

# Research on Marine Sciences under Core University Marine Science Program in the Period of 2001-2005: The Bibliometrics Approach

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## *Abstract*

This research aims to analyze the contribution of collaboration research under Core University Marine Science Program sponsored by Japan Society for Promotion of Sciences (JSPS) over a period of 2001-2005. The data were papers of JSPS seminars. We used co-word technique of bibliometrics methods to identify the research topics. Then we calculated which topics are core and prominence levels based on method of Sujit Battarcharja and Moh'd Taiyab Rashid Khan. In-depth interviews were also carried out to explore problems on Indonesian marine research besides getting confirmation, comments and ideas related to the result of bibliometrics analysis. The informants were experts in marine science from a research institution, a government ministry, and a university. The results of this study could be employed to evaluate the research collaboration program between LIPI and Japanese institutions especially under JSPS program in the future.

## *1. Introduction*

Research collaboration among Southeast Asian countries (Indonesia, Vietnam, Thailand, Malaysia and Philippines) and institutions in Japan on Marine science is a part of Multilateral Cooperative Research Program (MRCP), called Core University Marine Science Program, sponsored by JSPS (Japanese Society for Promotion of Sciences). Research Center for Oceanography, the Indonesian Institute of Sciences (P2O-LIPI) was a counterpart and coordinator of the program in Indonesia. The program started in 2001 and will be completed in 2010 [4].

The size of Indonesian waters is about 5.6 millions km<sup>2</sup>. Its coastline is about 81.000 km long. Furthermore Indonesia has an abundance of marine fisheries which are not only enormous in quantity but also in diversity, therefore marine research is important in Indonesia [3]. The main problems for Indonesia to develop its marine potential are budget limitation in doing research and limited expertise on marine research. Research collaboration with other countries is one of ways to explore Indonesian marine potentials besides knowledge transfer to improve the expertise of Indonesian researchers. Therefore it is important to analyze the contribution of research collaboration under Core University Marine Science Program to overcome Indonesian problems on marine research. The main purpose of this research was to analyze the research topics of papers produced by Core University Marine Science Program over a period, 2001-2005. The specific objectives of this research are as follows:

- To analysis the core and prominence topics of researches in Core University Marine Science Program.
- To analysis the core topics of researches between Indonesia and Japan in Core University Marine Science Program.
- To assess the contribution of research collaboration to overcome Indonesian problems on marine management.

Bibliometrics is an appropriate method to study the topics of a set of researches published in a period of time from quantitative perspective. We employed co-word analysis as a subsection of bibliometrics. It analyzes the co-occurrences of keywords in research documents. In information sciences area, keywords of a document are important subject. They are not only for recognizing a document in literature retrieval but also carry and represent concept and idea that contained in a document. Co-word analysis provides an immediate picture of the actual content of research topics dealt with in the literature [2].

### *Methodology*

This research used co-word technique of bibliometrics method to identify the research topics from quantitative perspective. The sources of data were proceedings of Marine sciences produced by seminars sponsored by JSPS in 2001-2005. The proceedings were obtained from Bureau for Science and Technology Cooperation and Promotion (BKPI-LIPI), a bureau in LIPI that manages the permit administration for foreign researchers and Center for Oceanography (P2O-LIPI), a center in LIPI who has a core competency on marine sciences and is a coordinator of Core University Marine Science Program in Indonesia.

In-depth interviews were also carried out to explore problems on Indonesian marine management besides getting confirmation, comments and ideas in related to the result of bibliometrics analysis. The informants were expert in marine science from LIPI, Ministry of Marine and Fisheries (DKP) whom manage the marine research in Indonesia and Bogor Institute of Agriculture (IPB) as a one of universities whom conduct research in marine science.

The number of papers processed was 204 papers. Then indexers extracted keywords from several sections such as title, abstract and the body of papers. The list of

keywords was standardized to make them consistent, unified and unambiguous using Library of Congress Subject Headings (LCSH), Agrofofoc (published by Food and Agriculture Organization-United Nations), Thesaurus of Engineering and Scientific Term and Japan Information Center of Science and Technology (JICST). Keywords with frequency of one or two were merged with their broad term. We eliminated the keywords with frequency one and two that did not have any broad term.

Afterward we calculated the number of times two keywords appear together in the same publication using software. Then we had a co-occurrence matrix whereas the value of each cell was co-occurrence frequency of  $x$  and  $y$ . Furthermore we calculated which topics are core and prominence levels based on method of Sujit Battarcharja and Moh'd Taiyab Rashid Khan [5]. Core topics are co-occurrence frequency of keywords that contained of more than 5% of total documents. Prominence topics are co-occurrence frequency of keywords that contained of 3- 5% of total documents [5].

