

Pauly, D. 1995. Critical mass and productivity in fisheries research institutions. Caribbean Technical Cooperation Network on Artisanal Fisheries and Aquaculture, Circular Letter (32): 3-5.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
REGIONAL OFFICE FOR LATIN AMERICA AND THE CARIBBEAN



---

## CARIBBEAN TECHNICAL COOPERATION NETWORK ON ARTISANAL FISHERIES AND AQUACULTURE

---

CIRCULAR LETTER No.32

---

1995 No.32

Network News

September 1995

---

**CRITICAL MASS AND  
PRODUCTIVITY IN FISHERIES  
RESEARCH INSTITUTIONS**  
by Dr. Daniel Pauly

In research, the concept of "critical mass" refers to the number of staff in a unit, and the resources available to it such that it can accomplish its mission. When a unit is below critical mass, it cannot do so, whatever its name and the legislation which created it.

I am not aware of any explicit study of the critical mass required for a fisheries management unit - indeed the only related study that has come to my attention is that edited by Daniels and Nestel (1993), assessing critical mass requirement for animal research in Africa and/or Latin America.

Its conclusions, however, appear to apply to fisheries research as well: below 4-5 professional staff, of which 2-3 should have at least an MS degree, with adequate clerical administrative and technical support (including a small craft in the case of fisheries research), and a small library, a local fisheries unit may well be useless.

This is confirmed by a study of Morgan and Hopkins (1986) who, in an attempt to estimate the relationship between scientific productivity and the size of 28 fisheries research in laboratories and 22 countries assembled a useful data set, presented in Fig. 1, and from which they drew the following inferences:

\* In both LDCs and western developed countries, there is a marked decline in productivity with the size of the laboratory; the decline appears at a smaller institute size in LDCs than in western developed countries;

\* Within the range of about 15-50 researchers, there is little difference in the productivity of laboratories in LDCs and western developed countries;

\* Very small laboratories in LDCs (less than about 15 research staff) have virtually zero productivity unlike such laboratories in western developed countries. This implies that the concept of a "critical mass" of researchers is of greater importance in LDCs than in western developed countries.

However, one cannot agree with these authors when they state that "the average number of publications [in the 13 LDCs laboratories] was 0.49 which is remarkably close to that for the 15 surveyed laboratories in western developed countries [and thus], the average fisheries laboratory in the LDCs was as productive as those in western developing countries".

