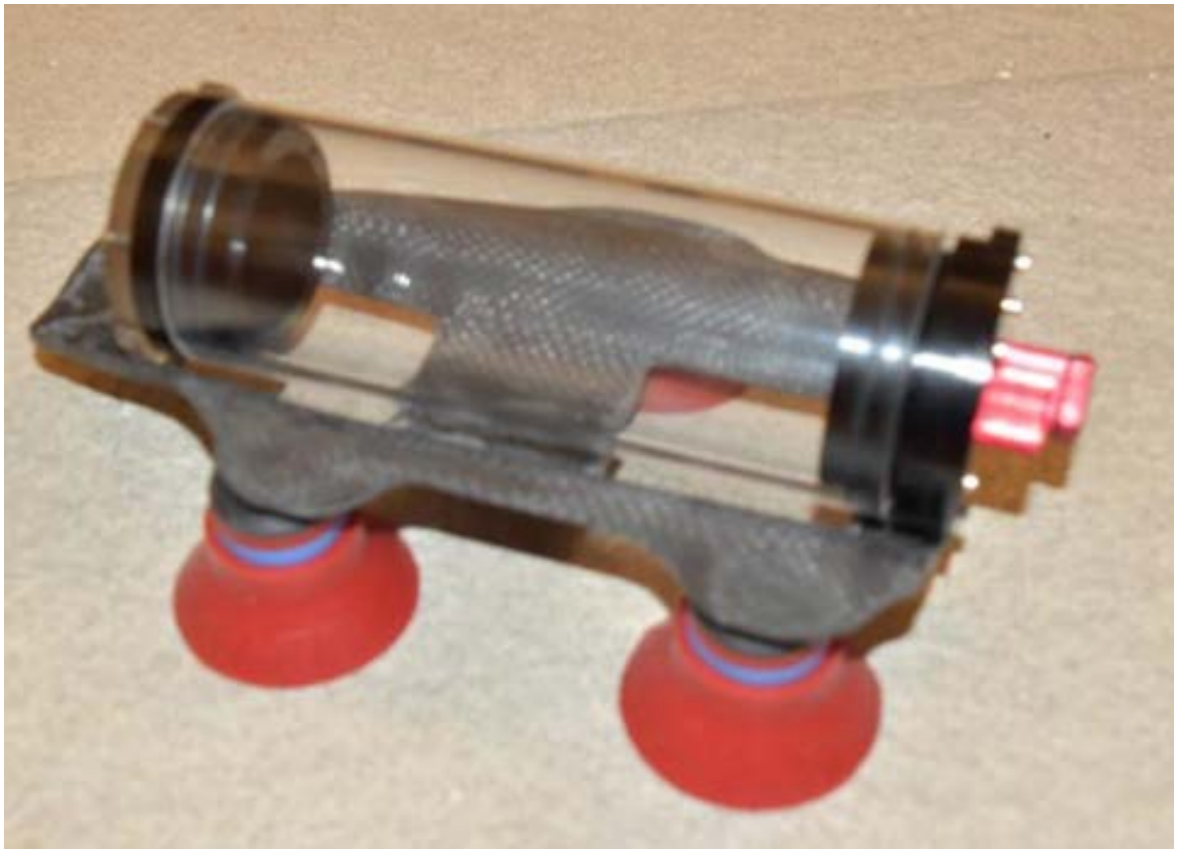

Figure 6. Technological changes made in raspiwhale, a non-invasive tag for whales.

