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# Asian Fisheries Science: A Profile

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## INTRODUCTION

The men and women who make up the Asian Fisheries Science community constitute an extremely diverse group in terms of their social, cultural and educational background. Yet they should be considered as a single group with regard to aquatic resources, because nearly all their countries lie within the one (Indo-Pacific) faunal zone, stretching from northern Australia to China and from India (and eastern Africa) to Hawaii. Thus, marine scientists in these countries are studying the same species and in some cases the same migratory stocks. The inland aquatic fauna are not as similar, however.

Overlying the biological aspects are social and cultural values which give the Asian region a unique flavour that percolates through the fisheries sector as much as if not more than other sectors. Thus, socioeconomic issues have a regional character also.

Nearly all the countries of the region were colonized or greatly influenced by various Western countries. This is reflected in their different fisheries educational systems and in their approach to research.

Until recently, there were no mechanisms for most researchers to meet to discuss their work. There were regional meetings for a few high-level scientists and specialists. For the most part, however, cooperation and even conversation did not extend beyond national borders. The formation of the Asian Fisheries

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*Editor's Note:* This article is an abridged version of the Asian Fisheries Society Special Publication No. 6 of 1991. In view of the importance to the industry of the subject material covered and its rarity in the literature, it was considered appropriate to include those findings here. Undertaking this type of survey and analysis is very time consuming, and often frustrating. The findings still shed much light on the personnel involved in research and development of the industry in Asia, as well as on their productivity and the limitations they encounter.

[1]Ms Cariño passed away in April 1993.

Society in 1984 has provided opportunities to develop the spirit of a regional community through the regular Asian Fisheries Forum, a journal and special projects and workshops to investigate regional issues.

In 1986, the Society began a project to investigate the nature of the Asian fisheries science community itself—a study of the Society's constituents. The primary objective of the study was to determine the academic and other characteristics of Asian fisheries scientists, as well as of their scientific output, to present a quantitative assessment of the status of Asian fisheries science. These results would form a basic tool for researchers, educators and administrators. The data would present a baseline of Asian fisheries science activities against which future directions and progress could be evaluated.

## Background

### Definitions

It is not easy to define "fisheries science". The subject matter includes elements of limnology, marine biology and oceanography as well as a broad range of socioeconomic, legal and technological subjects. It reaches into agriculture, biochemistry and medicine. Two widely used definitions follow.

"Fishery science is the application of scientific knowledge concerning fish populations to the problems of obtaining the optimum production of fishery products, whether stated in tons of factory material or in hours of angling pleasure" (Everhart, Eipper and Youngs 1975).

"The scientific study of the use of the living resources of the waters ... Part ... is concerned with the biological, physical and chemical aspects of the process of organic production; part, with the distribution of the resources; part, with the effect of fishing" (Royce 1972).

These two definitions of fisheries (or fishery) science have in common that they rightly stress use, production and populations rather than focusing on the fish.

In the preface to their textbook, Everhart, Eipper and Youngs (1975) note that "a strong foundation in mathematics, chemistry, biometrics and zoology is not enough. The fishery scientist must also understand the economics of natural resources, the sociological problems of Man, and be sensitive to all the different kinds of interrelated environmental problems". The authors then describe research in this broad area as being (1) of a background nature, e.g., surveys and inventories; (2) basic research, e.g., on fish behaviour; (3) applied research, e.g., using fish behaviour in raceway design; and (4) developmental, e.g., testing raceway designs, modelling. Thus, the authors blurred in their explanation the distinction made in their definition of fisheries science.

## Literature

The lack of distinction between those scientists focusing on the organisms and those focusing on the populations—in aquaculture systems or in capture fisheries—is a feature that permeates the fisheries literature also.

"The literature of fisheries is associated with a broad diversity of journals, most of which do not use the word 'fisheries' in their titles" (Maclean 1988a). FAO's Aquatic Sciences and Fisheries Abstracts (ASFA) has monitored over 30,000 items annually in recent years, although the total number of relevant items produced globally could be at least 40,000 (Freeman 1988). Some 65% (potentially 26,000 items/year) deal with living resources (Needham 1982). The coverage of marine biology by the Institute for Scientific Information (ISI) included 23 journals that published 1945 articles in 1987. These included a number of the most important fisheries journals, which include both marine and freshwater topics. Articles in these journals were cited by 7780 articles in the "51 journals that most cited" the 23 ISI-covered journals in 1987 (Fuseler-McDowell 1989). The implication is that this core aquatic biology/fisheries-related literature consists of only around 8000 articles/year.

