Small-scale fisheries research in Pacific South America

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1. INTRODUCTION

This paper presents an analysis and discussion of the evolution, characteristics and trends of small-scale fisheries research on the Pacific coast of Latin America (Fig. 1), i.e., in four countries (Chile, Colombia, Ecuador and Peru) in which the author has personal work experience. Emphasis is given on content and methodological approaches, on the practitioners and the institutional environment in which this research has developed.

This review will consider the evolution of research in terms of its content, substance and effectiveness («What has been the subject and impact of research ?»), their practitioners («who has conducted research and where ?»), their approach and methodologies («how has research been conducted ?») and the institutional set-up which has supported and made it possible.

A discussion of research in small-scale fisheries inevitably leads to the problem setup by the ambiguous, imprecise and widespread term «small-scale fisheries» which has already been addressed by several authors (KESTEVEN, 1973 ; SMITH, 1979 ; EMMERSON, 1980 ; SANT'ANA DIEGUES, 1983 ; PANAYOTOU, 1985). Accordingly, several criteria such as (i) objective pursued by owners, (ii) species caught, (iii) size of boats used, (iv) factor intensity in the operations, (v) input/output ratios, and a variety of other elements and attributes such as technological efficiency, socio-economic performance of the fishing activity etc, have been used to define, classify or characterize small-scale fisheries. The resulting classifications or definitions have sometime proved to be useful in specific locations while being inadequate for others (WOSNITZA-MENDO, 1989 ; RUSQUE, 1989).

Small-scale fisheries in South America present large differences not only between countries but within particular countries [1]. For practical and analytical purposes then, we will keep the limits, boundaries and content of

[1] *Large differences exist within the small-scale fisheries sector of a particular country as well as between countries. Recent figures presented by the Undersecretary of Fisheries in Chile (Subsecretaría de Pesca, 1989), reports that small-scale fishermen who are owners of their boat, earn between USD 180 and USD 2 300 per month, depending on the type of boat and the species caught. Investment for the small-scale boats they use range between USD 2 000 and USD 200 000. Income of non-owners is reported between USD 100 and USD 400 per month. The total production of small-scale fisheries for 1987 was reported at about 438 000 t. In Uruguay, CORSA (1989) reports that small-scale fishermen receive a salary close to the minimum wage and have produced a total annual production of about 7 000 t. In Peru, CHAPARRO (1983) reports that the 200 000 tons harvested by approximately 25 000 small-scale fishermen, generates a monthly average income of about USD 31 per month, equivalent to less than half of the minimum wage of Lima (USD 70). As can be observed, the differences within and between countries are large.*

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research on small-scale fisheries rather flexible within a specific range of relevant factors and categories which conform and explain the processes and relationships within the overall fishery system. Thus, we will consider as small-scale fisheries research all systematic inquiries into the various aspects of small-scale fisheries whether related to the resource base, the capture process, the marketing of products and/or the socio-cultural and institutional arrangements within which these fisheries take place.

Although several attempts have been made at local-specific levels to define small-scale fisheries (CPPS 1986), these various efforts have become rather meaningless when attempting to gain insights of small-scale fisheries research in general, from different disciplinary perspectives or from a multi- or interdisciplinary approach (HERNANDEZ, 1986 ; PRIETO, 1989).

2. HISTORICAL DEVELOPMENT OF MARINE AND FISHERY SCIENCES

2.1. History of marine science

Although Spanish and Portuguese conquistadores made great contributions to the exploration of the oceans five centuries ago, with Fernando de Magallanes contributing to the recognition of an entire continent by the world and a host of maps, charts and maritime knowledge, the evolution of findings and discoveries did not continue in the region with the same intensity.

The overview of the history of marine science in the region contributed by PALACIO (1980) shows that most research on Latin American waters was conducted up to the 19th century by foreign maritime powers with almost no contribution from Latin America [2]. Apparently, the abundance of natural resources and the relatively small human population at that time, provided no incentives for the exploration of the oceans and search for new resources. On the other hand, there was no urgent need to develop local technology nor science until the beginnings of World War I. Latin America was still dependent on European (especially Spanish and British) and to a lesser extent, North American technology and science ; these were introduced through direct investments of foreign firms exploiting the natural resources of Latin American countries [3]. Thus, colonialism, through economic dominance led to the intellectual dependency characteristic of scientific research in Latin America until recent decades. It also made the process of scientific acquisition a process of "transference" from developed to developing nations rather than of "discovery, development, absorption or adaptation" to local conditions.

