

Executive summary

GIWA region 38, Patagonian Shelf, comprises the La Plata River Basin, the South Atlantic Drainage System, and the Patagonian Shelf Large Marine Ecosystem. Given the significant differences in terms of biophysical and socio-economic aspects, the assessment was carried out separately for two systems: La Plata River Basin and the South Atlantic Drainage System.

La Plata River Basin

The La Plata River Basin is shared by Argentina, Bolivia, Brazil, Paraguay and Uruguay. Covering over 3.1 million km², it is the second largest drainage basin in South America and the fifth largest in the world. The Guaraní Aquifer, shared by Argentina, Brazil, Paraguay, and Uruguay, and containing over 40 000 km³ of freshwater, is also located in the region.

The region contains many large urban and industrial centres and politically important cities, including Buenos Aires, Asuncion, Montevideo, Brasilia, Sao Paulo, and Curitiba.

The Basin is an important centre for the regional economy. Approximately 50% of the population of the countries sharing the La Plata Basin live within the drainage basin while around 70% of GNP of the countries involved is produced within the same area.

The La Plata River Treaty provides a supra-national legal framework for the region, and the Intergovernmental Coordinating Committee (CIC) of the La Plata River Basin provides an institutional framework for management. International institutional agreements and basin committees can also be found within several sub-basins.

Assessment

The impacts of Freshwater shortage in the La Plata River Basin were assessed as moderate. Although freshwater supply aggregated at basin level greatly exceeds demand, the temporal and spatial distribution of flow is uneven, and the degradation of water quality by pollution is progressively decreasing the usability of supplies. Shortages in many locations have already been observed, and these are likely to become more common in the future.

The modification of water sources around major cities, the rising costs of water treatment, and the high cost of restoring degraded water sources stand out as pressing socio-economic issues that could potentially initiate conflicts at both sub-national and regional levels.

The impacts of Pollution in the Basin were assessed as moderate. The limited treatment of industrial wastes leads to widespread contamination by chemical pollutants. The lack of sewage treatment leads to the contamination of supplies by pathogens, particularly in the vicinity of cities. The use of agro-chemicals has introduced significant sources of chemical pollutants, and there is evidence of eutrophication in some areas of large reservoirs. In addition, land use changes and unsustainable agricultural practices have resulted in erosion that has greatly increased the turbidity of water supplies. Finally, occasional significant oil spills occur.

Economic impacts associated with Pollution were assessed as severe, particularly due to increases in water treatment costs. There is also considerable evidence of health impacts due to water-borne diseases. For example, diarrhoea and schistosomiasis are common, and during the 1990s, cholera epidemics were registered in all of the countries of La Plata River Basin except Uruguay. At local levels, there has been evidence of decreased viability of fish stocks due to pollution. Future improvements in pollution control will require major investments,

but are necessary for avoiding health problems, as well as a range of environmental and social impacts.

The impacts of Habitat and community modification were assessed as moderate. The construction of reservoirs for hydropower generation has caused modifications to several types of fluvial and riparian ecosystems. Migratory routes of fish species have been disturbed, flow regulation has affected species that use downstream floodplains for spawning, and there have been records of fish mortality due gas supersaturation caused by dam operations. In addition, alien bivalve species accidentally introduced from Asia (*Limnoperna fortunei* and *Corbicula fluminea*) have spread throughout a large part of La Plata River Basin and have displaced native benthic species. An increasing abundance of carp in the inner La Plata, Paraná and Uruguay rivers has also been evident. Urbanisation has also resulted in the loss of certain aquatic ecosystems types.

Socio-economic impacts caused by these changes include the loss of educational and scientific values, and increased costs associated with the control of invasive species and the restoration of habitats. Future impacts due to habitat modification are likely to either continue to worsen, or to improve slightly.

The impacts of Unsustainable exploitation of fish and other living resources were assessed as moderate. The sustainability of major commercial and recreational inland fisheries in the La Plata River Basin are at risk due to inadequate management practices and overexploitation. When combined with habitat modification, pollution, and impending climate change, overexploitation is threatening the long-term viability of fish stocks.

Although the fishing sector is small, socio-economic impacts have been assessed as considerable due to subsistence concerns associated with non-professional fishermen. A moderate increase in the impacts due to fishing are expected in the future.

The impacts of Global change were assessed as moderate. The La Plata River Basin has been extensively influenced by climatic variability and is very sensitive to El Niño events. In spite of present uncertainties, global change seems to have had a significant effect on the hydrological cycle, and cities located in the vicinity of rivers are now at greater risk of flooding disasters, especially in Argentina. In the future, it is assumed that global change will cause the global hydrological cycle to become more volatile and unpredictable, which will increase the risk of flooding and attendant socio-economic consequences due to impacts upon infrastructure, agricultural production, and the economy.

Based on the assessment of each major concern and the constituent issues, and a consideration of environmental, socio-economic, and health impacts, the GIWA Task team prioritised Pollution for further analysis, and chose the Uruguay River Basin to illustrate the Causal chain and Policy options analyses.

Causal chain analysis and Policy option analysis for Pollution: Uruguay River Basin upstream from the Salto Grande Reservoir

The primary immediate causes of pollution in the Uruguay River Basin were identified as: inadequate treatment of urban and industrial wastewater, application of agro-chemicals (fertilisers and biocides), inefficient irrigation practices, and soil erosion.

Identified root causes for pollution include:

- Lack of a framework for Integrated Water Resources Management, and lack of coordination between different levels of government;
- Lack of stakeholder participation in decision-making;
- Inadequate valuation of ecosystem goods and services;
- Persistence of unsustainable agricultural practices;
- Inadequate budgets of institutions in charge of management, which contributes to the lack of enforcement of existing agreements and policies;
- Poor spread of scientific and technological knowledge and training;
- Market incentives for short term economic gain;
- Poverty.

