

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	Martín Blettler
Project title	"Plastic debris in sediments of a large South American river (Paraná River): occurrence and spatial distribution"
RSG reference	21232-1
Reporting period	2 nd February 2017 - 2 nd February 2018
Amount of grant	£5000
Your email address	mblettler@inali.unl.edu.ar
Date of this report	1 st February 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
<p>1) "to determine particle number, size, shape and weight of plastic debris deposited on sandy banks (right and left) and bars (central position) in the Paraná River, nearby the Paraná city (Argentina)".</p>				<p>All collected macro-, meso- and micro-plastic particles were counted, measured and classify (one by one). A total of five sampling campaigns were performed during 2017. We sampled upstream and downstream the Paraná city as planned (see proposal). However, instead of bars we sampled islands located in front of the Paraná city. This change was given by the lack of emerged bars during the sampling campaigns (unfortunately, annual hydrological levels cannot be predicted with accuracy). However, we additionally sampled a large freshwater lake located in front of the Santa Fe city (drinking water supply for this city). This extra sampling allowed us a better understanding of the influence of plastic pollution from large cities on lakes. Results were compared with others freshwater lakes worldwide. This lake sampling proved to be strategic since we get great attention from media (TV, reporters, and newspapers), and even attention from politicians (Santa Fe government) who invited us to collaborate in the modification of the Solid Waste Management policies of the city. Currently, we are working together.</p>
<p>2) "To find out the dominant fraction of debris plastic (micro-, meso- or macroplastic) as well as its origin when possible (bottles, bags, packaging, clothing,</p>				<p>Objective fully achieved. We found that macroplastics was the dominant fraction. Food wrappers (mainly polypropylene and polystyrene), bags (high- and low-density polyethylene), bottles (polyethylene terephthalate), and disposable styrofoam food</p>

<p>etc)".</p>			<p>containers (expanded polystyrene) were the dominant items recorded in our study. Since this result is significant in the context of the international literature, we are currently writing a manuscript review focusing on macroplastics in freshwater environments and developing countries. The tentative title is "Analysis of the freshwater plastics literature: identification and recommendations of knowledge gaps and focus areas in developing countries".</p>
<p>3) "to establish spatial patterns of distribution of plastic debris in relation with morphological (erosion, depositional areas, etc) and hydrological (water levels) features of the river".</p>			<p>This objective was partially achieved. The river keeps relatively high water levels during 2017. Specifically, during flooding the river banks were completely covered by water. This fact precluded the planned sampling since plastic debris were covered and dragged by the water current. Unfortunately, this situation was not correctly contemplated in the proposal.</p>
<p>4) "to estimate plastic concentrations in relation to the distance from the urban areas (up and downstream), particularly the Paraná city".</p>			<p>Objective fully achieved.</p>
<p>5) Extra objective. While the following objective was not considered in the original proposal we incorporated it after RF's suggestion (via email interchange). <i>"To detect pathways of plastic pollution in the region. For example, one of Argentina's largest industrial centres (Rosario/San Lorenzo) is located in the study area and seems to include facilities of one of the world's largest plastics manufacturers".</i></p>			<p>Fulfilling our commitment, we performed an exploratory sampling campaign in Puerto San Martín (San Lorenzo department, nearby Rosario). We took some sediment samples from river banks in order to detect microplastic pellets. Even when it is an important industrial area, we did not detect plastic resin pellets (used in plastic manufacturing). We did detect microplastics but associated with fragmentation processes of domestic macroplastics. However, we recognise that new sampling efforts are requested to confirm (or reject) this preliminary result.</p>

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

Rising gas prices and the inflationary process in Argentina's economy was a growing threat to successfully complete this study (inflation reached 24.8 per cent in 2017; (Source: Financial Time <https://www.ft.com/content/510d01fa-0660-11e8-9650-9c0ad2d7c5b5>). To deal with, we made some changes in the budget (see Point 8 below). Specifically, we save some money buying less expensive trade marks for optical equipment. Sampling campaigns were the most impacted activity since there was a significant increase of fuel and oil prices during 2017. Additionally, we had to pay to boat and track drivers (technical staff) more money than expected due to the inflationary process.

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

3.1) Scientific achievements.

3.1.1) A first publication in an international peer review journal.

Blettler, Martin C. M.; Ulla, Maria Alicia; Rabuffetti, Ana Pia and Garelo, Nicolás. 2017. Plastic pollution in freshwater ecosystems: macro-, meso-, and microplastic debris in a floodplain lake. *Environmental Monitoring and Assessment*, 189:581. <https://doi.org/10.1007/s10661-017-6305-8>. (H index: 77; Impact factor: 1.7) (See "Funding information" section of the paper: "This study was fully supported by the Rufford Foundation, UK (RSG grant; Ref: 21232 1)").