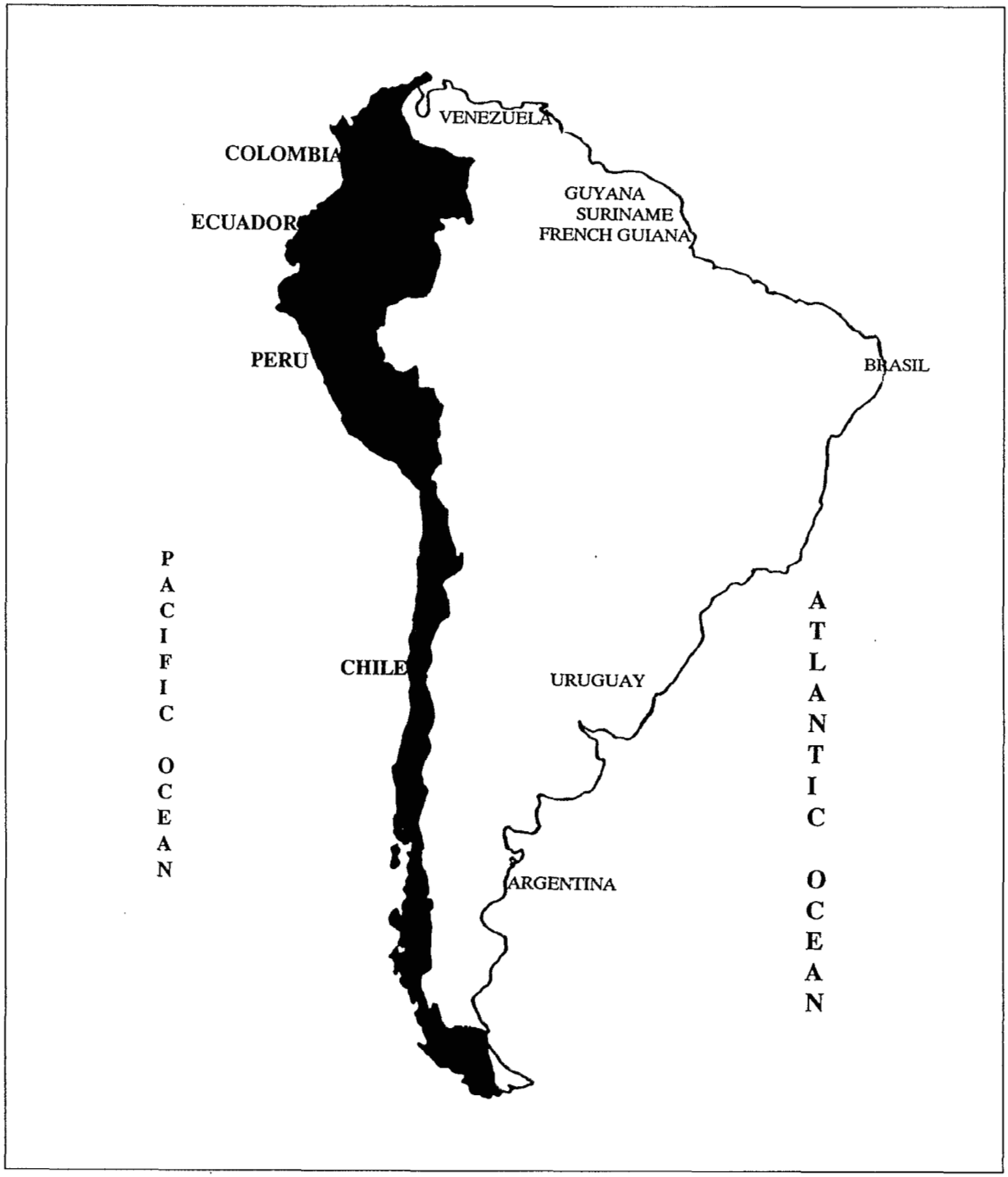
Emergence of fishery research

In spite of the great abundance of marine aquatic resources in the Pacific South America, (specially off the coast of Peru and Chile) it was only during the early 1940's that the first Marine Biological Station was established in the University of Chile's Montemar station (Vina del Mar). Later, the emerging concern over fisheries resources resulted in the creation of the Permanent Commission for the South Pacific (CPPS), which promoted the creation of

[2] *It is interesting to note that PAULY (1986), on a review of research on the living marine resources of the Philippines - a Spanish-colonized country of Asia with a large and important fishery sector - reports that most of the scientific contributions of that time in the country were written by «European scholars of non-Spanish origin».*

[3] *The literature in Latin America has extensively documented the operation and strategies of the multinational corporations exploiting the various natural resources of the countries of the region. From the 1940's to the early 1960's, notably the Kennecott Corp. and Anaconda Corp. exploiting copper mines in Chile, United Fruit Inc. exploiting bananas in Ecuador and Cuba, and several others exploiting tin in Bolivia, oil in Ecuador and Venezuela, coffee in Colombia and Brasil, etc.*

Fig. 1 - Map of South America showing countries considered in this review (in black)



three of the most important fisheries research centers of the region today : the Instituto National de Pesca (INP) of Ecuador in Guayaquil in 1961, the Instituto de Fomento Pesquero (IFOP) in Santiago, Chile in 1963 and the Instituto del Mar del Peru (IMARPE) in Callao in 1964. FAO and UNDP played a fundamental role in the development of these institutions providing the basic research and scientific skills at the early stages.

Although new marine and fisheries research centers and Universities have been created in the last decades (Tab. 1), continuous and long term funding for research has rarely been consistently budgeted and considered as a necessary component of these institutions by either local governments, donor agencies or private funding organizations. Usually, sufficient funding has been allocated for good physical facilities and shiny modern equipment but financial resources to maintain or run these modern infrastructures have run out quickly. Typical examples are the various research vessels donated by foreign governments to developing countries which usually require a daily operating budget equivalent to the monthly payroll of the entire staff of an institute. Moreover, the deteriorating economic conditions of most countries in the region has induced drastic short-term cuts in the already limited research funding which has produced the consequent discontinuity of research efforts and tradition (GALLARDO, 1982 ; VEGAS, 1987) and the emigration of the most competitive and highly trained professionnals to more attractive research environments. A vivid example is described by VEGAS (1987) in reviewing the history of the Faculty of Fisheries of La Molina University, in Lima, Peru. IMARPE's history has been no different either. Similar situations may be found in Chile where strong budget cuts (during the late 1970's and early 1980's) and new government policy on «university self-funding», forced drastic reductions in personnel of several fisheries research institutions and the non-replacement of vacancies left by those emigrating [4] (Faculty of Fisheries UCV, IFOP, Instituto de Biologica Marina, Montemar, etc).