### *Marine Researches in Indonesia*

Based on thesaurus of Library of Congress Subject Heading marine sciences consist of two main subfields i.e. Marine biology and Oceanography. Marine biology comprises Mariculture, Deep Sea Biology, Fisheries oceanography, Fisheries mammalogy, Marine biotechnology, Marine microbiology, Marine organism, Marine pharmacology, Marine resources, Plankton, Radioactive tracers in marine biology and Seashore biology.

Meanwhile Oceanography comprises Marine geology, Aeronautics in oceanography, Marine meteorology, Artificial satellite in oceanography, Astronautics in oceanography, Chemical oceanography, Estuarine oceanography, Marine pollution, Marine resources (Mineral, Energy resources, Ocean engineering and shell deposit), Military oceanography, and Ocean circulation.

Before 2000 there were several institutions tasked with developing marine sciences in Indonesia. They were Research Center for Oceanography, the Indonesian Institute of Sciences (P2O-LIPI), Agency for the Assessment and Application of Technology (BPPT), National Aerospace Institute (LAPAN), Research Center for Geotechnology - the Indonesian Institute of Sciences (P2Geotechnology-LIPI), Research Center for Marine Geology- Ministry for Energy and Mineral Resources (PPGL) and some universities such as Bandung Institute of Technology, Bogor Institute of Agriculture, University of Samratulangi, University of Patimura, University of Andalas etc. All the research projects in those institutions had not been coordinated nationwide and there were duplications in the priority researches amongst them.

In 2001 the government built an agency named the Agency for Marine and Fisheries Research (BRKP) under the Ministry of Marine Affairs and Fisheries (DKP) which has role in giving the research support and scientific input in management and development of marine and fisheries sector and also in harmonizing to support the marine and fisheries policy. The agency has major researches in both marine biology and oceanography comprised fisheries capture activities, aquaculture activities, product processing, marine and fisheries socio economic, oceanography and ocean meteorology, marine tectonic, maritime history and ocean policy and marine technology [3]. BRKP tried to organize marine data and fisheries nationwide systematically in 2005. There were

7 institutions collaborated in the project named National marine metadata on Malacca strait i.e. Bakosurtanal, BPPT, BRKP-DKP, LAPAN, P2O-LIPI, BMG and DISHIDROS.

