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Historical aspects and current state of
knowledge of the continental
ichthyofauna in Argentina

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La Plata, 2003

This document was presented at the "Seminario Internacional sobre Pesquerías Continentales en América Latina" [International Seminar on Continental Fisheries in Latin America], organized by Fundación Proteger [Proteger Foundation], at Santa Fe town, during November, 2001. Edited by,

CAPPATO, J.; N. OLDANI y J. PETEÁN (Comp.). 2003. *Pesquerías continentales en América latina. Hacia la sustentabilidad del manejo pesquero*, Ciencia y Técnica, UNL, Santa Fe, 222 pp.

Cover Illustration:

"Palometa", "Raya" and "Armado" by Dobrizhoffer

Taken from :

Castex, M. N. s. j. 1963. El género *Potamotrygon* en el Paraná medio. *Anales del Museo Provincial de Ciencias Naturales "Florentino Ameghino"*, Tomo **II** (1)-Zoología:1-86.

Historical aspects and current state of knowledge of the continental ichthyofauna in Argentina.

Hugo L. López*

INTRODUCTION

Considered from a zoogeographical viewpoint, the Argentine Republic is situated within the Neotropical Region, comprising such large scale hydrographical systems as the Orinoco, Amazonas, Paraguay and Paraná-Plata basins which encompass the greatest fish diversity among the continental waters of the planet. Our territory extends from subtropical (21° 41' S) to subantarctic regions (55° 03' S) with a significant latitudinal and altitudinal variation that generates two gradients of physical variability, in N-S and E-W direction. These gradients give rise to an ample range of climates and soils which support diverse biogeographical units. Argentina's hydrographical portrayal includes four fluvial systems: the Río de la Plata basin, the Atlantic and Pacific drainages, and diverse endorheic basins, which hold complex biological systems arising from the interaction of aquatic organisms with the diverse habitats occurring within the territory. The Argentinian continental ichthyofauna comprises approximately 450 species, less than 10% of the total species in the Neotropics. This ichthyofaunal assemblage has particular features that correspond to the existing relationships between the specific entities and the biotic and abiotic components of the ecosystems. These relationships result in an ichthyofaunistic assemblage with, on one hand, some similarities with other areas of the region, and on the other, some attributes of its own that make our fish fauna unique.

The aborigines were the first to convey the ichthyological knowledge of the region; their experience allowed them to identify properties, characteristics and behavior of the fishes that they captured.

The interest in the knowledge of the natural resources of the american continent grew along with the needs of the imperial powers to strengthen their territorial possessions in the New World. Thus, men formed within military, ecclesiastic or scientific settings began the description of the relationships between the indigenous peoples and nature, as well as of the first American taxa.

Various historical aspects of the Argentine continental ichthyofauna are reflected in the works of Birabén (1963), Nani (1963), Ringuelet (1967, 1984), Sánchez Labrador (1968), Furlong (1969), Di Persia & Neiff (1973), Fontana (1977), Seelstrang (1977), Parodiz & Balech (1992), López & Mariazzi (1994), López & Aquino (1996, 1998), Mones & Klappenbach (1997), Isla (2000) and López & García (2001), among others.

The present work is a historical synthesis of Argentine continental ichthyology which emphasizes diverse aspects of the development of its knowledge. A brief reference to events occurred during the last three centuries is made, and different stages, lines of work and trends observed since the work of Ringuelet *et al.* (1967) are indicated (1967). This latter publication, as well as the bibliographies included in López *et al.* and Ferriz *et al.*, and the information from López (1992, 2001) and Bonetto (1998), are the bases for the present paper.

It may appear obvious to state that in a work of this scope there is a risk of overlooking certain works; thus, the assessment/consideration of this issue should be made by the eventual readers of this publication. By reasons of space, only some works and persons have been mentioned, while this doesn't imply any disregard for the rest. It has been my purpose to indicate those persons who stand out, to the best of my judgement, because of their pioneering, integrative and supportive attitudes towards the diverse lines of research comprised by the discipline. All this is obviously influenced by the criteria and

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subjectivity of the author of the present 'essay', which is in itself an endeavor to establish a referential framework for the significant and immense labor of many persons.