Table 1 - Marine and fisheries research, training and management institutions in South America [a].

Country	Institution	Established
Argentina	Instituto Antártico Argentino	1951
	Instituto de Biología Marina, Mar del Plata (INIDEP)	1960
	Instituto Argentino de Oceanografía, Bahía Blanca	1969
	Centro de Investigación de Biología Marina	1961
	Instituto de Biología Marina, Prov. Santa Cruz	
	Centro de Investigación de Tecnología Pesquera (CITEP)	1974
Ecuador	Instituto Nacional de Pesca (INP)	1960
	Escuela Superior Politécnica del Litoral (ESPOL)	1958
	Facultad de Ingeniería Marítima	
Uruguay	Instituto Nacional de la Pesca (INAPES)	1975
Peru	Instituto del Mar del Perú (IMARPE)	1960/1967
	Universidad Nacional Agraria La Molina	
	Depto. de Tecnología Pesquera	
	Universidad Nacional Federico Villarcal, Lima	
	Faculdad de Oceanografía, Pesquería y Ciencias Alimentarios	
	Universidad Nacional José F. Sánchez Carrión, Huacho	

[4] The emigration of well trained scientists for political reasons after the establishment dictatorships in various countries, has been an important additional drain of research capabilities from the region.

	Instituto para el Desarrollo de la Pesca y la Minería (IPEMIN), Lima	
	Universidad Nacional de Callao	
	Faculdad de Ingeniería Pesquera y de Alimentos	
	Universidad Nacional de Trujillo, Trujillo	
	Universidad Nacional Mayor de San Marcos	
	Universidad Nacional de San Augustín de Arequipa	
	Instituto Tecnológico Pesquero (ITP)	
Chile	Instituto de Fomento Pesquero (IFOP)	1963
	Universidad de Concepción	1955
	Depto. de Biología Marina y Oceanografía	1957
	Universidad Católica Valparaíso	
	Escuela de Ciencias del Mar	
	Universidad del Norte, Antofagasta	1960
	Universidad de Chile	
	Depto. Acuacultura, Coquimbo	
	Escuela de Biología Marina, Montemar	1964
	Universidad de Antofagasta	
	Instituto de Investigaciones Oceanológicas	
	Universidad Arturo Pratt, Iquique	
	Depto. de Ciencias del Mar	
	Universidad Católica de Chile, Talcahuano	
	Area Biología y Tecnología del Mar (BIOTECMAR)	
	Universidad Austral de Chile, Talcahuano	
	Instituto de Zoología	
	Universidad de Tarapáca	
	Instituto Profesional de Iquique	
	Instituto Profesional de Osorno, Osorno	
	Instituto Profesional de Osorno, Sede Puerto Montt	
Colombia	Instituto de Los Recursos Naturales Renovables y del Ambiente (INDERENA)	1969
	Universidad Tecnologica del Magdalena, Sta. Marta	
	Instituto de Investigación Tecnológica	
	Instituto de Investigaciones Marinas (INVEMAR), Punta de Betin	
	"José Vives de Andreis"	
	Universidad del Valle A.A., Cali	
	Depto. de Biología	
	Universidad de Córdoba	
	Universidad del Choco	
	Escuela de Tecnología Pesquera, Bahía Solano	
	Universidad de Bogotá	
	Fundación Jorge Tade Lozano	
	Universidad de Caldas	
	Sección Cultivo de Peces	
	Centro de Investigaciones Oceanográficas e Hidrograficas, Cartagena	1968
	Corporación Autonomía del Cauca	

*(a) Based on Palacio 1980, FAO 1980, IMARPE 1988, Alfaro 1982, Chaparro 1983, Reyes 1984, FAO 1976 and personal experience. It is worth noting that several "International directories" of educational and training programs exist (*CARIGMA et al., *1976 ; FAO, 1976 ; UNEP/CPPS, 1981 ; GFAO, 1970) but Latin American training and research institutions are very much underrepresented in all of them.*

Furthermore, governments in the region have until recently assigned a secondary place to the development of fisheries and the allocation of research funds (BUZETA 1983). In Chile, for example, the total government contribution to research and technological development including funds from the university system for research was estimated in 1982 to be US $ 44 millions (reflecting a 50 % reduction with respect to 1981) which represented 0,3 % of the GNP and approximately US $ 4/habitant ; of this, only 15 % was allocated to research in renewable resources [5].

In Chile, national research funds for small-scale fisheries are therefore almost insignificant (probably no more than 10 % of the total fisheries share of the 15 % allocated to renewable resources). In fact, what little research is done with local funding, is usually through small grants (ranging between US $ 2 000 to 7 000) provided by the National Commission for Technological and Scientific Development (CONYCIT) or by specific requests made by the Undersecretary of Fisheries or their Sub-Divisions (SERNAP). In these cases, not only the subject matter of research is pre-conditioned, but often the methodology as well. In any of these alternatives, several rounds of draft proposals, discussions and negotiations take place before the project is actually approved and funded, consuming most of the researchers time and patience. Finally, research results under these terms are usually classified as "confidential" or for "exclusive use of the government authority" with limited possibilities of dissemination, peer review or discussion. The constraints for sound and independent research under these conditions are clear.

Similar situations are found in the other three CPPS countries, where local funds for sustained research in small-scale fisheries have been equally insignificant, and where, especially in Peru, the production of anonymous and confidential reports, which completely demoralize their authors, has taken epidemic proportions (PAULY, 1987).

