THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

Oceanography

CITATION

St-Onge, G., and G.A. Ferreyra. 2018. Introduction to the special issue on the Gulf of San Jorge (Patagonia, Argentina). *Oceanography* 31(4):14–15, https://doi.org/10.5670/oceanog.2018.406.

DOI

https://doi.org/10.5670/oceanog.2018.406

INTRODUCTION TO THE SPECIAL ISSUE ON

The Gulf of San Jorge (Patagonia, Argentina)

By Guillaume St-Onge and Gustavo A. Ferreyra

San Jorge Gulf (SJG) is home to a complex ecosystem that provides a variety of high-quality services to the regional and national economy of Argentina, particularly oil and gas, fisheries, and tourism. The gulf is located in the central region of Patagonia between 45°S and 47°S, covers an area of 39,340 km^2, and is open to the Atlantic Ocean. Until recently, although some interdisciplinary scientific information had been gathered for the SJG, very little had been published in widely accessible journals. This special issue of *Oceanography* aims to document fundamental research into SJG biological, physical, chemical, and sedimentary processes undertaken in the last few years. More than 40 researchers, students, and technicians from Québec (Canada) and Argentina participated in the initial efforts of PROMESse (Multidisciplinary program for the study of the ecosystem and geology of the San Jorge Gulf and the coastal region of the province of Chubut), which closely matches the Argentinean government's Pampa Azul Initiative. The general objective of the PROMESse research program is to conduct an integrated study of the SJG, with the results serving as a baseline for the sustainable management of the ecosystem services of this rich marine ecosystem. This bilateral effort included two workshops, held in 2017, one in Rimouski (Québec, Canada) and another in Comodoro Rivadavia (Chubut, Argentina), that led to the 15 articles published in this special issue.

The SJG bilateral research program began in 2014, when scientists, students, and technicians from Argentina and Québec participated in an expedition on board R/V *Coriolis II*. The 72-day mission included 30 days of work in the gulf in February 2014 and 42 days of transit between Québec and Argentina. Argentina invested $1,742,124 Canadian dollars to finance the ship time (MARES and MARGES expeditions) through a bilateral collaboration agreement signed in 2013 by the Université du Québec à Rimouski, the Ministerio de Ciencia, Tecnología e Innovación Productiva, the province of Chubut, and the Consejo Nacional de Investigaciones Científicas y Técnicas de la República Argentina. In addition, the BEC.AR training program funded 16 fellowships that allowed Argentinian students and researchers to travel to the Université du Québec à Rimouski ($439,086 Canadian dollars) to collaborate with Canadian colleagues.

The special issue begins with a numerical study of ocean circulation in the SJG by Matano and Palma. It is followed by an examination of macronutrient dynamics by Torres et al. and consideration of dust as a potential macronutrient source in the South Atlantic by Paparazzo et al. Then, Williams et al. discuss phytoplankton, non-algal particles, and dissolved organic matter and their implications for ocean color algorithms, and Latorre et al. define mixing processes in the pycnocline and their relationship with nutrient supply and microbial communities. Carbajal et al. and Flores-Melo et al. investigate the physical and biological aspects of fronts, and

R/V *Coriolis II*.
Photo credit: Reformar

Klotz et al. present a modeling study that assesses the potential effects of a chronic oil spill on the SJG planktonic system.

The occurrence of marine biotoxins, shellfish poisoning events, and toxigenic dinoflagellates and associated toxins in Argentinean waters are then reviewed and discussed by Krock et al. and Fabro et al. Next, Giménez et al. describe the distribution patterns, composition, and trophic structure of the SJG zooplankton community.

The special issue next explores SJG surface sediment distribution, possible sediment sources, and transport pathways (Desiage et al.); benthic biodiversity (Kaminsky et al.); and the free-living marine nematode communities (Pastor de Ward et al.). Faye et al. provide an analysis of the distribution of modern dinoflagellate cyst assemblages in surface sediments of the gulf.