This is just the first publication; we are currently writing two more papers based on the results obtained from several sampling campaigns.

3.1.2) We created the first dataset comprised of qualitative and quantitative information about the occurrence and distribution of plastic debris in sandy sediments in the large Paraná River.

3.1.3) We found an alarming number of macroplastics were recorded by comparison with other studies worldwide, with a dominance of household waste over industrial ones. Macroplastic surveys would not serve as surrogates for meso- or microplastic items, as proposed by other authors. Our results also indicated a similar relevance of microplastic contamination regarding other studies worldwide (704 particles per m²). The large amounts of plastics recorded endanger the Paraná River ecosystem.

3.2) Media attention.

We get a great local and national media attention trough many interviews with the leader of the project and also with the full team:

TV:

i) 5R TV Rosario. Interview. Dorrego 627 1er Piso, Rosario, Santa Fe. Journalist: Salomé Crespo.

ii) TV EL LITORAL. TV show: "Arriba Santa Fe", Santa Fe, Argentina. Journalists: Priscila Enrique, Luis Amsler. https://m.youtube.com/watch?v=Nq5_6Ni8Dmc

iii) TV 13 (Río Cuarto, Córdoba). Journalist: Mildred Nievas. TV show: Telediario Federal de Canal 13. https://m.facebook.com/profile.php?v=approval&highlight=1995653810722610¬ification_id=1514912048386339&ref=m_notif

iv) TV show: "Apto para Todo Público, ATP". 04.01.18. Santa Fe. <https://youtu.be/qO0v9UFREG4>

v) TV CABLEVISION S.A. TV show: "Somos Santa Fe" (Santa Fe). https://www.facebook.com/CanalSomosSantaFe/?hc_ref=ARTE_oe7WvjTcFl66hqinl8jyX7ffrDJLsEwhwPMOL4bA2AXplqoHyGh5y79b-XEQ1w&pnref=story

News paper:

i) Newspaper "Sin mordaza" (Santa Fe). <http://www.sinmordaza.com/noticia/460329-coordinan-acciones-para-la-gestion-y-tratamiento-de-los-residuos-solidos.html>

ii) Newspaper "UNO" (Santa Fe). <https://m.unosantafe.com.ar/medio-ambiente/contaminacion-casi-100-botellas-plasticas-kilometro-la-laguna-setubal-n1534215.html#fotogaleria-id-1853720>

iii) Newspaper "UNO" (Santa Fe). <https://www.unosantafe.com.ar/medio-ambiente/contaminacion-la-setubal-el-informe-la-laguna-es-la-punta-un-iceberg-n1534814.html>

iv) Newspaper "UNO" (Santa Fe). <https://www.unosantafe.com.ar/medio-ambiente/basurales-cielo-abierto-la-principal-amenaza-las-aguas-la-setubal-n1536799.html>

v) Newspaper "El Litoral" (Santa Fe). http://m.ellitoral.com/index.php/id_um/162200-alarman-te-contaminacion-en-la-laguna-setubal-100-botellas-plasticas-por-kilometro-area-metropolitana.html

vi) Agencia CyTA. Instituto Leloir Foundation web site. Science and technology news. <http://www.agenciacyta.org.ar/2017/12/alertan-sobre-los-residuos-plasticos-en-la-laguna-setubal-de-santa-fe/>

vii) The National Scientific and Technical Research Council (CONICET) web site, Argentina. <http://ww.santafe-conicet.gov.ar/la-setubal-muy-contaminada/>

Note: RF is mentioned in most of the articles.

Radio:

i) Radio Eco Medios AM 1220. Radio show: "Aquí El Planeta". (Buenos Aires, Argentina). Journalist: Maria Laura Del Rosso.

ii) AM LT9 Radio (Santa Fe). 2.1.2018. Journalist: Ignacio Donetti. Radio show: "A pura Radio". <http://www.lt9.com.ar/6101-investigacion-contaminacion-en-la-setubal>

iii) AM LT10 Radio Universidad Nacional del Litoral SA; 9 de Julio 3560; Santa Fe S3000EXB – Argentina. <http://www.lt10.com.ar/> (Santa Fe). 2018-01-03. <https://www.lt10.com.ar/noticia/209311--preocupante-nivel-de-contaminacion-en-la-laguna-setubal>

iv) AM LT10 UNIVERSIDAD (Santa Fe). 2018-01-23. Radio show: "Primera Tarde". Journalist: Ileana Hotschewer.