The effects of the tight financial conditions under which the researcher must operate not only affects the scope of their work, but also their capacity to interact with other researchers (even mailing costs are often too high), acquire up-to-date literature (journals, recently published books, etc) or communicate their own results for peer review (circulation of drafts or publications). The inevitable consequence of this impoverishment is intellectual isolation, duplication of efforts, low quality of research, and above all, ineffective communications of results with limited impact on policy and management.

In his review of the evolution of marine sciences in Latin America, PALACIO (1980) distinguishes three progressively overlapping stages of how western science has spread in Latin America : foreign exploration and investigation, establishment of a dependent colonial science resulting from advances made abroad but adopted locally, and completion of the process of transplantation. Accordingly, he points out that the marine sciences in most Latin American countries are evolving from the first to the second stage while only Mexico, Argentina and Chile are moving into the third stage, with an «overwhelming emphasis» on marine orientation that was induced by specialists working either in the US or Europe. According to the author, this emphasis can also be traced to the influence of immigrants to southern South America, who have promoted the study of local faunas and have trained generations of biologists.

2.3. Impact of foreign research institutions

Because of the scarcity of funds for graduate programs in the marine and fisheries fields at local universities and training centers, higher education is usually sought either in the USA, Europe or even Japan. The higher status that foreign degrees holders enjoy locally, makes the pursuit of higher degrees abroad even more intense. Methodological emphasis and subject matters for graduate programs and thesis degrees are usually on issues of

[5] *By that time, the USA were spending USD 270 per inhabitant and Japan USD 123 per inhabitant. On the other hand, IBM Corp. alone was spending approximately USD 1 419 millions, that is, 32 times the total research Budget of Chile (CANAS and GASMAN, 1984).*

concern for the host country (e.g. USA or Europe) and rarely that of the country of origin of the graduate student. Consequently, areas of specialization and research of Master and doctorate candidates from Latin America are geared towards developed nations' interests (or their advisers' interest). The difficult process of re-adaptation of the newly graduated scientist back into his or her country's scientific environment has been excellently described, showing the bias of graduate and post-graduate education abroad and the local constraints which work against the development of local and self-sustained growth of scientific knowledge.

In these early foreign-induced scientific efforts, several foreign institutions also played an important role. Among them, The Lamont-Doherty Geological Observatory at Columbia University, the Woods Hole Oceanographic Institution, the Oregon State University, the University of Rhode Island, and several European research centers have helped the countries of the region to establish their marine science programs.

3. RESEARCH, RESEARCHERS AND FUNDING IN THE LAST DECADE

Research in South America today is conducted in basically three types of institutions :

- Non-government organizations devoted to research ;
- University faculty staff and their assistants ;
- National Institutes of Marine and Fisheries Research with sporadic collaborative agreements among them.

Research on small-scale fisheries of Latin America is also conducted by international or bilateral institutions working independently or in collaboration with local researchers, e.g., the International Center for Marine Resources Management (ICMRD) of the University of Rhode Island which worked in Ecuador and various countries of Central America. The International Center for Living Aquatic Resources Management (ICLARM) conducting collaborative research in Peru and Colombia, the Inter-American Development Bank, the World Bank, FAO, PROCOPA, CORPESCA, etc.

3.1. Private research institutions

Private research institutions in the region have developed largely in response to the need for a more independent and better funded research environment. The low salaries at universities and governmental research centers, the limited research budgets and the various constraints imposed on researchers under military dictatorships of the past decades in Latin America have induced the more motivated scientists and researchers to create independent private small research groups. As the reputation and effectiveness of these groups have developed over the years, several of them have been able to gain national and international recognition, attract well-known scientists, increase the number of full-time staff and secure research funding for their activities (basically from local and international grants and consultancies).

Thus, the most significant research work in small-scale fisheries in the last few years in the region has been conducted in private research centers or in collaboration with them (CEPLAES, CORPONARINO, ECONIN, etc).

In Colombia, an interesting research project in small-scale fisheries has been conducted by the Corporacion Fondo de Apoyo de Empresas Asociativas (CORFAS) in which participatory research techniques in several fishing communities of Colombia have allowed to test the effectiveness of the Fisherman Services Center (CESPA). Although local funding has been made available for this experience, international donor agencies have been an important source of funds as well (Ramirez 1988).

The Fundación para la Educacion Superior (FES) and the Fondo Colombiano de Investigacion Cientifica y Proyectos Especiales «Francisco José de Caldas» (COLCIENCIAS) with funding from IDRC (International Development Research Center - Canada), conducted a pilot research project to evaluate development alternatives for the small-scale fisheries of Santa Marta, Colombia. The study considered technological (harvest and processing methods and their efficiency), biological (i.e. acoustic biomass estimates), economic (price and income determination, investment structure, etc) and socio-cultural aspects. Some inferential analytical techniques were also used. Although the integration of the various aspects was more formal than real, this project is probably the best attempt to date at conducting a multi-disciplinary project in Colombia (HERNANDEZ, 1986).

In Chile, Economistas e Ingenieros Asociados Ltda (ECONIN) has conducted extensive research work in small-scale fishing villages of four representative regions where action-research techniques, surveys and participatory research have been used for elaborating a methodology for the development of Small-scale fisheries (ECONIN Asociados Ltda, 1985). This project has been fully funded by the Inter-American Foundation.

IDRC has been supporting extension and research activities on small-scale fisheries through a network based at Pontificia Universidad Catolica de Chile in Talcahuano (BIOTECMAR) with strong participation of fisherfolks. IDRC has also granted research funds to IFOP and various universities to conduct research in small-scale fisheries, the most recent one being the funding of a research project to elaborate a national data base system for monitoring and management purposes.

