

Editorial

ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY IN LATIN AMERICA

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HOW HAS ENVIRONMENTAL RESEARCH DEVELOPED IN LATIN AMERICA?

Environmental toxicology and chemistry in Latin America is a relatively young discipline. Whereas the first international publications in the United States, for example, can be tracked to the 1920s and 1930s [1–4], in Latin America the earliest international publications appeared in the 1970s [5–14] (Fig. 1). Two accelerations can be observed in the growth rate of scientific production in Latin America: the first in the 1990s, involving most of the region, followed by another in 2000–2005, particularly in Brazil and Argentina. Figure 1 shows that more than 90% of Latin America's total scientific production published in international journals is concentrated in only five countries: Brazil, Mexico, Argentina, Chile, and Colombia. This indicates that concern and development of scientific capabilities to face environmental issues remain a challenge for many Latin American countries. Strengthening scientific collaboration across Latin American countries could contribute to a more even development of the discipline in the entire region.

WHAT ARE LATIN AMERICAN RESEARCHERS STUDYING TODAY?

A quick analysis of studies published in 2011 by researchers based in Argentina, Brazil, and Chile, the three countries in SETAC-LA with the greatest number of contributions, reveals subtle differences in the relative development of environmental disciplines (Fig. 2). In Argentina, the field was dominated by ecotoxicology, environmental chemistry, and environmental technologies. Brazil presented a similar distribution, but environmental health took precedence over technologies. In comparison, the Chilean profile appeared more oriented to developing clean technologies and environmental chemistry, with less relative development of ecotoxicology and environmental health.

Further analysis of these studies helped to identify some differences in the major environmental issues researchers in each country have tackled (Fig. 3). Categories were established using keywords from titles, abstracts, and keywords of analyzed publications. "Pesticides" (mainly endosulfan, glyphosate, cypermethrin, and azinphos-metil) were the major issue in Argentina, in keeping with the importance of agriculture in

this country. "Metals" (mainly Cr and Pb) were in second place, probably related to industrial and urban activities, such as tanneries, smelters, metal processing plants, and incinerators. "Metals" were also the major issue in Brazil, primarily Hg and MeHg in populations that consume contaminated fish. Brazil's second level of relevance was filled by "Air Pollution," which is dedicated mainly to studying adverse effects on human health and identifying pollutants adsorbed on particulate matter. Such studies seem mostly to be responses to air-quality problems in megacities such as São Paulo. "Pesticides" (mainly the herbicide diuron and organophosphate insecticides) and "Hydrocarbons" (mainly air pollution by volatile organic compounds [VOCs], soil remediation, and marine oil spills) are two categories of pollutants addressed almost at the same level. In Chile, "Metals" were also a major issue, but Cu rather than Hg was given the most attention, probably in connection with mining. As in Brazil, Chile had "Air Pollution" in second place, followed by "Pesticides"; air quality is a highly relevant environmental issue in Santiago. A distinctively high percentage of studies on pulp mills were observed in Chile compared with the other two countries, showing the relevance of this industrial activity in the country. In addition, emergent pollutants (endocrine-disrupting chemicals [EDCs] and pharmaceuticals) were studied in Chile during the last year, mostly in relation to the development of waste treatment technologies. Arsenic appeared as a sensitive issue in both Chile and Argentina (mostly considering that in Figure 3 this category includes a single contaminant), particularly related with groundwater pollution and human health. Studies on persistent organic pollutants were distributed evenly among the countries, in good agreement with the global distribution of these pollutants.

The analysis also revealed important differences among Latin America countries regarding the environments considered to be the most relevant as a focus for investigations (Fig. 4). In Argentina, more publications are concerned with assessing effects, concentrations, or treatments of pollutants in freshwater ecosystems. The percentage of studies on groundwater was also relatively high in Argentina. A different distribution of the number of studies dedicated to each environment was observed in Chile, where marine ecosystems attracted greater effort; in addition, a comparatively high proportion of studies focusing on terrestrial ecosystems and air pollution have characterized environmental research in this country. The distribution of studies in Brazil fell in between those observed for Argentina and Chile, with the exception of studies focused on groundwater pollution, which were, at least in 2011, comparatively lower than in both mentioned countries.