On a different aspect, the references to the works included in the research lines that are mentioned may be found in the aforementioned bibliographies, while those posterior to 1998 may be found at the División Zoología Vertebrados [Vertebrate Zoology Division] at the Museo de La Plata [La Plata Museum]. In addition, only the national organizations concerned are indicated in Figure 1, because information at other levels is fragmentary. The contributions of foreign researchers, whose work on diverse subjects has fostered the development of Neotropical ichthyology, cannot be disregarded. However, I won't mention any of them, because my references, which are limited to my field of work, would be unfair to others, and could also possibly cause annoyance in some of my native colleagues.

18th CENTURY

The outstanding events are the works of Army engineer Félix de Azara, the Jesuits Miguel Marimón, Pedro Lozano, Florián Paucke and José Sánchez Labrador; as well as the beginning of expeditions with naturalists, which would in some cases produce comprehensive works of immense value.

19 th CENTURY

The expeditions continue, and focus especially on the basins of the large rivers in the north and center of South America. An exception is the voyage of Alcide Dessalines d'Orbigny, who navigated the Paraná river up to Corrientes, and then journeyed to the north of Patagonia, Chile and Bolivia. Along with the travels of Louis Antoine de Bouganville, Isidore Dupery and Captain Fitz Roy, his expeditions provide the first background for continental fishes in our country.

With the stimulus of the policies supported by Domingo F. Sarmiento, the Universidad Nacional de Córdoba [Córdoba National University] hires Dutch naturalist Hendrik Weyembergh to work for the so-called "Córdoba group", signaling the birth of Ichthyology as scientific discipline in Argentina. The first local zoologist to publish in this subject was Eduardo L. Holmberg; although the references made by Luis Fontana in his expedition to Gran Chaco cannot go unmentioned. During the last part of this century, the remarkable elements were the works of Fernand Lahille and Carlos Berg in the museums of La Plata and Buenos Aires.

20th CENTURY

During the first half of this century F. Lahille continued his work; others such as L H Valette, C A Marelli, J Holartes, T Marini, E Mac Donagh, A Pozzi, E Siccardi, T Marini, V Angelescu, F Gneri, A Nani, R López, M L Fuser, A Thormalen, R A Ringuelet, R H Arámburu and A Alonso de Arámburu made their respective contributions. With respect to ichthyology in the Río de la Plata area, we cannot fail to mention the work of G. Devicenzi, L P Barattini, D Legrand, R Vaz Ferreira, H Nion, J A Luengo and G Fabiano, among others.

Since the 60s decade, a series of occurrences related to the cultural development of the country gave great stimulus to this discipline; regrettably, in very few years this situation dissolved and it was never repeated. These were:

- ♦ The publication of three very significant referential works: "Peces argentinos de agua dulce, claves de reconocimiento y caracterización de familias y subfamilias, con glosario explicativo" by R A Ringuelet and R H Aramburu; two volumes on living aquatic resources as part of the "Serie Evaluación de los recursos naturales de la Argentina" (edited by the Consejo Federal de Inversiones, C. F. I. [Federal Investment Council]) by T L Marini, R López and V Mastarrigo, and "Los peces argentinos de agua dulce" by R. A Ringuelet, R H Aramburu and A Alonso de Aramburu (1967). This publication, edited by the Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CIC) [Buenos Aires Province Scientific Investigations Commission], became a foundational work for the diverse research lines that would develop in the following decades. In addition, the works of R. A. Ringuelet and R. H. Aramburu, J. C. Vidal, R. L. Rosenzvaig and L. Freyre on fish mortality and the contributions to the biology of species

present in the Río de la Plata made by C. Candia, S. E. Cabrera and M. de Lourdes Baiz, as well as parasitological studies by L. Szidat and M. Ostrowski de Nuñez, which would continue during the following decades through the labor of some of the abovementioned authors and other researchers such as M. Hamann, L. Semenas, S. Ortubay, C. Ubeda and L. Lunaschi.