v) AM 870 Radio Nacional. 04.01.2018. Interview.

vi) FM SOL (Santa Fe). 3.1.2018. Interview. Radio show: "El imán". Journalist: Hugo Saak.

vii) AM LT10. Radio Universidad Nacional del Litoral SA; 9 de Julio 3560; Santa Fe S3000EXB – Argentina. <http://www.lt10.com.ar/> (Radio belongs to the National University of Littoral, UNL, Santa Fe, Argentina). Radio program: "Sobre el agua" (English: "About water") <http://www.arribando.com.ar/>. Domingo 13 a 14 hs. Journalist: Hugo Luis Bonomo. Sunday September 9th 2017: Interview of 30 min. (2 times invited).

viii) FM 93.7 Rosario. Radio Cordial. Journalist: Miguel Jesús Martínez (30.01.2018).
Note: RF was explicitly mentioned in most of the interviews.

This great repercussion and media exposition brought political implications. Two politicians from Santa Fe government have contacted us. One of them is the Councilor Franco Ponce de León (FPCyS-CC-ARI; <http://francoponcedeleon.com.ar/>) and the other one is Mariano Gabriel Cejas (CAMBIEMOS, Secretario de Ambiente y Espacios Públicos; http://www.santafeciudad.gov.ar/estructura_gobierno/departamento_ejecutivo/secretario_ambiente_espacios_publicos.html). Currently, we are working with both in order to modify the current SWT (Solid Waste Management) city polity in order to mitigate the plastic pollution. Several mitigation measurements are currently been discussed in collaboration.

3.3) Social and educational achievements.

3.3.1) We established formal collaborations with two NGOs: "Taller Ecologista" (Rosario city, Santa Fe province, ARG, <http://tallerecologista.org.ar/sitio/home.php>) and "La Tribu del Salto" (Paraná city, Entre Ríos province, ARG, <http://elsaltoparana.blogspot.com.ar/>). In both cases, we are coordinating activities to educate and mitigate impacts of plastic pollution with local activist, government agencies and general public. One of the most important activities is the

coordination (and active participation) of cleanup programmes in polluted river beaches.

3.3.2) More than 1 dozen of volunteers were involved in order to helping us and to increase the educational values of the project (for details see below Point 11).

3.3.3) Four public conferences (50 to 90min of duration; 50 to 110 attendees). RF was always explicitly mentioned as funding source during PowerPoint presentations).

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

Local community was closely involved in the project through the participation of volunteers during field activities, public conferences (schools, municipality and other public institutions of education and research), media exposition (TV, radio, newspapers, and web), the interest of politicians and the potential modification of the current legislation about solid waste treatment and final disposal methods in Santa Fe city. Politicians have reacted with surprising promptness due to the media pressure.

The dissemination of results quickly captured the population attention and concern about the plastic pollution problem in the Paraná River. Thus, this study becomes a significant educational element for the local population.

5. Are there any plans to continue this work?

Yes, absolutely. It is necessary to increase the frequency of sampling campaigns as well as to expand the sampling area. As a results of this study, we are currently sure that plastic pollution is a big problem in the Paraná River (we statistically quantified this pollution). We believe that the next step is to evaluate its impact on aquatic fauna. Bird and fish communities must be urgently evaluated. It has been shown that microplastics can be ingested by freshwater fish, birds and invertebrates in freshwater environments, being a great ecological problem. However, we also must evaluate the potential impact of macroplastics in freshwaters since many species of marine vertebrates have been recorded as entangled in macroplastic debris and there is no reason to assume that riverine fauna is not effected by macro-debris. Information about the impact of plastic pollution on fauna in freshwater systems is very poor worldwide and minimum in the Paraná River.

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

To the scientific community: through the publication in international peer review journals and attendance of symposia and congresses.

To the general public: through the media exposition, making simplified versions of the published papers (available on line, in Spanish, accessible style of language, shorten, etc), public conferences, and active collaborations with NGOs.

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

Most of the grant money was used during the first 3 months of the project (first sampling campaigns expenses, zoom microscope, microscope camera and balance). Other expenditures were performed throughout the whole project (expendable material, glassware, fuel, and the successive sampling campaigns). The length of the project was relatively well predicted in the proposal and every step developed in time. We had to make some adjustments regarding what was said in the original proposal. However, these changes were more related to the budget than to timescale (see below).