According with the performed survey, environmental issues that Latin American countries face are not the same in all

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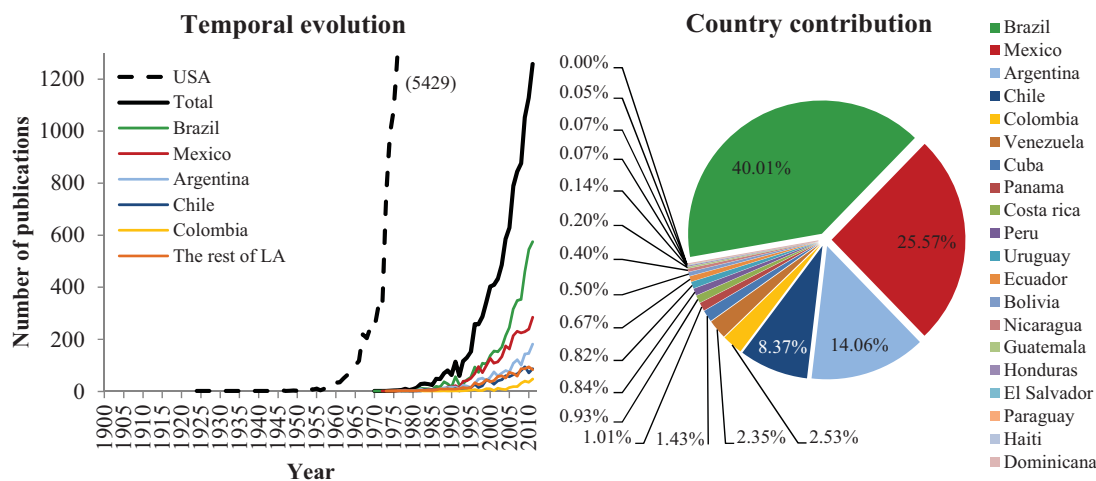


Fig. 1. Temporal evolution of the number of publications on environmental toxicology and chemistry topics in Latin America compared with the United States and contribution by country. Data was obtained from SCOPUS (January 2012) Search criteria included: TITLE-ABS-KEY(pollution) OR TITLE-ABS-KEY(exposure) OR TITLE-ABS-KEY(toxicity) OR TITLE-ABS-KEY(biomarker) OR TITLE-ABS-KEY(bioassay) OR TITLE-ABS-KEY(heavy metals) OR TITLE-ABS-KEY(pesticides) OR TITLE-ABS-KEY(hydrocarbons) AND AFFIL(country)) AND (LIMIT-TO(SUBJAREA, "ENVI") OR LIMIT-TO(SUBJAREA, "MULT"))).

countries. This indicates some degree of specialization and should encourage joint efforts among countries to complement capabilities.

WHAT ARE THE CHOSEN VEHICLES FOR PUBLICATION?

The journals selected most frequently by Latin American researchers for publishing their results vary among countries (Table 1); this is particularly evident in Argentina, Brazil, and Chile. In Chile especially, some selected journals reflect the major issues and environments studied in that country, such as *Atmospheric Environment* and *Marine Pollution Bulletin*. Other journals are equally popular in all three countries, such as *Chemosphere*. The mean impact factor of the five most used journals was similar among countries, with the most frequent values hovering around 3, a figure close to that for *Environmental Toxicology and Chemistry (ET&C)*. Despite the similar impact factors, however, *ET&C* is ranked between 17th and

28th place of preference in the countries surveyed. This could be, in part, an awareness issue; that is, it may be a consequence of unfamiliarity with the journal. It could also be, however, that *ET&C*'s page charges are an economic obstacle for some Latin American researchers who are not members of SETAC. Indeed, this point is a comparative disadvantage for *ET&C* compared to other journals.