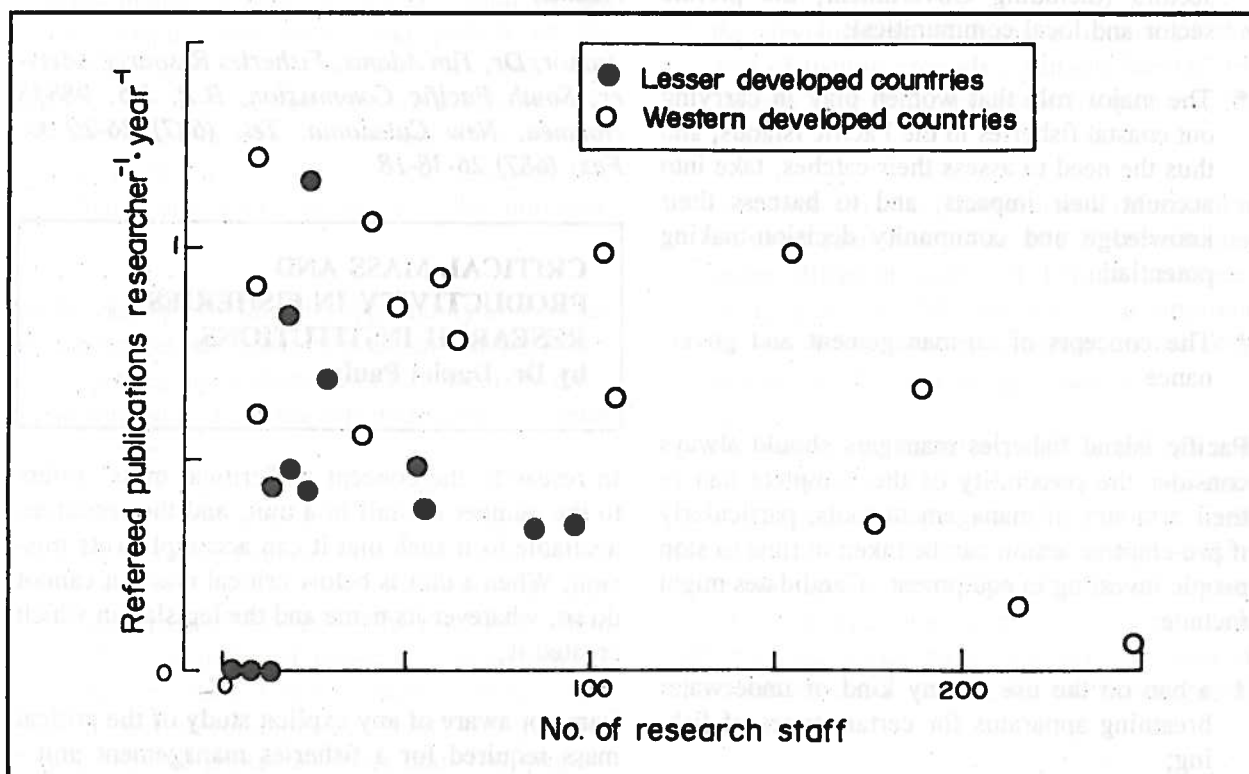


Figure 1 Relationship between productivity and size of 28 fisheries research institutions (from Morgan and Hopkins 1986).



As might be seen from Fig. 1, the average productivity in western developed countries of 0.53 is strongly affected by the five laboratories with more than 150 staff, which have no counterparts in LDCs and which, because of the size effect noted above, may not be included in a comparison. Without these laboratories, "western" productivity increases to 0.86, markedly higher than the LDC figure of 0.49.

This difference is largely the result of the limited funding and other resources available to LDC laboratories, which other authors have found to affect productivity (see e.g., Anon 1993, and Dizon 1995).

Other factors also matter however, notably education levels. The studies of Rounsefell (1961), Dizon and Sadorra (1995) and Dizon (1995) jointly indicate that the formal education of scientists increases their productivity (BS < MS < Ph.D.), as does the support and recognition they get through and/or from the institutions where they work.

Also, these studies suggest for all costs associated with generating publications (i.e., not only the "publications cost") a mean figure of about US\$ 1,000 per page, with values below this for technical reports, and above this for papers in international refereed journals [see Morgan 1983 and Mathews 1987 for attempts to reduce costs e.g., by using length-based, instead of age-based techniques for studying fish growth].

The implications of this for a small fisheries unit are obvious, and should be followed through - e.g., by relating the expected cost of studying a given fishery to the benefits (if any) to result from improved management of that fishery.

#### References:

Anon. 1993. The effects of resource concentration on research performance. National Board of Employment, Education and Training. Commissioned Report No. 25, Canberra, 104 p.

Daniels, D. and B. Nestel (eds.). 1993. Defining critical mass: the case of animal research. International Development Research Centre, Ottawa, 61p.

Dizon, L.B. 1995. The impact of publication productivity of scientists in fisheries institutions in the Philippines on the development of fisheries science. PhD thesis, College of Mass Communication, University of the Philippines. 287 p.

Dizon, L.B. and M.S.M. Sadorra. 1995. Patterns of publication by the staff of an international fisheries research center. *Scientometrics* 32(1): 67-75.

Mathews, C.P. 1987. Fisheries management in a developing country: the most appropriate balance of size- and age-related methods for practical assessments, p. 321-337. In D. Pauly and G.K. Morgan (eds.) *Length-based methods in fisheries research*. ICLARM Conf. Proc. 13.

Morgan, G.R. 1983. Application of length-based stock assessment to Kuwait's Fish stocks. *ICLARM Newsletter* 6(4):3-4.

Morgan, G.R. and K.D. Hopkins. 1986. Productivity in fisheries laboratories in lesser developed countries. *Naga, the ICLARM Q.* 9(2):3-4.

Rounsefell, G.A. 1961. How can research production be measured? *Proc. Gulf and Caribb. Fish. Inst.* 13:139-150.

#### Author:

*Dr. Daniel Pauly, Principal Science Advisor, International Center for Living Aquatic Resources Management. Extracted from a contribution entitled "When is fisheries management needed?" presented at the joint FFA/SPC Workshop on the Management of South Pacific Inshore Fisheries, 26 June - 7 July 1995, Nouméa, New Caledonia.*