In Ecuador, the Centro de Planificacion y Estudios Sociales (CEPLAES) has recently produced the most penetrating socio-economic study on small-scale fisheries of Ecuador within a multi-disciplinary approach based on three fishing communities of Central Ecuador, in the province of Manabi (PRIETO, 1989). Although the study used elementary statistics for the analysis of data, it is probably the first attempt in the region to integrate various aspects of the fishery system into a single analysis. Funding for this research has been provided by the IDRC.

ESPOL, in collaboration with the University of Rhode Island and funding provided by USAID and the Inter-American Development Bank, has been conducting research in various technological aspects of small-scale fisheries for penaeid shrimp (ZAPATA, 1987). The experience and knowledge acquired have been a useful source for the development of similar activities in other countries of the region (Colombia, Honduras, etc.).

In Peru, the Programa Cooperativo Peruano-Alemán de Investigacion Pesquera (PROCOPA) in collaboration with IMARPE has recently finished one of the most extensive studies on small-scale fisheries, with detailed catch and effort data and other information collected from 12 representative landing places along the Peruvian coast (WOSNITZA-MENDO *et al.*, 1988). The detailed data collected and turned into a large micro-computer data base have allowed to identify significant underreporting in the official statistics of small-scale fishery catches (ESPINO and WOZNITZA-MENDO, 1988). Although the preliminary report and analysis is largely descriptive, it sheds light on various hypotheses about fishermen's attitudes and working habits and their relationships to resource availability and catch. Funding for this activity has been provided by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

3.2. University faculty staff and assistants

University staff and their research assistants have been probably the most stable and continued element of research on the small-scale fisheries of the region. Although no University or Faculty as such has a specialization on small-scale fisheries either as a graduate degree or undergraduate diploma, (except the Universidad del Choco in Bahia Solano, Colombia, which provides training at a semi-technical level), research on small-scale fisheries is conducted by staff members of various faculties. Their emphasis has generally been on case studies but their work has been constrained by the limited funding available and the requirements for thesis degree work. Few faculty members followed a continuous line of work in this area. Those who did continued their work either through students conducting their thesis or through small grants received from the university or governmental national research system.

Among the few doing such work, in Chile for example, are P. ARANA (biologist/fisheries engineer) with his study of the lobster fishery of Juan Fernandez Island and the editing of several books on the fishery resources and fisheries of Chile, P. WHITMAN (social worker, Universidad de Concepcion) with studies of social aspects of fishing communities in the VIII Region (south of Chile), J. CASTILLA (biologist, Universidad Católica de Chile, Santiago) with research on shellfish, M.A. Barbieri (biologist, School of Marine Science, Universidad Católica del Valparaiso) developing research in the use of satellite data for small-scale fisheries application.

One of the most serious attempts to systematically develop the regional capability to conduct research in small-scale fisheries took place in 1985 with funding provided by the Social Science Division of IDRC. An intensive training program, the "Small-scale Fisheries Training for Research Methodologies" (PEIDPA) was successfully conducted at the School of Marine Sciences of Universidad Catolica, Valparaiso (AGUERO 1985) and provided intensive training on the various aspects of fisheries research to Latin American professionals who had demonstrated research experience and interest in small-scale fisheries [6].

In Ecuador, at the Escuela Politecnica del Litoral, a fisheries engineer, B. ZAPATA (1988) and his colleagues have been conducting research on culture technology of shrimp for several years. A. CEDENO (1987) (fisheries technologist) has been developing applied research in small-scale fisheries gear and technology, and M. FIERRO (1987) and POLLNAC *et al.* (1987) have been working on various aspects of fishermen's cooperatives.

In Peru, V. VENTURI, a zootechnologist, H. NAVA a fisheries engineer, and J. Moscoso, a fisheries engineer, all of Universidad Agraria La Molina in Lima, have been working on various aspects of aquaculture with high potentials for small-scale fisheries activities. In Huacho, V. OBREGON a fisheries engineer, has been involved in the analysis of technological aspects of small-scale fisheries. However, most of his publications are in the grey literature.

In Colombia, two biologists, C. MOSQUERA and M. BERNAL, of the Universidad del Choco, worked for more than a decade on small-scale fisheries of Bahia Solano ; their work is also unpublished, unfortunately.

The list of faculty staff in various institutions which are equally motivated, trained and prepared to conduct research in small-scale fisheries in the region, if proper funding and coordination were made available may be much longer, but today, only a few have been able to survive in the prevailing research environment.

3.3. National institutes of marine and fisheries research

National Institutes such as IFOP in Chile, INP in Ecuador, IMARPE in Peru, or INDERENA in Colombia, conduct research mostly as benchmark reports and diagnosis of the small-scale fisheries sub-sector. Again, few staff members in each of these institutions have became well-known for their research and involvement in this area. In IMARPE, the biologists Maria VELIZ, M. A. ESPINO and M. FLORES are probably the best-known professionals working in small-scale fisheries. At INP, R. MONTANO (1987), J. MARTINEZ (1987) have been involved with various aspects of small-scale fisheries of Ecuador. At IFOP, in Chile, E. ARANDA, and R. TORO (1989) are mainly concerned with small-scale fisheries aspects.