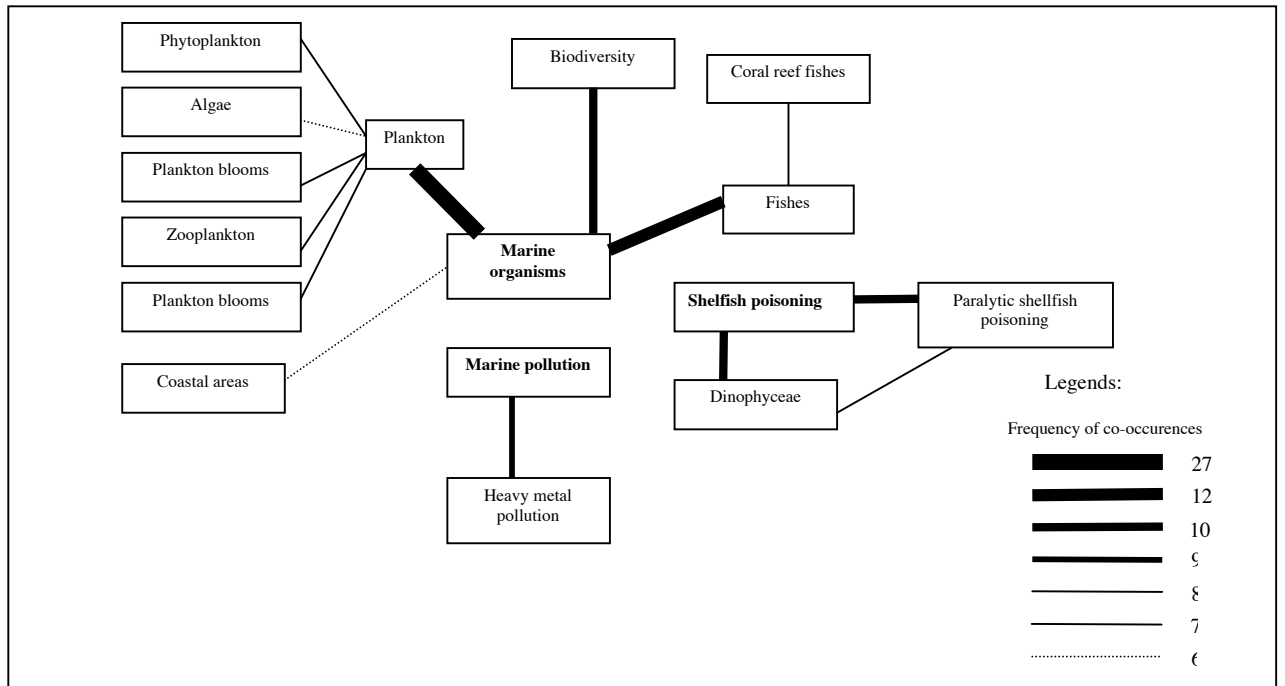
### *Results and Discussion*

Marine science program started in 1988. It is a part of several cooperation programs between LIPI and institution in Japan sponsored by JSPS. The program formerly named Bilateral Cooperative Research Program (BCRP), since 2001 it has been developed to Multilateral Cooperative Research (MRCP) comprised 5 Southeast Asia countries (Indonesia, Vietnam, Thailand, Malaysia and Philippines) and Japan. The four main research programs of MRCP are as follows:

- Project 1: Water circulation and the process of material transport in the coastal areas and marginal seas of the East and Southeast Asia
- Project 2: Ecology and oceanography of harmful marine micro algae
- Project 3: Biodiversity in the coastal waters of the East and Southeast Asia
- Project 4: Pollution of hazardous chemical in the coastal marine environment and their ecological effects.

There were 204 papers produced by Core University Marine Science Program over a period of 5 years. The papers were published in proceeding of symposium on marine science between 2003 and 2005. The core topics of the papers were showed on Figure 1. Figure 1 shows the core and prominence topics of researches on Core University Marine Science Program. Co-occurrences Marine organism-plankton had the highest frequency of co-occurrence. The frequency was 27 or 13.5 %. Meanwhile Marine organism-fishes had co-occurrence frequency of 12 or 5.9%. The frequency for Marine organism-biodiversity was 10 or 4.9%. The frequency of Shelfish poisoning-Paralytic shellfish poisoning was 10 (4.9%).

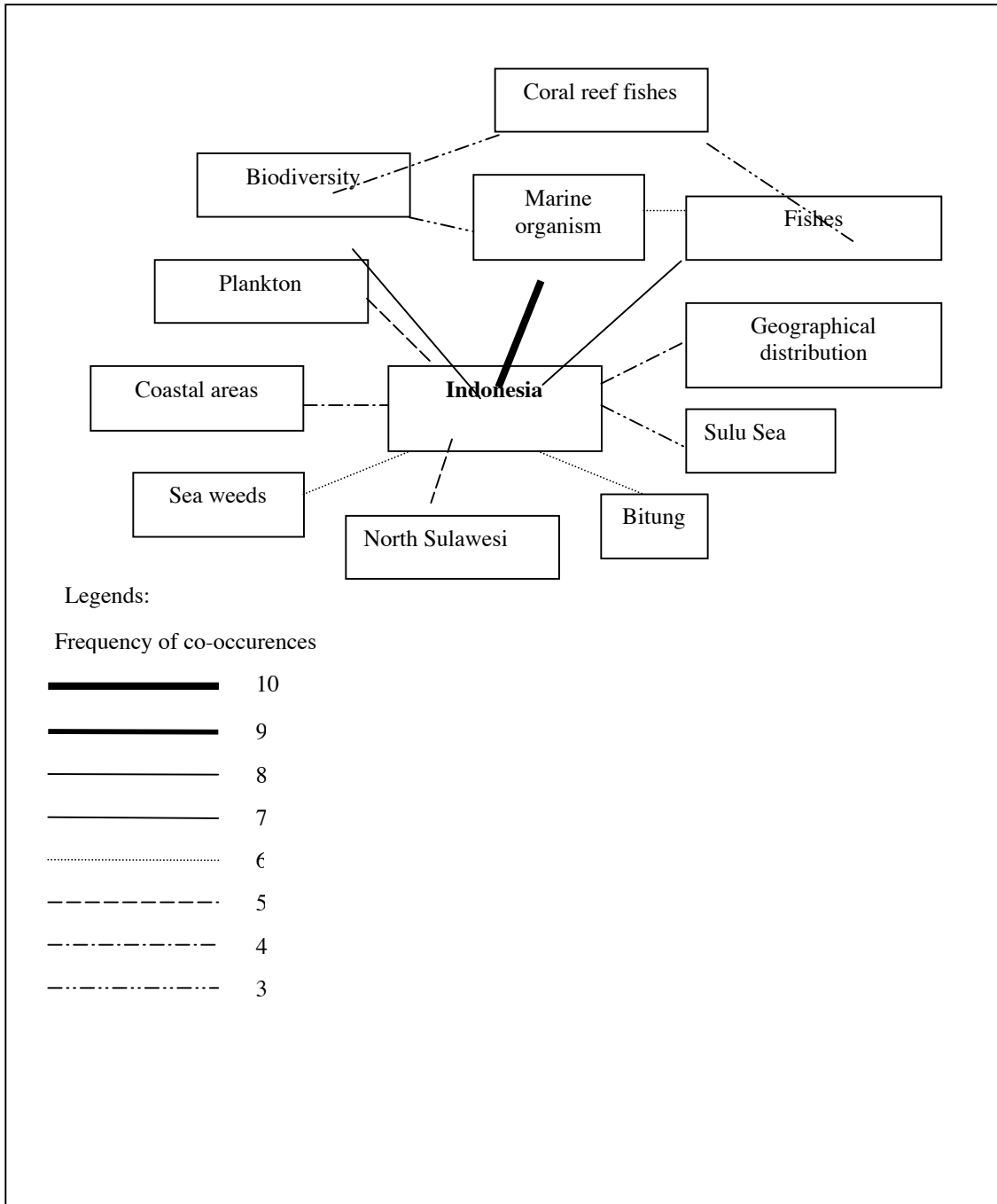
Fig. 1: The core and prominence topics of researches on Core University Marine Science Program, 2001-2005