The number of Latin American studies in *ET&C* has been increasing since 1994. However, the number of articles still is low and fluctuating (Fig. 5). Consequently, additional dissemination of the journal could help *ET&C* become a natural vehicle of communication among the Latin American scientific community.

ABOUT THE SPECIAL SECTION

The preparation of this special section on *Environmental Toxicology and Chemistry in Latin America* has a twofold aim:

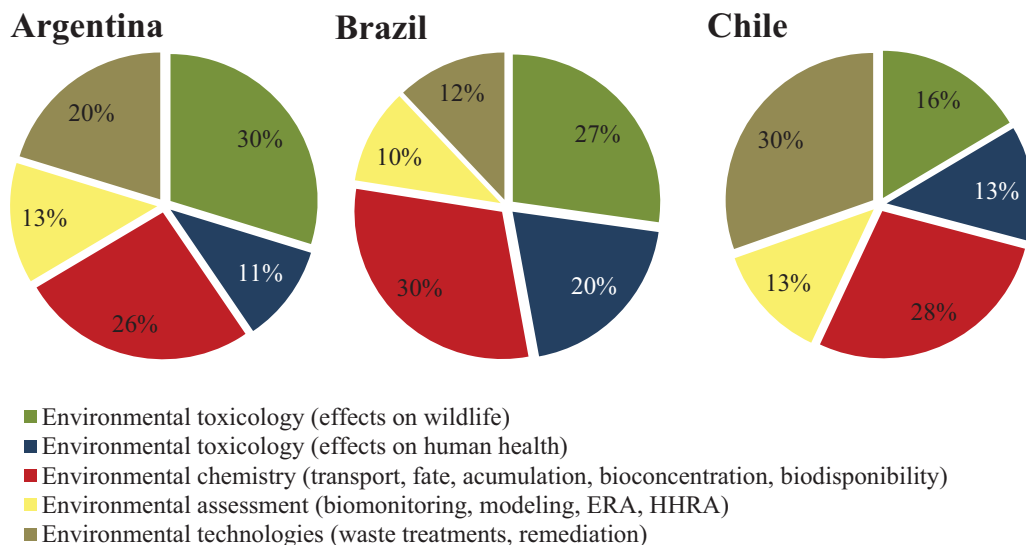


Fig. 2. Percent distribution of studies published by Latin American researchers during 2011 grouped according to major disciplines for Argentina, Brazil, and Chile. Data was obtained from SCOPUS (January 2012). Search criteria were the same as listed with Figure 1. ERA = Environmental Risk Assessment; HHRA = Human Health Risk Assessment.