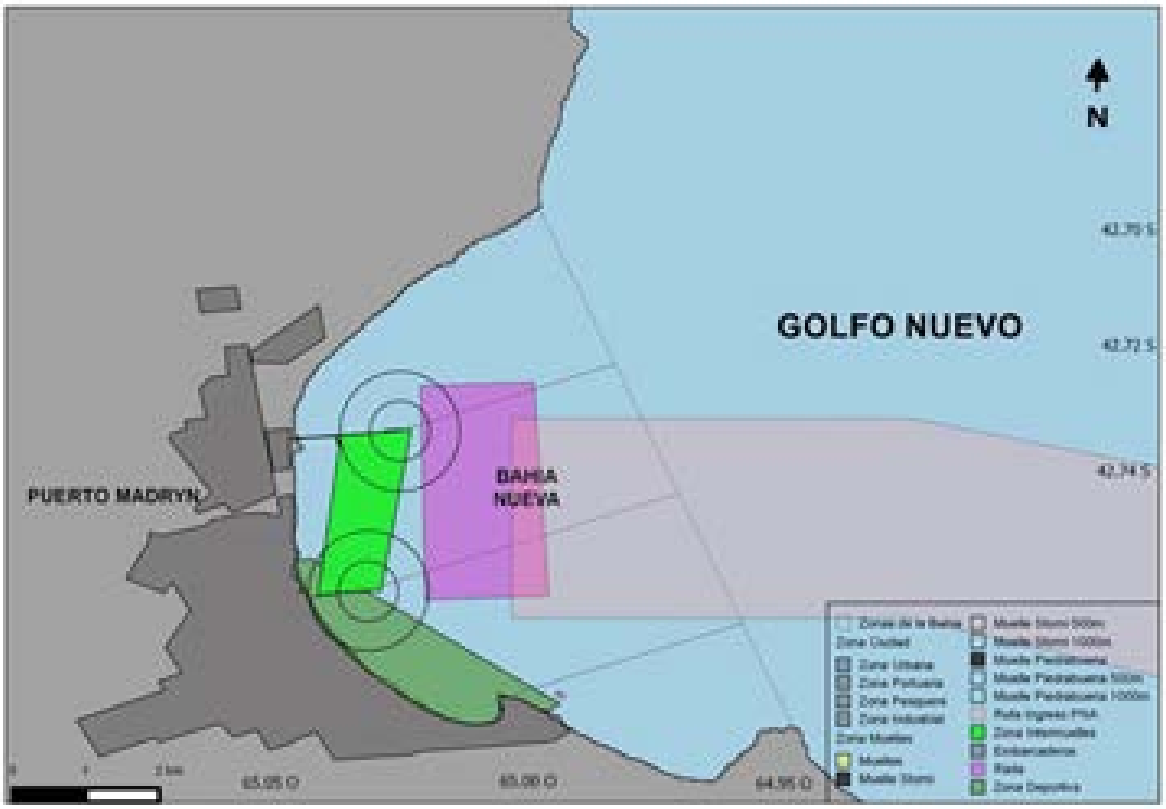

Figure 7. Areas inside Bahía Nueva.

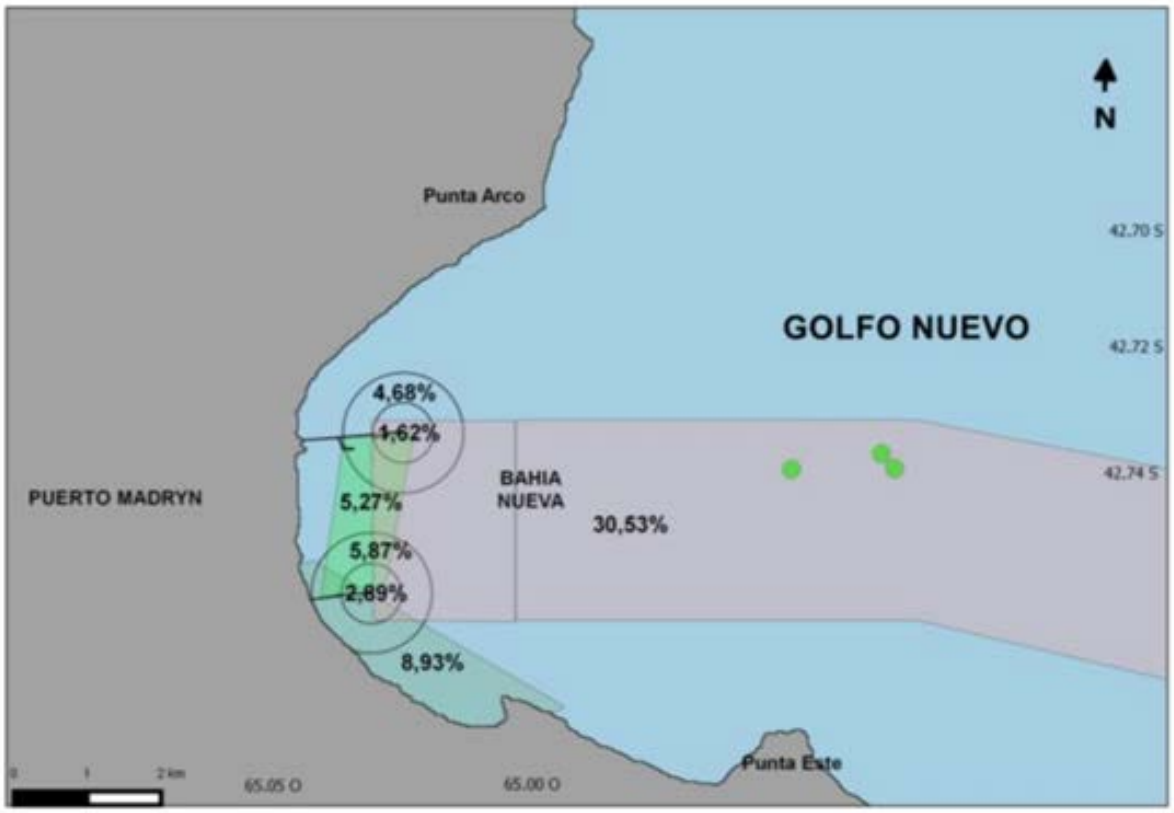

Figure 8. Percentage of whales observed in Bahía Nueva.