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[6] *Key training and research institutions in most Latin American countries were visited by the author of this synthesis to carefully select a team of the best available professionals interested in small-scale fisheries research with background from various disciplinaries including biology, economics, sociology, and engineering. The curriculum content drew extensively from the fields of marine biology, maritime anthropology, fisheries economics, fisheries technology and quantitative methods (statistics, mathematics). A total of about 15 participants from six different countries participated to a 7-week intensive training program consisting of lectures, field visites (including fishing activities), workshops and panel discussions. During the training program, the participants were asked to prepare a research proposal which would eventually be submitted to IDRC for funding. Some of the proposed projects have been actually funded and completed (PRIETO, 1989).*

4. EMPHASIS, APPROACH, METHODOLOGIES AND TOOLS

4.1. National/State level

In Chile, INDAP (Gross, 1968) produced the first diagnostics with specific sections dealing with social and economic aspects and data about the fishermen, the resource (taxonomy, distribution, environment, etc) and the harvesting and processing infrastructure, the various gears and capture methods, and trade. Later, several other studies and diagnostics have been presented, emphasizing particular regions, subsectors, gears, areas or species (Wurman, 1971 ; INDAP, 1971 ; IFOP, 1971 ; Herrera *et al.*, 1976 ; CORFO-IREN, 1979 ; Campos, 1976 ; MOP, 1976 ; MOP, 1977 ; Hoyl, 1980 ; SERCOTEC, 1981 ; SERNAP, 1982 ; Bitran y Contardo, 1982 ; Silva y Saa, 1983).

In Peru, until recently (Woznitza, 1989), there has not been a comprehensive study, diagnostic or research on small-scale fisheries. The first serious studies on sociological and marketing aspects were done in the early 1960s by Hammel and Hesse (1962) and by Doucet (1963), respectively. Later, particular aspects were expanded e.g. by Guevara (1971) working on factors affecting marketing or by Larrea (1974) working on marketing of small-scale fisheries catches. More recent comprehensive analyses of small-scale fisheries have been presented by Valdivia (1979), Walsh (1981), Zapata (1987) and most recently and comprehensively by Woznitsa (1989).

In Ecuador, overall reviews of the small-scale fisheries subsector have been published only recently ; the most relevant ones are those by ESPOL/CEPLAES/ILDIS (1987), INP (1987), Villar (1987), Zapata y Fierro (1988), Lenz-Volland (1988) ; the most recent and comprehensive is by Prieto (1989).

In Colombia, only few comprehensive reports have been produced, notably those of Botero and Lozano (1983), Silva (1984) ; some regional studies are also available : Robayo (1983), Hernandez (1986) for the Atlantic coast, and Valverde (1988) for the Pacific coast.

4.2. Methodology and approaches

The general approach to fisheries research on small-scale fisheries in the region has, until recently, been fish-oriented, that is, emphasis has been placed on the characteristics of the resources, their distribution, behaviour, taxonomy, the technological requirements for their capture, and the quantification of the catches and associated parameters. Socio-economic studies have focused on determining social attributes (age, sex, location, education, health and community structure), market conditions (prices, supply, demand, distribution channels, structure and behaviour of prices over time), costs and returns (of production units and/or labor). Cultural and institutional studies have been mostly concerned with characteristics of the operation of cooperatives and other community organizations, perceptions and attitudes. Few recent efforts on experimental basis have been made to conduct training and education at fishing community level with serious consideration of social and cultural aspects (Maira *et al.* 1988). Also, research on the contribution of women in the fisheries sector has been minimal with only one attempt being presently conducted in the south of Chile under the FUNCAP Artisanal Development Project. In general, the emphasis has been descriptive, qualitative and site/case specific.

Where quantitative data has been collected and presented, only descriptive statistics have been used (means, percentiles, etc) with little efforts to use inferential statistics, (as applied to economics, sociology, etc) for assessing functional relationships and determine causality or dependency of variables in quantitative terms. Data acquisition has been performed using a wide variety of tools and instruments such as literature and secondary information review, direct interviews and questionnaires, participatory research, direct observation, etc. Most of these instruments have been used by sociologists or anthropologists involved in the various research teams. Modelling efforts to integrate

various aspects of small-scale fisheries in a simultaneous analysis has have been minimal except in the works of GOMEZ and ADRIASOLA (1975), AGUERO (1984, 1986). To date, no dynamic nor comparative analysis of small-scale fisheries has been conducted in the region.

Most of the existing literature on small-scale fisheries has been in the form of internal or unpublished reports ("grey literature"). Workshops and conferences have been helpful instruments to stimulate researchers of the region to write and publish. A literature search on international journals and periodicals shows the present very few contributions originating from the region. Indeed, publications based on local symposia and conferences appear to contain the bulk of what is published. The latest meeting of Fisheries Science in the region (2nd Conference of Marine Sciences, August 1987, Lima) received a total of 470 abstracts of contributions (ALICMAR 1987) ; the International Symposium on Living Resources and Fisheries organized by the CPPS in Vina del Mar, Chile, May 1988 received 170 abstracts of contributions (CPPS/FAO/IOC/UNEP/CEE, 1988) while the latest regional Seminar in Small-scale Fisheries held in Talcahuano, Chile in Jan-Feb 1989, accounted for contributions (BIOTECMAR/FUNCAP/CIID, 1989).

4.3. Status and trends

In Latin America, as in other regions, small-scale fisheries research encompasses a wide variety of issues, disciplines and problems. Research on the complexities of fisheries and their natural environment requires the concurrence of several disciplinary approaches. Moreover, it is well recognized now that this concurrence of various disciplines should ideally be simultaneous or inter-disciplinary (SUTINEN, 1976 ; SMITH, 1979 ; AGUERO and LOCKWOOD, 1986). Therefore, the assessment and analysis of research in small-scale fisheries not only need to distinguish each of these disciplines but also to evaluate them in their interactions and predictive capacity.