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. * Local exchange rate: 1£= ARG 27.4 (source: Banco Nación Argentina; <http://www.bna.com.ar/>)

Item	Budgeted Amount	Actual Amount	Difference	Comments
Fuel and oil for pickup truck and boat, plus engine maintenance	450	1174	-724	Rising gas prices and the inflationary process in Argentina's economy was a growing threat to successfully complete this study (inflation reached 24.8 % in 2017). To deal with, we bought less expensive devices (zoom microscope and photo camera; see below) in order to save money to cope with the rising prices (see Point 2 of this report).
Boeco zoom microscope, model BST-606	2530	1620	910	See comment above
Camera 5.0 Megapixels Arcano ISCapture	1129	543	586	See comment above
Balance Ohaus Scout Pro	336	330	6	No comments
Sieve 5mm	189	235	-46	No comments
Chemical solutions	150	679	-529	In the original budget we underestimated the real amounts (and price) of chemical solutions requested (particularly for microplastic processing and resin composition). As a result, we increased the amount of money

				available for this item.
5 tweezers	136	220	-84	A bit more expensive than estimated.
Glassware and chemical material	80	180	-100	More quantity needed than estimated.
TOTAL	5000	4981	19	

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

The next step is to evaluate the impact of plastic pollution on aquatic vertebrate fauna. Particularly, bird and fish communities must be urgently studied (see Point 5). Many species of bird and fish have a key importance from an ecological, commercial and cultural point of view. Several species play a significant role in the local cultural and people commonly identify with these species for cultural or economic reasons, particularly indigenous communities. We urgently must evaluate the potential risk to these species, particularly to endangered and threatened species, from exposure to plastic debris.

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?

The Rufford Foundation logo was showed at the beginning of all public conferences (see pictures in Reports 2nd, 4th, 5th and 6th) and mentioned during TV and radio interviews. Additionally, some news papers mentioned the RF as founding resource. Furthermore, the RF was explicitly mentioned in the section of "Funding information" of the published paper (see Point 1).

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr Martin Blettler (leader of the team). I was involved in each activity: planning and execution of sampling campaigns, samples processing (identification and classification of plastic debris), analysis of data, writing of RF reports and paper publication. I was the main media communicator; however other members (Ana Pia Rabuffetti) also actively participated in this activity. I leaded the public conferences; but all members of the team were also present and involved in feedback discussions in close interaction with the audience. Meetings with politicians involved in Solid Waste Treatment of the Santa Fe city: Dr. Luis Espinola and me. NGO's activities were carried out by all members of the team. Finally, I used a Fourier Transform Infrared (FT-IR) Spectrophotometer Shimadzu IR Prestige 21™ (aided by Dr. Alicia Ulla; FIQ, UNL) to identify the polymer composition of the main founded particles.

Dr Luis A. Espínola. He has participated in sampling activities, general logistic and written of reports. Additionally, he and I meet with politicians (Santa Fe government) in order to discuss the execution of future mitigation actions.

Eliana Eberle (PhD student). She was involved in sampling activities, samples processing and data analysis (statistics; R Core Team software packages).

Elie Abrid (PhD student). She was involved in sampling arrangements and execution (particularly in the selection of morphological areas of potential plastic accumulation), and laboratory activities. He also contacted potential volunteers.

Ana Pia Rabuffetti (PhD student). She was involved in sampling activities, writing of the paper, media interviews, contact with NGO's and volunteers. Group of volunteers. They participated in sampling campaigns and many of them also were part of the audience during the public conferences.

12. Any other comments?

12.1) During the execution of this project, we used a Fourier Transform Infrared (FT-IR) Spectrophotometer Shimadzu IR Prestige 21™ to identify the polymer composition of the main founded plastic particles. While, this was not considered in the original proposal, we improved the quality of data (and therefore of the paper) by taking this opportunity to use this electronic device. The unexpected collaboration with Dr. Alicia Ulla (chemistry FIQ -UNL- professor; CONICET principal researcher; co-author of the paper) allows us to use this device without charge.

12.2) We would like to express our sincerely gratitude and appreciation to RF. This study would not have been possible without the RF support. We sincerely believe that the present study was successful at scientific level (peer review publications, one in *Environmental Monitoring and Assessment* and other two coming soon), legislative (meetings with politicians from Santa Fe government to modify the current solid waste management policy in order to mitigate the plastic pollution), educational (creation of groups of volunteers), and social level (great deal of media attention, more than expected, and NGO collaboration). Definitely, these achievements encourage us to continue working in this direction.



Left: Plastic pollution in Thompson beach (Paraná River). Right: Plastic rubbish in the Curupí Island (Paraná River).