After analysing several policy options, the following policy instruments were highlighted as recommended options:

- Improved wastewater treatment by strengthening and coordinating financial mechanisms between private and public sectors (including international sources);
- Promote sustainable agricultural practices by enforcing regulations concerning agrochemicals ('polluter pays'), facilitating the introduction of practices that reduce soil erosion, and making irrigation more efficient ('user pays');
- Carry out systematic campaigns of environmental awareness and education that target specific stakeholders;
- Use subsidies to promote the treatment and/or reuse of wastes originating from livestock production;
- Create basin management mechanisms with transboundary, integrated approaches. These would include and/or extend the scope of existing institutions.

South Atlantic Drainage System

The South Atlantic Drainage System comprises basins located between the Andean ranges and the Atlantic Ocean, which drain large arid areas of Argentina and some small parts of southern Chile. This sub-system also contains one of the world's largest continental shelves, which is over 769 400 km², and extends up to 850 km from the coast at its southernmost point.

This system is characterised by very low population densities, and the primary economic activities include farming (e.g. fruit, sheep), mining (oil and coal), and fishing.

Assessment

The impacts of Freshwater shortage were assessed as moderate. Localised overexploitation of groundwater and pollution of water supplies have had major impacts on freshwater supplies. In addition, the construction and operation of dams has modified riparian habitats and changed seasonal flow patterns.

The impacts of Pollution were assessed as slight. Oil spills, suspended solids, and microbial pollution are responsible for most of the environmental impacts. Wastewater discharges are the main sources of microbiological pollution. The extensive use of pesticides and fertilisers has impacted some lakes, and eutrophication has been evident in areas with restricted water circulation. In addition, oil spills and toxic waste spills have had negative impacts on both ecosystems and water supplies.

The impacts of Habitat and community modification were assessed as moderate. Marine ecosystems have been extensively modified due to fishing, dredging and tourism development. In addition, reservoir development has altered many fluvial and riparian ecosystems, particularly in the Limay River.

The impacts of Unsustainable exploitation of fish were assessed as moderate. Hake has been exploited beyond safe biological limits, resulting in the collapse of fish stocks. Overexploitation, by-catches and discards of organisms without commercial value, and habitat destruction by trawling methods have generated threats to ecosystem integrity and marine biodiversity.

The impacts of Global change on the South Atlantic Drainage System were assigned a score of 0 or no impact. However, impacts of global change are expected to increase in the future.

Based on the assessment of the major concerns and their issues, the following linked concerns were prioritised within the transboundary regions of the Argentinean-Uruguayan Common Fishing Zone and the Buenos Aires Coastal Ecosystem:

- Habitat and community modification, which is tightly linked to unsustainable exploitation of fish and other living resources, and also linked to pollution.

Causal chain analysis and Policy option analysis for the Argentinean-Uruguayan Common Fishing Zone and the Buenos Aires Coastal Ecosystem

The Argentinean-Uruguayan Common Fishing Zone and the Buenos Aires Coastal Ecosystem were selected as a case study for the Causal chain and Policy options analyses. The most significant immediate causes of habitat modification are related to the fisheries sector, and include: overexploitation of target species, by-catch, and the modification of the sea floor by fishing gear. Other significant causes of habitat modification include urbanisation and shipping activities. Habitats are also being altered by pollution originating from urban and industrial wastewater discharges and agricultural non-point sources.

Besides market forces, the primary root cause for habitat modification is a general lack of surveillance and regulation. This applies primarily to fishing activities, but also to urbanisation, tourism development, and agriculture. Ineffective governance leads to inadequacies in the budgets and personnel of agencies charged with management, hinders the efficient application of legal instruments, and contributes to a lack of research and knowledge development. There is also a lack of consent between Argentina and Uruguay in many aspects related to joint administration of shared resources and joint research and assessment of ecosystems. In addition, technology to increase selectivity of fishing gears is missing, and fishers show significant socio-cultural resistance to the use or development of new types of fishing gear.

Policy options to address the identified root causes require management policies based on a set of multiple tools that should be applied simultaneously. Recommended actions include:

- Demarcate a coastal area and restrict fishing operations in this area to small boats only (under 25-30 m);
- Include a National Programme of Preservation of the Marine Environment within Argentina's Science and Technology System (SCYT);
- Link fisheries development to national programmes for the preservation of the marine environment;
- Reorient research policies to reconcile research and development issues with state policies;

- Optimise national, provincial, and state budget allocations to fisheries management agencies;
- Develop a mechanism to finance long-term research aimed at achieving the sustainable management of ecosystems;
- Strengthen efforts to systematically compile and analyse fisheries data;
- Coordinate research data from several projects at both national and international levels;
- Regulate fishing efforts “in parallel” (Argentina-Uruguay), allowing each country to develop its own fishery exploitation models and then reconcile both practices;
- Jointly evaluate the state of resources and obtain more reliable scientific data. This requires continuous bi-national research campaigns;
- Promote the exchange of data and knowledge among regional organisation through research units and workshops (Argentina, Uruguay, Brazil) to identify shared resources and assess genetic diversity;
- Optimise communication systems among scientists, administrators and managers;
- Improve the capacity of land-based and on-board fisheries inspectors to undertake control and monitoring activities;
- Involve fishermen in developing selective practices and devices;
- Disseminate information throughout communities in order to foster public awareness about goods and services related to marine ecosystems;
- Launch educational campaigns among the general population to discourage consumption of products based on endangered species, or species whose exploitation is likely to undermine the integrity of the ecosystem or disrupt ecosystem function;
- Carry out technical studies to develop selective fishing gear that minimises by-catch and safeguards biodiversity and habitats;
- Expand research on species exposed to incidental exploitation.