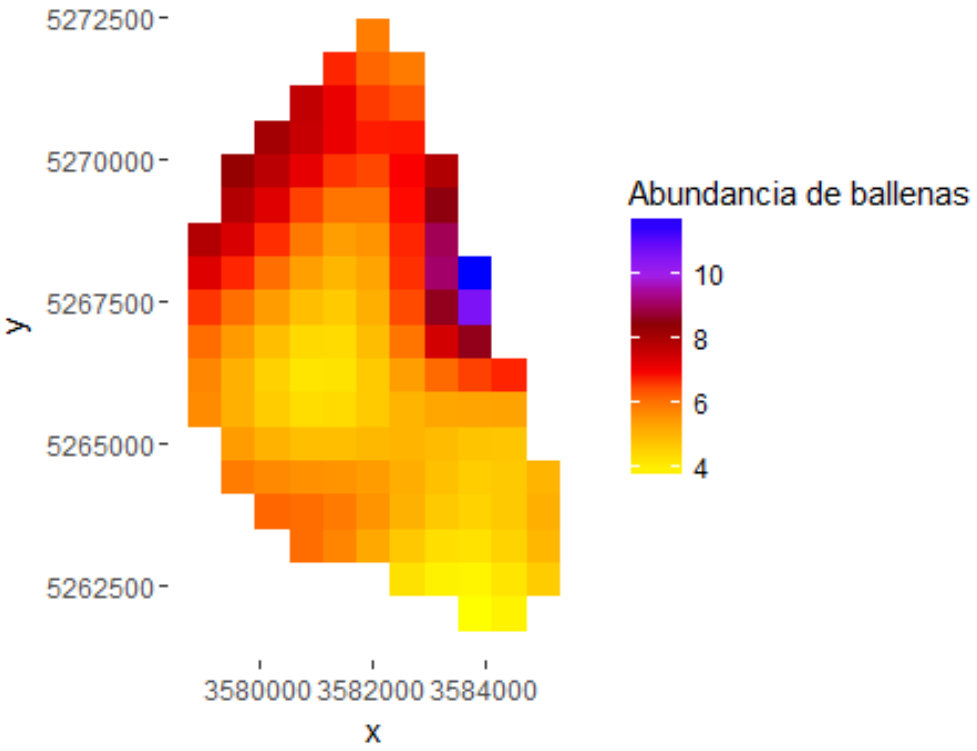

Figure 9. Whale abundance in Bahía Nueva.

Figure 10. Workshop Urban Whales

Figure 11. Participation in 1° Jornadas de Tecnología Marina.

Figure 12. Participation in Semana de la Creatividad e Innovación.

23/05/2018 | DIVULGACIÓN CIENTÍFICA

Investigan la interacción entre las ballenas de Puerto Madryn y los barcos

El estudio es llevado adelante por Belén Argüelles, becaria posdoctoral del Centro para el Estudio de los Sistemas Marinos (CESIMAR-CONICET).

Fotografía: gentileza Grupo de Ecofisiología Aplicada (GEA CESIMAR-CONICET)

Cuando las colas de las ballenas empiezan a asomarse imponentes sobre el agua, motivan la visita de personas que llegan de todas partes del mundo para poder observar el fenómeno que a partir del mes de mayo, aproximadamente, sucede en Puerto Madryn, Provincia del Chubut. Sin embargo, no son solamente estos animales quienes ocupan las aguas costeras, sino los humanos en el desarrollo de actividades turísticas y comerciales. En el uso de ese espacio común, pueden generarse potenciales conflictos entre humanos y ballenas.

Desde 1970 y hasta la actualidad, se estima que la población de la Ciudad de Puerto Madryn, aumentó catorce veces. Ese crecimiento se ve reflejado en una mayor cantidad de actividades que se realizan en torno al mar. Diariamente navegan la zona, embarcaciones comerciales, buques pesqueros, mineraleros, portacontenedores, entre otros. Y además se observan embarcaciones deportivas y de pequeño porte que pueden estar o no relacionadas a una actividad comercial como las lanchas de buceo, lanchas semirrígidas de particulares, embarcaciones sin motor como veleros, kayaks y tablas de windsurf. "Ese aumento demográfico humano coincide con un crecimiento en el número de ballenas que visitan la zona. Llegué a contar unas 200 el año pasado, durante un solo día dentro de la Bahía", describe Belén Argüelles, becaria posdoctoral del Centro para el Estudio de los Sistemas Marinos (CESIMAR-CONICET).

Figure 13. Interview to CONICET.

Figure 14. Whales of Bahía Nueva.

Figure 15. Field work.