To date, in Latin America as well as in other regions of the world, there is not yet a well established, shared and accepted body of knowledge that actively integrates into a dynamic and truly interactive way, the various disciplines implied by and the components of the fishery and the small-scale fishery system in particular (SUTINEN 1976). What is generally referred to Fishery Sciences (of which small-scale fisheries should be an element) is no more than a conglomerate of traditional disciplines (fisheries biology, oceanography or limnology, fisheries technology, economics, sociology, anthropology, etc) attempting to use the fish resource and some research results (produced by traditional disciplines) as common denominator, the subject matter and linking factor being the capture and social use (actual or potential) of the resource.

For a long time, research in fisheries science and in small-scale fisheries in particular, has been dominated by resource and technology-oriented professionals who predicably put the emphasis of their research on the fish resource and the techniques for catching them, rather than on the catchers or users of the resource (AGUERO and LOCKWOOD 1986). This bias though, has been rapidly diminishing in the last few years as new professionals from various backgrounds, specially social science, become interested and involved in this area. Yet, it is still a slow process with only few, maybe not more than half a dozen of the many marine, fisheries and natural resource institutions involved in small-scale fisheries research in South America (see Tab. 1) presently having in their full-time staff, professionals from social science background, namely the Instituto de Fomento Pesquero (IFOP) in Chile and the Instituto de Recursos Naturales Renovables y del Medio Ambiente (INDERENA) in Colombia.

Only a few major projects devoted to applying such multi-disciplinaries perspectives have been conducted to date in the developing world, notably the research project conducted by the International Center for Marine Resources Management (ICMRD) of the University of Rhode Island (URI) in Central America. This project has also served directly or indirectly as guidelines and source of inspiration to more recent research efforts conducted in Colombia (HERNANDEZ, 1986), Ecuador (CEPLAES, 1987), Peru (WOSNITZA-MENDO, 1989), Chile (ECONIN, 1986).

5. CURRENT PROBLEMS FOR RESEARCH

Several factors may be blamed for the relatively underdeveloped and impoverished situation of research on South American small-scale fisheries. The following section will discuss some of the important aspects that to our opinion have prevented a stronger and robust research.

5.1. Fragmentation of research

Research on small-scale fisheries in South America has been usually concerned with particular aspects of these fisheries such as the taxonomy and biology of the resource species, boat and gear descriptions, economic performance of specific production units, socio-economic attributes of specific fishing regions or accounts of personal experiences or case studies in particular fishing communities. No analytical efforts to date have been made to generalize or compare, on a regional basis, the various aspects of small-scale fisheries.

In a recent regional workshop in Colombia (CPPS, 1986) with representatives of all member countries of the CPPS (Ecuador, Chile, Colombia, Peru), a working group prepared a detailed list of species caught by small-scale fishermen in the various countries of the Pacific South American region. The objective of this exercise was to indentify and establish the state of scientific knowledge about them. The Workshop's conclusion was that the information and knowledge about small-scale fisheries is "fragmentary and in many cases non-existing". This situation was attributed to a large extent, to the priority given in these countries to collection of data and information on large-scale industrial fisheries (CPPS, 1986). The group also established that most of the existing information relates to taxonomy and distribution of the stocks with a few biological parameters and data on various fishing gears thrown in. The group also noted that there were next to no data on the population dynamics of resource species (biomass, growth, mortality, recruitment, etc). Data on fishery, catches and effort were found to be incomplete and generally inappropriate. Moreover, the unaccuracy of official data and statistics has been pointed out by several researchers of the region who found large differences with their own carefully collected data (see e.g. Wosnitza-Mendo, 1988).

5.2. Lack of appropriate data and information

Data and information systems on small-scale fisheries in the region are generally deficient and incomplete. Where data are collected, the inferences made from it are often inaccurate due both to poor quality of the basic data and the inferential process itself. Usually, data are obtained on the basis of improper or undefined sampling procedures which the enumerator does not even understand. Lack of personnel, infrastructure and procedures in quality and quantity (budget constraints) make the entire process of data collection, recording and reporting more a formality than a real concern to produce and maintain a reliable and useful data base system.

Consequently, almost every research project or activity on small-scale fisheries must start by generating its own data with the associate waste of time, funding and resources. Moreover, data and information collected under these conditions become a costly asset for researchers who are not willing to share them freely and thus the little reliable data that is produced is kept unpublished.

The particular characteristic of each fishery in the region determines different specific objectives and research needs for particular countries. Common methodologies, nevetheless, could be applied but the lack of coordination and a regional view to approach and identify research methods and tools has prevented both the comparisons, extrapolation and generalization of research results, and the fine-tuning methods used in various countries to study small-scale fisheries.

5.3. Dissociation and lack of communication

Research in many developing countries is still viewed by many policy makers and politicians as dissociated from their own management efforts. It is viewed in general, as a legitimate but rather useless activity that researchers and academicians conduct within their own research centers and facilities but with limited or no real-life applications. Modelling efforts are quickly classified as «theoretical», «too abstract» and «non-realistic». Researchers, on the other hand, do little to overcome this problem and research results are rarely presented or explained in ways that non-specialists can understand. Jargon, long mathematical formulations and undefined terms are usually the major sources of misunderstandings.