- ♦ The establishment of the Instituto Nacional de Limnología (INALI-CONICET) [National Limnology Institute] located in the town of Santo Tomé, Santa Fe province (Fig 1), thanks to the work of A. A. Bonetto. The ichthyological research of this institute was focused on the Middle Paraná basin and contributed important works on fisheries biology, trophic relations and migration, in the publications by A. A. Bonetto, C. Pignalberi, E. Cordiviola, O. Oliveros and R. N. Occhi.
- ♦ The Convenio de Estudio de Riqueza Ictícola [Agreement for the Study of Ichthyofaunistic Richness] established between the Consejo Federal de Inversiones (CFI) [Federal Investment Council] and the Ministerio de Asuntos Agrarios de la Pcia de Bs As [Ministry of Agricultural Affairs of Buenos Aires Province] thanks to the efforts of R A Ringuelet, who was at the time director of Fishing Resources. This represented an integration of academic and scientific fields in the search for an optimization of the management of natural resources within this province; a clear example of the so-called “knowledge transferral”, a concept that had already been emphasized by authors such as F Lahille and R A Ringuelet at the beginning and middle of the last century, but which many temporarily appointed bureaucrats seem to consider as a recent discovery of their own.
- ♦ The establishment of the Instituto de Limnología de La Plata (ILPLA) (CONICET.UNLP) [La Plata Limnology Institute] known today as Instituto de Limnología “Dr Raúl A Ringuelet” [“Dr. Raúl A. Ringuelet” Limnology Institute] (Fig, 1), owing to the intervention of the latter researcher. At first, the activities of this institution were focused on the provincial territory, but afterwards they extended to different areas of Argentina. Under the direction of L. Freyre, the early stages of ichthyology show a continuation of the research on continental fisheries biology that had been commenced as part of the abovementioned Convenio de Estudio de Riqueza Ictícola.

The 70s decade encounters a growing interest in Ichthyology, reflected in the teaching of the first Ichthyology course as a graduate and postgraduate subject in Argentina, at the Facultad de Cs Naturales y Museo of the Universidad Nacional de La Plata (FCNyM, UNLP) [Faculty of Natural Sciences and Museum, La Plata National University] (Fig 1); R H Aramburu was Head Professor until the end of the 80s decade. This cathedra has received many students and professionals from various universities, a significant part of which are at present working on this discipline in different areas of Argentina and abroad. Other noteworthy events which occurred during this period are:

- ♦ The beginning of the activities of two research centers: the Centro de Ecología Aplicada del Litoral (CECOAL) [Littoral Center for Applied Ecology] in Corrientes city, and the Departamento de Aguas Continentales [Continental Waters Department] (established in Buenos Aires) which are dependencies of CONICET and the Instituto de Investigación y Desarrollo Pesquero (INIDEP) [Institute for Fisheries Research and Development] respectively (Fig. 1). The first of these, under the influence of its founder A. A. Bonetto, focused the research in its area of influence (Paraná river, Riachuelo basin, Iberá system) while the second studied the area of Salto Grande dam and the fisheries resources of Argentina. This period signals the start of the research related to the building of large dams on the Río de la Plata basin (Paraná Medio, Corpus, Yacyretá and above mentioned Salto Grande) supported, in various degrees, by binational organizations such as the Comisión Mixta Argentino-Paraguaya (COMIP) [Argentina-Paraguay Mixed Committee], Comisión Administradora del Río Uruguay (CARU) [Adminitrating Committee for Uruguay River] and Entidad Binacional Yacyretá (EBY) [Yacyretá Binational Entity]. These activities fostered the establishment of work groups such as the Programa de Estudios Limnológicos Regionales [Program for Regional Limnological Studies] at Universidad Nacional de Misiones (UNaM) [Misiones National University] under the direction of B. Roa (Fig. 1). Apart from this, the Departamento de Zoología [Zoology

Department] of ILAFIR issued a directory of South American ichthyologists, compiled by M. N. Castex, H. P. Castello and A. E. Roberti.