Two studies (Pauly 1984; Maclean et al. 1990) of citations to ICLARM contributions to the literature showed that only about 10% of all citations were reported in the ISI coverage. On this basis, the total annual literature related to aquatic biology/fisheries may be as much as 80,000 documents.

It is worth noting other aspects of the core literature, as derived by ISI, in aquatic sciences—if only for comparison with Asian data. A recent analysis of the ISI database (Schubert, Glanzel and Braun 1989) covering 1981–85 showed that in the field of marine and freshwater biology, 9403 papers in 22 journals covered by ISI were published. The top 22 countries, covering 92.5% of all articles, were listed, of which India was the only one from developing Asia. The Indian contribution was 251 papers (50/year) or 2.67% of the world total. The expected citation rate of these papers was 1.29 (times cited/year), but was only 0.78. The observed/expected proportion (0.60) was the lowest of the English-language countries represented.

The ISI analysis gave separate results for a further nine journals in the fisheries field. These journals published 5135 papers during 1981–85. Eight major countries were represented, covering 91.7% of the literature. Asian developing countries were among the other 63 countries making up the remaining 8.3%.

The low citation rates of Indian papers were observed by Arunachalam (1979) who examined 1977 data from SCI files. He found that papers in Indian journals were rarely cited, and that almost all the citations were in Indian journals, i.e., that "the cognitive structure of Indian science is to a large extent a closed system". A contributing factor to this insular nature was that references cited by Indian authors were older than those by authors in other countries, suggesting a lack of relevance of many Indian contributions.

Arunachalam and Markanday (1981) compared India with three other "middle-level" countries from the point of view of scientific productivity: Australia, Canada and Israel. They noted that the insular effect observed above for India was a phenomenon of all four countries. However, a large percentage of the better-cited Canadian and Australian papers were published overseas, i.e., the insular effect was much less than in India or Israel.

Garfield (1983) observed that not only was India the major developing country in terms of numbers of articles in the database, but also that other Asian countries were insignificant in comparison. Those mentioned were Malaysia, Singapore, Thailand and the Philippines. India was said to produce half of all developing-country scientific literature.

Again, based on ISI data, several authors have commented recently on the scientific output of various Asian countries. Of the ASEAN countries, it was reported that "their contribution to worldwide enterprise of generating new knowledge in the sciences is ... meagre" (Arunachalam and Garg 1986). A study of scientific productivity and citation analysis in the Philippines using 1976–78 data concluded that scientific output there was "the wretched product of a wretched scientific effort" (Calleja 1980). Thailand was producing more scientific publications than other ASEAN countries, according to 1981 ISI data, as a "hopeful" developing country (Yuthavong 1983).

It must be remembered that the coverage of developing-country literature by the ISI database is extremely limited, and while some authors contend that the literature not covered by ISI is of minor significance only, there is growing evidence that this is not the case. A critique is given by Davis and Eisemon (1989), who examined the scientific literature of four newly industrialized countries (NICs) of Asia—Malaysia, Singapore, South Korea and Taiwan. Among their findings was that often the same authors contribute to both the "core" literature (of ISI) and to the "peripheral" literature. Perhaps then we are not seeing core and peripheral science but two different markets.

Some support for the "different market" concept comes from a recent study by Dizon (1991) on citations to two Philippine scientific journals (*Kalikasan* and the *Fisheries Research Journal of the Philippines* (*FRJP*)). Her extensive manual search for citations to the journals, covering nearly 2500 institutional publications and theses, showed that about half of all articles in the two journals had been cited (63% for *FRJP* and 44% for *Kalikasan*). This is similar to the citation pattern of fisheries-related (Western) journals in the ISI database: approximately half have been cited at least once (Schubert, Glanzel and Braun 1987) and to journal articles by ICLARM, of which 47% have been cited (Maclean et al. 1990).

## Productivity

One consequence of not being able to define the amount of literature produced by fisheries scientists due to its broad coverage or absence of proper

From Tables 21 and 22, the influence of non-Asians in Asian-based institutions is strongest in the coauthor field, suggesting that the level of collaborative research within the region is high (non-Asian influence in the editorial field is also high but the absolute numbers are low).

## Discussion

The present survey has few points of comparison. Its results are based on a large sample, including nearly 10% of all Asian fisheries scientists, estimated to be about 3600 in 1983.