The School of Marine Science (UCV) in Valparaiso has been sucessful in the last six to seven years in partly bridging this gap. An annual meeting which has became a traditional and expected event among policy-makers, researchers, academicians, small-scale and industrial fishermen, offers an opportunity to discuss research findings, practical problems and regulatory and policy measures. Although during the early years, policy-makers and industrial fishermen were reluctant to participate, they now look forward to participate, and even to sponsor the meeting.

At the regional level, the CPPS is partially taking a coordinating role with two meetings held in which research and aspects of small-scale fisheries have been discussed. It is expected that CORPESCA, the IDRC small-scale fisheries Network will also play a similar role in a larger geographical area.

5.4. Staff turnover

Staff turnover has been a serious problem in many countries of the region, specially because many of those leaving research and academic activities are precisely those who have the longest research experience and MS or PhD degrees.

The main reasons for resignation (often followed by emigration) have been the relatively low levels of salaries at research institutions, the increasing opportunities for higher paid jobs in the private sector or the quest for a better research and professional environment. Political considerations have also been a major factor in the high turnover of researchers [7].

In addition, administrative positions, associated with higher status, social recognition, perks and higher pay are usually a temptation for well-recognized scientists and researchers. Thus, research becomes more a "stage" in the professional carrer of highly trained individuals than an end in itself.

The result is that there is a continuous process where young graduates and post-graduates become initiated in research in small-scale fisheries (attracted by funding, curiosity or whatever) which is quickly abandoned to assume higher administrative positions (Chairman, Deans, Rectors, Undersecretaries, etc) attained by the social and administrative leverage that higher degrees create in developing countries. Therefore, those who can effectively conduct research are precisely those who quickly leave the research environment for better conditions and opportunities.

[7] *Until recently, most of the major fisheries institutes in the region did not have in their staff any professional from social sciences disciplines. It has been only during the last decade that a few economists have joined these institutions on full time contracts. Traditionally, social scientists were brought in to research on specific, ad hoc, consultancy basis, usually at the end of a project, when it was felt that «some socio-economics» was needed. The author of this synthesis was the first economist to join the School of Fisheries of the Universidad Catolica in Valparaiso, Chile, on full time contract in 1982. This school was created in 1956, as School of Fisheries in the region. To date, IMARPE in Peru, the largest research center of one of the most important fisheries country, does not have any sociologist, anthropologist or economist on full contract basis.*

CONCLUSIONS

This review of research on small-scale fisheries along the Pacific coast of South America has emphasized its fragmentation, underdevelopment, and general insufficiency. Lack of sufficient and sustained funding, the deteriorating economic conditions under which researchers must operate, insufficiency and inadecuacy of data and information, lack of an established and accepted theoretical framework, and research isolation of research groups are among the main causes for this situation.

The review has also discussed the shift of emphasis from resource-oriented to people-oriented research, as induced by the increased recognition of the socio-cultural and economic importance of small-scale fisheries. The increasing role of independent research groups in conducting more comprehensive studies has been highlighted; this allowed an indirect assessment of the role of (international) donor agencies, in funding research on small-scale fisheries.

List of Acronyms

ALICMAR	Asociación Latinoamericana de Investigadores en Ciencias del Mar
ANPAC	Asociación Nacional de Pescadores Artesanales de Colombia
BIOTECMAR	Departamento de Biología del Mar
CEPLA	Centro de Planeamiento
CEPLAES	Centro de Planificación y Estudios Sociales
CIID	Centro Internacional de Investigaciones para el Desarrollo
COLCIENCIAS	Fondo Colombiano de Investigación Científica y Proyectos Especiales "Francisco Jose de Caldas"
CONYCIT	Comisión Nacional de Investigación Cientifica y Tecnologíca
CORFAS	Corporación de Fondo de Apoyo de Empresas Asociativas
CORFO	Corporación de Fomento de la Producción
CORPONARINO	Corporación Autónoma Regional para el Desarrollo del Nariño
CPPS	Comisión Permanente del Pacífico Sur
ECONIN	Economistas e Ingenieros Asociados Ltda.
ESPOL	Escuela Superior Politécnica del Litoral
FAO	Food and Agriculture Organization of the United Nations
FES	Fundación para la Educación Superior
FUNCAP	Fundación para la Capacitación del Pescador Artesanal
GTZ	Deutsche Gesellschaft für Technische Zusammernarbeit
ICLARM	International Center for Living Aquatic Resources Management (Philippines)
ICMRD	International Center for Marine Resources Management (Rhode Island)
IDRC	International Development Research Centre (Canada)
IFOP	Instituto de Fomento Pesquero
ILDIS	Instituto Latinoamericano de Investigaciones Sociales
IMARPE	Instituto del Mar del Perú
INDAP	Instituto de Desarrolllo Agropecuario
INDERENA	Instituto Nacional de los Recursos Naturales Renovables y del Ambiente
INE	Instituto Nacional de Estadísticos
INP	Instituto Nacional de la Pesca
ION	Instituto Oceanográfico Nacional
IPEMIN	Instituto para el Desarrollo de la Pesca y la Minería

IREN	Instituto de Recursos Naturales
MOP	Ministerio de Obras Publicas
OPSA	Oficina de Planeamiento del Sector Agropecuario
PEIDPA	Programa de Entrenamiento en Investigacion para el Desarrollo Pesquero Artesanal
PROCOPA	Programa de Cooperación Peruano Alemano
SERCOTEC	Servicio de Cooperación Tecnica
SERNAP	Servicio Nacional de Pesca
SERPLAC	Secretaría Regional de Planificación y Coordinación
UCV	Universidad Católica de Valparaiso
UNDP	United Nations Development Program
USAID	United States Agency for International Development
URI	University of Rhode Island

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