- ♦ The publications for this period include works on trophic relations by S. Destefanis and L. Freyre; cytology and reproductive phenomena (J Calvo, E Morriconi and J E Zavala Suárez), developmental biology (L Freyre and C. Togo), R. A. Ringuelet's ichthyogeographical proposal, which establishes a new zoogeographical frame for the continental fishes of South America, and a chapter on freshwater fishes of Argentina by R. C. Menni and H. L. López that appeared in a publication on continental aquatic fauna. In addition, diverse contributions include anatomical studies, taxonomic revisions and regional ichthyofaunistic surveys made by researchers working at the Ichthyology Sections of the museums at La Plata and Capital Federal, as well as the abovementioned Instituto de Limnología "Dr Raul A Ringuelet" (ILPLA) ["Dr. Raúl A. Ringuelet" Limnology Institute]; these contributions continue to the present day. Other works which are also worth mentioning are the publications of K H Luling and J Gery on *Gymnocharacinus bergi*, the "naked characin" from Valcheta creek, Río Negro province. Thus, after almost fifty years, the study of this endemic species was resumed; afterwards various aspects of this species would be studied by A. M. Miquelarena and R. H. Arámburu during the eighties decade, and by V. Cussac, S. Ortubay, R. C. Menni, S. Gómez and A. Escalante during the nineties. Also within this period, N. Oldani began the study of Characoidei larvae; L. Rossi and C. Fuentes would later take up again various aspects of these studies. With respect to exotic species, various research lines focused almost exclusively on Salmoniformes (see Ferriz et al 1998) start to develop during this decade.

The **eighties decade** marked a significant boost for the discipline at institutional levels, thanks to the mentioned labors and also to the results generated by work teams such as: Centro Regional Universitario (CRUB) [Universitary Regional Center] at Universidad Nacional del Comahue (UNComa) [Comahue National University], Instituto Argentino de Zonas Aridas (IADIZA-CONICET) [National Institute for Arid Zones]; Fundación Miguel Lillo [Miguel Lillo Foundation] and Instituto de Limnología del Noroeste (ILINOA) [Northwestern Limnology Institute] at Universidad Nacional del Tucumán (UNT) [Tucumán National University], various departments at National Universities: del Sur, Córdoba, Salta, Luján and La Pampa; and the contributions of the Centro Nacional Patagónico (CENPAT) [National Patagonian Center] (Fig 1). At provincial level there are various contributions; the creation of the Centro de Ecología Aplicada del Neuquén (CEAN) [Neuquén Center for Applied Ecology] by the government of the homonymous province is noteworthy.

Among the contributions, a series of bibliographical compilations for the specialty began at this time, which were to be continued during the nineties and finally became a large "artisanal hand-made" database. The compilers were A. A. Bonetto, R. Ferriz, M. Garcia, S. Gómez, J. M. Iwaszkiw, H. L. López, R. C. Menni, L C Protogino, R A Ringuelet and C. Togo. Other contributions were the ichthyogeographical proposal of G. Arratia, S. Menu Marque and S. Peñafort, who, using more available data for the western areas of Argentina, propose some modifications to Ringuelet's scheme; the excellent Fishes of Chaco poster (with drawings by the author) made by E. Martinez and edited by the Argentine Air Force as part of a series on fauna and flora of that province. This latter work has not received due acknowledgement, despite its being, thanks to its quality, scientific thoroughness and educational value, a pioneering work in the use of illustration for the synthesis of the ichthyofaunistic biodiversity and its regional distribution. The monography edited in 1985 by the Organización de los Estados Americanos (OEA) [Organization of American States] entitled "Fishing and pisciculture in continental waters of South America" by A. A. Bonetto and H. P. Castello is a valuable contribution. The description of the dentition of more than thirty species of Characoidei by A. M. Miquelarena resulted in a highly useful work for the recognition of this complex group. "The fishes of the Río de la Plata and its maritime front" by B. Cousseau. The "List of freshwater fishes of Argentina" by H. López, R. C. Menni and A. M. Miquelarena, which represented an update of the nomenclature and new data arisen since 1967 (the year of publication of "The freshwater fishes of Argentina") and thus fulfilled one of the basic requirements for the adequate use and management of the natural resources in any region. The first works on floodgate for fish by R Delfino, C Baigún and R Quirós; a study of the relationship between fish abundance and presence of organic matter in the Río de la Plata basin by R Quirós. The work of N Oldani on acoustic assessment; the

experimental research lines of J. Parma de Croux, A. Salibián, L. Freyre, O. H. Padín, A. Denegri, L. Protogino and S. Gómez; genetics studies at Universidad Nacional de Misiones (UNaM) [Misiones National University] by A. Fenocchio and J. O. García. Hystological studies by H. Domitrovic and L. Ulibarrie; embriological studies by C. Maggese, V. Cussac, M. Matkovic, A. Pisanó, M. Cukier and G. A. Guerrero; aquaculture studies by A. Espinach, V. Amutio, J. P. Mestre Aceredillo, G. Ortí, A. Nani, A. Fortuny, L. Luchini and A. Salas.