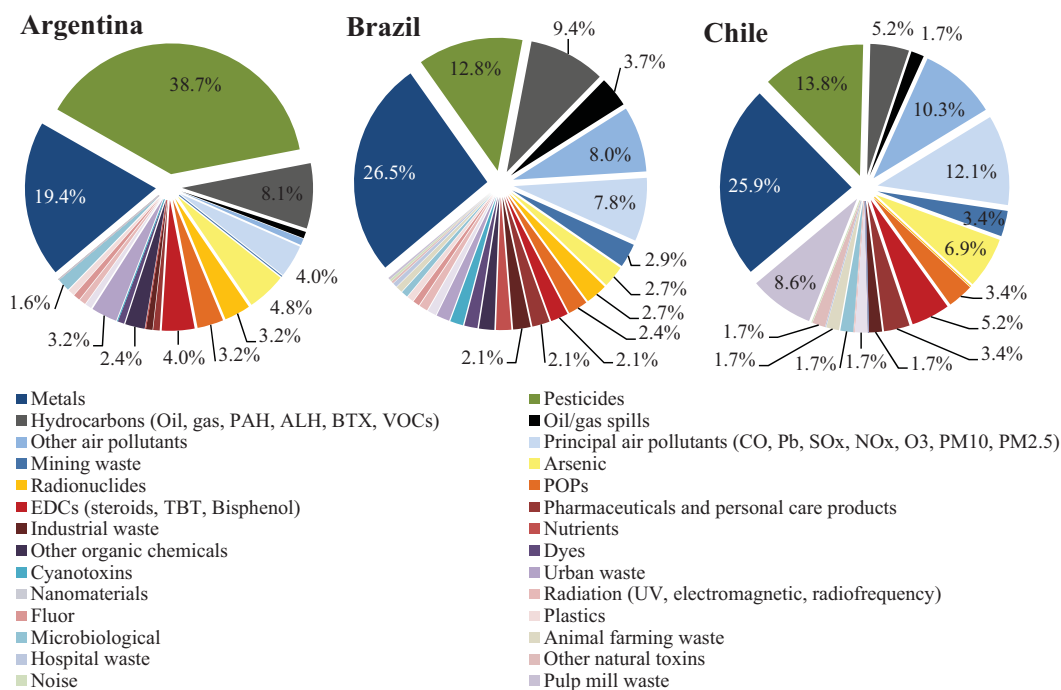


Fig. 3. Percent distribution of the major environmental issues tackled by Latin American researchers during 2011 in Argentina, Brazil, and Chile. Number of assessed publications: Argentina, 159; Brazil, 403; Chile, 59. Complete references are provided in the Supplemental Data.

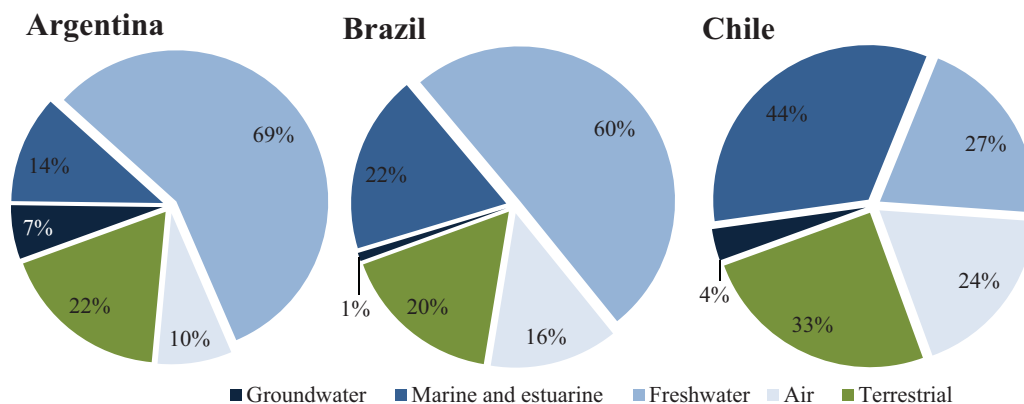


Fig. 4. Percent distribution of the studies published by Latin American researchers during 2011 grouped according to the assessed environment. Number of assessed publications: Argentina, 159; Brazil, 403; Chile, 59. Complete references are provided in the Supplemental Data.

to spread recognition of *ET&C* among Latin America researchers working in the environmental arena as an alternative way to communicate their findings and to inform SETAC members and *ET&C* readers around the world about some current studies on environmental toxicology and chemistry in Latin America.

This special section was organized by calling for papers submitted to SETAC-LA meetings in Lima in 2009 and Cumana in 2012. In total, 21 manuscripts were received: 10 from Argentina, eight from Brazil, and one each from Chile, Ecuador, and Venezuela. Ultimately, six manuscripts were

Table 1. Scientific journals most frequently used by Latin American researchers for publishing their results