One reference point is the publication rate of articles as captured by ASFA. In Table 17, the ASFA "harvest" was found to be about 3700 articles/year for Asia (averaging 1982–89 data). The publication estimate for Asian (Pacific) scientists in the survey sample is about 3500, including as does ASFA, semitechnical publications. The results are close.

From the survey data, 60% of all Asian publications can be classed as scientific (as opposed to semitechnical/popular articles), including journal articles, proceedings papers and reports. This is lower than the proportion found in the earlier survey of ASFA records by Chua and Maclean (1988) which found 75% of Indo-Pacific related documents to be scientific articles, proceedings papers or reports.

Elsewhere in the text, comparisons on productivity have been made. These should not be taken too seriously in view of the dissimilarity of data, but it is hoped that they give food for thought as well as provide a benchmark on the activities of a large sample of scientists working in Asia.

A gratifying feature of the results is the finding that Asian scientists are productive and that the extensive criticisms of developing-country literature cited in the Background section of this report are unfounded. That the majority of the literature is not cited in the ISI database reflects the fact that most of the work deals with national or regional or even international issues (e.g., tropical fisheries science) not relevant to most scientists in Western countries. Neither are the differences in productivity (papers/author/year; Table 18) great among the scientists of many Asian countries.

Various authors (summarized in Davis and Eisemon 1989) have noted that even if productive, Asian scientists produce articles that are of lower quality in that they cite older literature than do their Western counterparts. A study of Philippine biological scientists (Maclean and Vega 1990) showed that citations in articles in the major Philippine fisheries journal (*Fisheries Research Journal of the Philippines*) had a mean age of 9.2 years, little different from citations in a major Western journal such as *Aquaculture* (8.1 years).

Thus, the successful developing-country scientists—those publishing in the primary literature, whether or not covered by ISI—probably behave in a similar manner to their Western counterparts, even if not quite as productively.

The disturbing feature of the present survey results is the lack of use of available information sources by the majority of respondents. ICLARM, through its Selective Fisheries Information Service, is one such source. Through that Service, the Center has learnt that few scientists have the capacity (or willingness) to pay for information. This poses a dilemma for information producers/providers, which is well known also to donor agencies. Funding information appears to be feeding a bottomless pit. Not providing information, however, can eventually cause meaningful research to come to a complete standstill. As Jay Ogilvy, quoted in Brand (1988), put it: "A Nobel Prize is waiting for the person who figures out the economics of information".

Information sources, such as ICLARM, have a responsibility to seek ways to provide maximum information at minimum costs to both clients and donors. From the present survey, the main guideline is very clear: that the available information has to be passed around more efficiently and more effectively.

## References

Arunachalam, S. 1979. Scientific journals in India. Their relevance to international science. *Science Today* March 1979: 45–50.

Arunachalam, S. and K. C. Garg. 1986. Science on the periphery—a scientometric analysis of science in the ASEAN countries. *Journal of Information Science* 12: 105–117.

Arunachalam, S. and S. Markanday. 1981. Science in the middle-level countries: a bibliometric analysis of scientific journals of Australia, Canada, India and Israel. *Journal of Information Science* 3: 13–26.

Asian Fisheries Society. 1988. Workshop statement on fisheries education and training in Asia. In *Fisheries education and training in Asia: Workshop proceedings*. Asian Fisheries Society Special Publication 2, 1–6. Manila, Philippines: Asian Fisheries Society.

Baldauf, R. B. Jr and B. M. Jernudd. 1983. Language use patterns in the fisheries periodical literature. *Scientometrics* 5: 245–55.

Brand, S. 1988. *The media lab*. New York: Penguin Books.

Calleja, G. B. 1980. Science in the boondocks. *Filipinas: a Journal of Philippine Studies* 1: 21–43.

Chua, T. E. 1986. Aquaculture training in developing Asia. *Naga, the ICLARM Quarterly* 9(4): 7–10.

Chua, T. E., M. A. A. Agulto, F. Y. Guarin and S. C. Guerrero. 1989. *Directory of institutions and scientists in the ASEAN region involved in research and/or management related to coastal areas*. Manila, Philippines: ICLARM.

Chua, T. E. and J. L. Maclean. 1988. Has scientific research in Asia contributed to Asian fisheries development? In *The First Indian Fisheries Forum, Proceedings*, ed. M. Mohan Joseph, 5–8. Mangalore, India: Asian Fisheries Society, Indian Branch.

Coche, A. G. 1987. *Selected aquaculture publications: serials, newsletters, meeting proceedings, and bibliographies/directories/glossaries*. FAO Fisheries Circular 808, 108 pp. Rome: FAO.