At institutional level, the **nineties decade** witnessed the creation of the Instituto de Ictiología del Nordeste (ILINOA) [Northeastern Ichthyology Institute], a dependency of the Facultad de Ciencias Veterinarias [Faculty of Veterinary Sciences] at Universidad Nacional del Nordeste (UNNE) [Northeast National University]. During 1992, this institution began issuing the periodical Revista de Ictiología [Ichthyology Journal], the first Spanish-language journal for this specialty. Two courses at CAECE University and one at Universidad Nacional de Misiones (UNaM) [Misiones National University] were dictated; a regional workshop on one of the emblematic species of the basin, the “pejerrey” [silverside] *Odontesthes bonariensis*, was organized by the Ministerio de Asuntos Agrarios [Ministry of Agricultural Affairs] of Buenos Aires province. On a different level, the Area de Sistemas de Producción Acuática [Area of Aquatic Productive Systems], a dependency of the Facultad de Agronomía [Faculty of Agronomy] of Universidad de Buenos Aires [Buenos Aires University], was established during this period. In addition, the Dirección de Recursos Ictícolas y Acuícolas [Direction of Aquatic and Ichthyc Resources] of the Secretaría Nacional de Recursos Naturales y Desarrollo Sustentable [National Secretariat of Natural Resources and Sustainable Development] generated significant efforts in the management of fisheries resources of Argentina. The Secretaría de Agricultura, Ganadería, Pesca y Alimentación [Agriculture, Farming, Fishing and Food Secretariat] published a series of documents on aquaculture elaborated by the Dirección de Acuicultura [Aquaculture Direction], a dependency of this Secretariat. Also during this period, the launch of a GEF project with the participation of rioplatensean researchers and the Comisión Administradora del Río de la Plata (CARP) [Administrative Committee for the Río de la Plata River].

In terms of publications, some noteworthy contributions are: an Argentinian directory of ichthyology, fishing and freshwater aquaculture published by Fundación Cassará [Cassará Foundation]; the publication of six volumes about fishes (Characiformes and Siluriformes) written by A. Aquino, M. M. Azpelicueta, L. Braga, H. López and A. M. Miquelarena in the series Programa Fauna de Agua Dulce de la Argentina (PROFADU-CONICET) [Program for Freshwater Fauna of Argentina]; the ichthyofaunistic lists for diverse Argentinian provinces (Buenos Aires: A. Almirón, S. E. Gómez and N. Torresani; Misiones: S. E. Gómez and J. C. Chébez; Córdoba: G. Haro and M. A. Bistoni; and Santa Fe; D. M. del Barco); the publication of books focused on sectors of the Paraná and Paraguay rivers, edited by the Comisión Mixta Argentino-Paraguaya (COMIP) [Argentina-Paraguay Mixed Committee] and the Comisión Administradora del Río Uruguay (CARU) [Administating Committee for Uruguay River] respectively (the first one included a list of fish species within a more general work; the second one, by S. Sverlij, R. Delfino, H. López and A. Espinach, focused on the fish species occurring in the area of influence of Salto Grande dam); the synopsis on “sábalo” *Prochilodus lineatus* by S. Sverlij, A. Espinach and G. Ortí published by the FAO; the publication of a book on the bonaerensean silverside *Odontesthes bonariensis* by F. Grosman; some aspects of the ecology of Río de la Plata fishes studied by H. Nion and published within a more comprehensive work; the effects of “bubble disease” on fishes of the Paraná river, by H. Domitrovich, J. A. Bechara, W. R. Jacobo, C. I. Flores Quintana, J. P. Roux and G. Gavilán; the diverse works originated at the Centro Regional Universitario Bariloche (CRUB) [Bariloche University Regional Center], among them, the first methodological proposal for the conservation of continental fishes, by M. T. Bello and C. Ubeda, the work on intralacustrine migrations of some species of patagonian fishes by V. Cussac, P. M. Cervellini and M. A. Battini, and the works of P. Vigliano, G. Lippolt, A. Denegri, M. Alonso and P. Macchi presenting an integration of anthropogenic factors and recreational fisheries; also the publication of a chapter on fishes of Argentina (R. C. Menni, A. M. Miquelarena and H. López) in the Manual de Limnología [Limnology Handbook] edited by E. Lopretto and G. Tell; contributions from Universidad Nacional de La Plata (UNLP) [La Plata National University] such as the research on relationships between biotic and abiotic factors and the distribution of continental fishes in Argentina (R. C. Menni, S. E. Gómez, F. López Armengol) which received an award from the Secretaría de Cultura de la Nación, [National Culture Secretariat] and on ichthyofauna and limnology of thermal waters in the Northwestern regions of Argentina (R. C. Menni, A. M. Miquelarena and S. E. Gómez); a special issue of