Rank	Argentina	IF	Brazil	IF	Chile	IF
1	<i>Bull Environ Contam Toxicol</i>	1.1	<i>Sci Total Environ</i>	3.2	<i>Atmos Environ</i>	3.2
2	<i>Chemosphere</i>	3.2	<i>Chemosphere</i>	3.2	<i>Bull Environ Contam Toxicol</i>	1.1
3	<i>Environ Pollut</i>	3.4	<i>J Hazard Mater</i>	3.7	<i>Chemosphere</i>	3.2
4	<i>Sci Total Environ</i>	3.2	<i>Water Sci Technol</i>	1.1	<i>Mar Pollut Bull</i>	2.4
5	<i>Ecotox Environ Saf</i>	2.3	<i>Water Air Soil Pollut</i>	1.8	<i>Environ Monitor Assess</i>	1.4
17	<i>Environ Toxicol Chem</i>	3.0			<i>Environ Toxicol Chem</i>	3.0
28			<i>Environ Toxicol Chem</i>	3.0		

IF = impact factor.

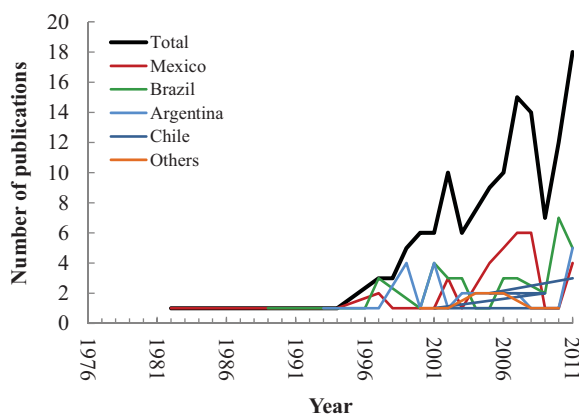


Fig. 5. Temporal trend in the number of studies published by Latin American researchers in *Environmental Toxicology and Chemistry*, total and for each country. Data was obtained from *ET&C*'s online search (Wiley Online Library), searching for each Latin America country in the affiliation field.

selected for the special section after the revision process. The issues covered relate to EDCs, nanomaterials, and pharmaceuticals. Among these studies, the first four deal with the impact of EDCs: two of these evaluate the effects of exposure to EE2 and E2 on the gonad and brain gene expression of two local fish species and its relationship with biological and behavioral consequences, while the other two address the impact of TBT on gastropods inhabiting commercial harbors in Brazil and Peru, showing the occurrence of "fresh" TBT in snail tissue and the incidence of imposex in Latin American harbors. These two studies show the ongoing effects of this chemical, despite the banning of TBT in 2008.

Of the remaining two studies, one deals with the potential adverse effects of nanomaterials in the environment, particularly evaluating *in vitro* the effects of fullerene (C_{60}) on the redox status of the gill and brain of the fish *Cyprinus carpio*. This paper demonstrates that C_{60} can induce redox disruption, leading to oxidative damage and loss of antioxidant competence at the tissue level. The last study concerns the potential effects of pharmaceuticals on plants, specifically investigating the induction of oxidative damage and antioxidant response by the antibiotic and antiprotozoal metronidazole in the meristematic and elongation cells of the well-known ecotoxicological model plant *Allium cepa*.

Having assessed the publications of Latin American researchers during 2011, we can note that the articles in this special section are not representative of the major environmental issues of concern in Latin America. However, these papers address emerging issues at the global level that are now beginning to be assessed by a few research groups in Latin America.

A double contribution is expected from the present editorial and the organized special section. On the one hand, the published articles could encourage researchers in Latin America to direct their investigations toward new environmental problems that are poorly explored in the region; on the other, they could help bring the editors of *ET&C* into closer contact with relevant environmental issues in Latin America.

Finally, it is our wish that this special section will bring more Latin American researchers to SETAC and help them discover *ET&C* as a natural vehicle for publishing the results of their investigations.

Acknowledgement—The guest editors especially acknowledge *ET&C*'s Co-Editor-in-Chief C.H. Ward for supporting the publication of this special section, and we thank him and the editorial staff for their advice, help, and dedication during the entire publication process. We also thank all contributors who submitted manuscripts for consideration in this section.

SUPPLEMENTAL DATA

Suggested reading list. (98 KB DOC).

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