Davis, C. H. and T. O. Eisemon. 1989. Mainstream and non-mainstream scientific literature in four peripheral Asian scientific communities. *Scientometrics* 15(3-4): 215–39.

Dizon, L. B. 1991. *An analysis of citations to the* Fisheries Research Journal of the Philippines *and* Kalikasan, the Philippine Journal of Biology, MLS special publication, 98 pp. Diliman, Quezon City: Institute of Library Science, University of the Philippines.

Everhart, W. H., A. W. Eipper and W. D. Youngs. 1975. *Principles of fishery science.* New York: Cornell University Press.

Freeman, R. R. 1988. Bibliographic coverage of the growing fisheries literature in ASFA. *Naga, the ICLARM Quarterly* 11(1): 5.

Fuseler-McDowell, E. 1989. Documenting the literature of marine biology. In *Marine science information throughout the world: sharing the resources,* ed. C. P. Winn, R. W. Burkhart and J. C. Burkhart, 45–60. St. Petersburg, Florida: International Association of Marine Science Libraries and Information Centers.

Garfield, E. 1983. Mapping science in the third world. *Science and Public Policy* 10(3): 112–27.

Knorr, K. D., R. Mittermeir, G. Aichholzer and G. Waller. 1979. Individual publication productivity as a social position effect in academic and industrial research units. In *Scientific productivity. The effectiveness of research groups in six countries,* ed. F. M. Andrews, 55–94. Cambridge: Cambridge University Press, and Paris: UNESCO.

Maclean, J. L. 1982. Fisheries literature services: an overview. *ICLARM Newsletter* 5(2): 3–5.

Maclean, J. L. 1988a. The growth of fisheries literature. *Naga, the ICLARM Quarterly* 11(1): 3–4.

Maclean, J. L. 1988b. An overview of fisheries education and training in Asia. In *Fisheries education and training in Asia: Workshop proceedings.* Asian Fisheries Society Special Publication 2, 12–16. Manila, Philippines: Asian Fisheries Society.

Maclean, J. L. and M. J. M. Vega. 1990. Citation behavior of Philippine biological scientists. Paper presented at the International Conference on Science Indicators for Developing Countries, 14–19 October 1990, Unesco, Paris, France.

Maclean, J. L., R. M. Temprosa, N. I. Jhocson and A. F. Diaz. 1990. *Bibliographic impact of ICLARM.* ICLARM Technical Report 26, 19 pp. Manila, Philippines: ICLARM.

Morgan, G. R. and K. D. Hopkins. 1986. Productivity of fisheries laboratories in lesser developed countries. *ICLARM Newsletter* 9(2): 3–4.

Nababan, P. W. J. 1985. Bilingualism in Indonesia: ethnic language maintenance and the spread of the national language. *Southeast Asian Journal of Social Sciences* 13(1): 1–18.

*Nature.* 1981. Productivity by numbers. *Nature* 292: 665.

Needham, R. 1982. ASFIS: vehicle for international exchange of scientific information. *ICLARM Newsletter* 5(2): 5–8.

Pauly, D. 1984. Who cites your publications when you work in the tropics? *ICLARM Newsletter* 7(2): 6–7.

Royce, W. F. 1972. *Introduction to the fishery sciences.* New York: Academic Press.

Sarria, J. P., ed. 1982. *Fisheries bibliography.* Vol. 1. (1976-1982). Los Baños, Philippines: Southeast Asian Regional Center for Graduate Study and Research in Agriculture.

Schubert, A., W. Glanzel and T. Braun. 1987. World flash on basic research. Subject field characteristic citation scores and scales for assessing research performance. *Scientometrics* 12: 267–91.

Schubert, A., W. Glanzel and T. Braun. 1989. Scientometric datafiles. A comprehensive set of indicators on 1649 journals and 96 countries in all major science fields and subfields 1981-1985. *Scientometrics* 16: 34–78.

SEAFDEC. 1985. *Report of the SAFIS Seminar on Fisheries Extension Literature,* Bangkok, Thailand, 5–8 February 1985. Bangkok, Thailand: Southeast Asian Fisheries Development Center.

Sibayan, B. P. 1985. Reflections, assertions and speculations on the growth of Pilipino. *Southeast Asian Journal of Social Sciences* 13(1): 40–51.

Yuthavong, Y. 1983. The input and output of science and technology in Thailand. *Journal of the Science Society of Thailand* 9: 1–4.