the Revista de Ictiología [Ichthyology Journal] dedicated to fisheries biology in Yacyretá region, where the editor J. A. Bechara brought together twelve authors to focus on diverse aspects of this sector of Paraná river; the research lines on endocrinology (A. V. Stefano and G. M. Somoza) and analysis of genetic variability (M. C. Abel, M. Ravaglia, M. C. Maggese and J. C. Vilardi); as well as contributions from Universidad Nacional de Río Cuarto (UNRC) [Río Cuarto National University], (Fig. 1) on the conservational status of the ichthyofauna of the Pampean hills in Córdoba. With respect to exotic species, there are diverse works on Salmoniformes (P. Vigliano and M. F. Alonso, M. A. Pascual, H. R. Fernández, L. A. Fernández, F. Grosman, J. Iwaszkiw and O. Padín) and Cypriniformes (D. Colautti, N. S. Sidorkewicz, A. C. López Cazorla, O. A. Fernández, M. Villanueva and V. C. Roig).

21th CENTURY

In the brief time elapsed, an electronic ichthyology forum arose as outcome of the course on Continental Ichthyology that had been dictated in 2000. The following contributions may be mentioned:

Population structure and biogeography of genus *Prochilodus* based on mitochondrial DNA (A. Sivasundar, E. Bermingham and G. Ortí); a second book on the “bonaerensean silverside”, edited on this occasion by F. Grosman, who gathered a group of investigators to develop twenty-two chapters on the subject; a new contribution of the Consejo Federal de Inversiones (CFI) [Federal Investment Council] to the field of continental ichthyology, by means of a document about continental fisheries on the Argentinian sector of the Río de la Plata basin, by J. Iwaszkiw; the first work on comparative performance of fish stairs in Argentina, by N. Oldani, C. Baigún and R. Delfino; a chapter on the fishes of Mar Chiquita coastal lagoon by M. B. Cousseau, J. M. Díaz de Astarloa and D. E. Figueroa, which appeared within a general work on the area; a book on exploitation and use of fisheries resources in the Salado river basin in Buenos Aires province, by H. López, C. Baigún, J. Iwaszkiw, R. Delfino and O. Padín; as well as the elaboration of the ichthyological ecoregions of Argentina by H. López, C. Morgan and M. Montenegro, as part of the Freshwater Ecoregions of the World Project of World Wildlife Fund. These last two works were carried out within the Programa para el Estudio y Uso Sustentable de la Biota Austral (ProBiota) [Program for the Study and Sustainable Use of the Austral Biota] at Facultad de Ciencias Naturales y Museo (FCNyM) [Faculty of Natural Sciences and Museum], Universidad Nacional de La Plata (UNLP) [La Plata National University].

With respect to the management aspects, the Fundación Proteger [Proteger Foundation] organized the “Seminario Internacional sobre Pesquerías Continentales de América Latina” [International Seminar on Continental Fisheries in Latin America] in the town of Santa Fe [in the homonymous province]. During this seminar there was a meeting of representatives of non-governmental and governmental spheres, living forces from diverse areas in other provinces and foreign researchers, which resulted in significant actions as well as in the production of the present document.