This set of papers clearly illustrates the complexity of the structure and the interactions among the different components of the SJG ecosystem. One of the main findings of this research is that the central (largest) area of the gulf is a depositional environment, evidenced by the dominance of fine sediments, dust inputs, relatively high organic matter content (Desiage et al.; Kaminsky et al.), and the area's highest dinocyst concentrations (Faye et al.). These features are directly related to local hydrography, ocean circulation, and strong westerly winds. The gulf's circulation, which in summer is determined by the interaction between tides and stratification, moves with low residual current speed (Matano and Palma) that favors the sinking of particles. The sharp pycnocline at ~40 m depth, approximately matching the depth of the euphotic zone, separates the surface nutrient-poor, oxygen-rich waters from deeper nutrient-rich, oxygen-poor waters (Torres et al.). This marked decrease in oxygen concentration below the pycnocline is the result of heterotrophic respiration related to organic matter recycling. The combination of all these characteristics plays a key role in structuring the food web in both the pelagic and the benthic environments. In the case of the benthic environment, these processes modulate the distribution and functional diversity of the benthic epifauna (Kaminsky et al.), while the high diversity and abundance of nematodes in the sediments indicate intense organic matter recycling at the seafloor (Pastor de Ward et al.). It is hypothesized that in the pelagic environment, phytoplankton biomass accumulation is supported by nutrient inputs through three main processes: (1) pumping by turbulent processes at the pycnocline in stratified waters (Latorre et al.), (2) lateral transport in fronts (Flores-Melo et al.; Carbajal et al.), and (3) dust transport at a wider spatial scale (Paparazzo et al.). Phytoplankton are dominated by small cells (picophytoplankton; Latorre et al. and Williams et al.), probably due to selective grazing on larger cells by zooplankton. These processes, at the base of the trophic food web, help to explain the pelagic and benthic richness of the SJG ecosystem, as well as the presence of important fisheries in this area.

Despite the significant number of results presented here, some important gaps in the knowledge of this ecosystem came to light, yielding some challenging questions: What is the local and global contribution of the biological pump to carbon flux, and how much is partitioned either in dissolved or particulate carbon? What fraction of the nutrients that are pumped into surface waters is recycled locally below the pycnocline, and what fraction is advected? How do those processes change on seasonal and interannual scales? To answer these essential questions, seasonal and interannual measurements of currents and the physical and biogeochemical properties of the water column are still needed, and the importance of dust in the SJG should be closely investigated. Finally, the papers by Faye et al. and Desiage et al. establish the basic relationships necessary for paleoclimatic and paleoceanographic studies of this key area with its interplay between ocean circulation, former glacial activity, and strong westerly winds.

The production of this special issue benefited from the generous financial support of the Gouvernement du Québec through its Secrétariat à la Stratégie maritime, the Secretaría de Gobierno de Ciencia, Tecnología e Innovación Productiva de la República Argentina, the Université du Québec à Rimouski (UQAR) and its Institut des sciences de la mer de Rimouski (ISMER), and the Fonds de recherche du Québec. We also acknowledge the financial support of Québec Ocean for some of the logistical costs associated with the expedition in the SJG. We express our sincere thanks to the captain, officers, crew, and scientists of the 2014 MARES and MARGES expeditions, and to Marie-Pier St-Onge (ISMER-UQAR) for her help in handling the manuscripts, as well as *Oceanography* Editor Ellen Kappel and Assistant Editor Vicky Cullen for their efforts editing this special issue. Finally, we acknowledge Lino Barañao (Secretary of Government of the Secretaría de Gobierno de Ciencia, Tecnología e Innovación Productiva de la República Argentina), Jean-Pierre-Ouellet (Rector, UQAR), Ariane Plourde (Director, ISMER-UQAR), Serge Demers (former Director, ISMER-UQAR), and Alejandro Mentaberry (head of the General Coordination Unit of the Secretaría de Gobierno de Ciencia, Tecnología e Innovación Productiva de la República Argentina) for their constant support in bringing the PROMESse program and the 2014 expedition to reality.

AUTHORS

Guillaume St-Onge (guillaume_st-onge@uqar.ca) is Professor and holds the Tier I Canada Research Chair in Marine Geology, Institut des sciences de la mer de Rimouski (ISMER), and GEOTOP, Université du Québec à Rimouski, Québec, Canada. **Gustavo A. Ferreyra** (gferreyra@cadic-conicet.gob.ar) is Head, Centro Austral de Investigaciones Científicas (CADIC)-Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Ushuaia, Tierra del Fuego, Argentina, and Associate Professor, ISMER, Université du Québec à Rimouski, Québec, Canada.

ARTICLE CITATION

St-Onge, G., and G.A. Ferreyra. 2018. Introduction to the special issue on the Gulf of San Jorge (Patagonia, Argentina). *Oceanography* 31(4):14–15, https://doi.org/10.5670/oceanog.2018.406.