CONCLUSIONS

A preliminary diagnosis of this synthesis of the last thirty-five years in continental ichthyology indicates a quantitative leap in general production since 1967 (Fig. 2). A more profound and detailed assessment would result in an extensive document that would greatly exceed the limits of the present publication. The analysis of Figure 2 indicates a marked growth in some research lines and the lack of development of others, such as molecular biology and conservation.

A panorama of these thirty four years of history of continental ichthyology in Argentina shows the labor, sacrifice, creativity, optimism and imagination of its protagonists, faced with a general context that was continually unfavorable, while the cultural elements were just variables used by the succeeding state policies for their neverending budget cuts. The sequels of these processes were the creation of insecure and unpredictable work environments, and the consequential profound degradation of the system. There are various consequences of these phenomena, but I will mention only one of them: the growing exclusion of young professionals, which precludes generational exchange and bans the possibility of planning for future growth.

In my opinion, the first steps towards a long-term reversion of this serious and upsetting situation, should be:

- ♦ Strong integration between the different fields involved in the discipline. This integration must transcend our borders, with goodwill and defined goals, and discard useless protagonisms and personal interests; thus it will result in the optimization of the efforts and resources destined to diverse regional projects. This will allow the participation and education of new generations through various methods of funding, as well as the consolidation of the diverse work teams already working in different regions of the country.
- ♦ The access of those naturalists with management abilities to work situations within the State structure, so that natural sciences are included in the national priorities. This will contribute to the general development and rise of the country in these dark times; as Raúl A Ringuelet said: *“One of the most remarkable differences between developed and undeveloped countries goes hand in hand with their modes for the management of natural resources”*.
- ♦ Transmission of the scientific, ethical, aesthetical and economical value of biodiversity at the different educational levels, as well as of the significance of the so-called “ecosystem services” for society as a whole. This may help to form citizens who will get along harmonically with nature instead of being at odds with it, and also to stop the “hypocritical species” from applying economic criteria to the exploitation and management of natural resources, under cover of the principles of “protection” and “conservation”.

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Figura 1

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Figura 1. Instituciones nacionales.

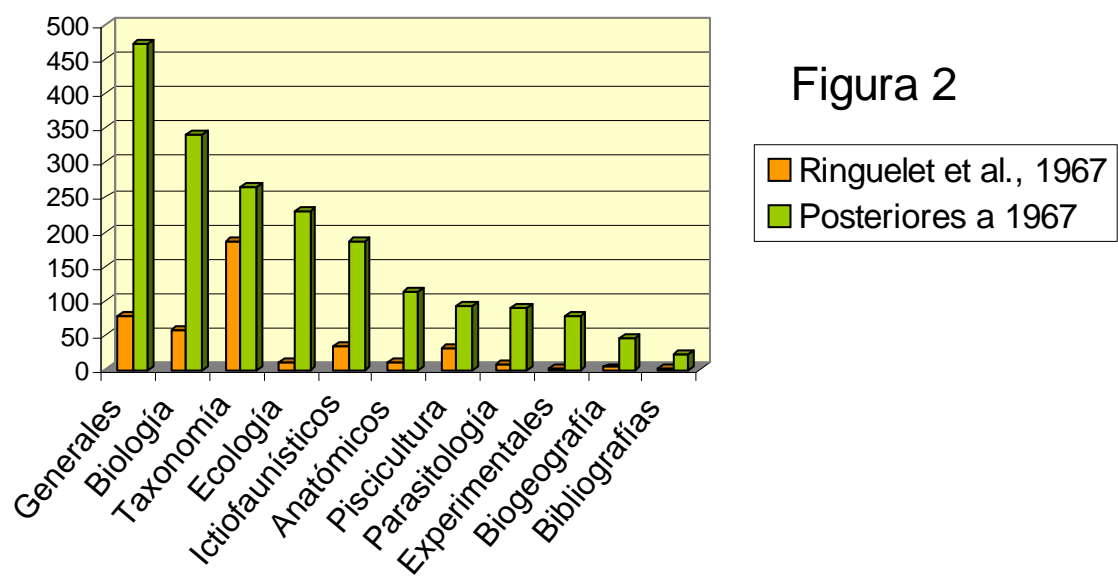


Figura 2. Comparación numérica de las publicaciones de la Argentina.

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