The main species on Shelfish poisoning was Dinophyceae which has co-occurrence frequency (Shelfish poisoning – Dinophyceae) of 10 (4.9%). In the meantime the co-occurrence frequency of Marine pollution and Heavy metal pollution was 9 [4.4%].

There are about 33 of 204 papers which the research topics were about marine in Indonesia. We showed co-occurrence frequencies of more than 4, although the core topics covered co-occurrence frequency more than 1. The core topics which have more than 4 frequencies are showed on Figure 2. The highest frequency of co-occurrence was Indonesia-marine organisms, 10 or 30.3%. Then the frequency of Indonesia-biodiversity was 8 or 24.2% and the frequency of Indonesia-fishes was 7 or 21.2%. Meanwhile the co-occurrence frequency of Indonesia-plankton and Indonesia-North Sulawesi were 5 or 15.2%. The frequency of Indonesia-geographical distribution, Indonesia-Sulu sea and Indonesia-coastal areas were 4 or 12.1%.

Fig. 2: The core topics of collaboration research between Indonesia and Japan, 2001-2005



Based on the data in figure 2 the core topics of research between LIPI and institutions in Japan under MRCP were Marine organism (plankton, fishes, coral reef fishes, seaweeds, and biodiversity), Geographical distribution, and Coastal areas. Most researches were conducted in North Sulawesi, Sulu sea and Bitung. Based on the 4 main projects of MRCP, most research topics were categorized into project 2, 3 and 4.

If we compared between the priorities researches of MRCP and strategic planning 2004-2008 of P2O-LIPI it was synergy. The researches were categorized into sub-program number 2 to 5. Those 5 sub-programs of P2O-LIPI are as follows:

Sub-program 1: Climate and marine dynamics

Sub-program 2: Ecosystem and environmental protection

Sub-program 3: Oceanography of coastal marine management

Sub-program 4: Exploitation of marine resources

Sub-program 5: Oceanography competency acceleration

P2O-LIPI has sub-programs of research in both marine biology and oceanography. MRCP's main projects were also in both. The core topic of MRCP's research was in marine biology. Based on the interview with several experts they assessed that the research priority of MRCP was proper.

Firstly, the research on marine biology is fewer than oceanography in Indonesian. The researches in oceanography such as Climate and marine dynamics and Water circulation have been done by BRKP-DKP. There are several institutions besides BRKP-DKP which have research area in the field of oceanography such as LAPAN, P2Geoteknologi-LIPI and BPPT. There is a lack of researches on marine biology conducted by BRKP-DKP.

Some Universities in Indonesia conducted researches in marine biology. Unfortunately most researches in universities were conducted based on project only. So far it seems that only P2O-LIPI has competitive and sustainable researches in marine biology since decades ago.

When we asked informant's opinion about the topics becoming core and prominence in MRCP they said that any topics in marine biology were useful for Indonesia. It seems that there is no the national policy in Indonesian marine biology to define research priorities. Research priorities are defined in institutional level not national level. The difference of research priorities among the institutions sometimes is not that large. The duplication in the research priorities gives disadvantages such as waste of budget fund. The condition in some universities is not as good as research institution and government ministry. They do not have strategic planning on research. They do research based on project only. Sometimes the results of research are not publicized. It is because the research budget in universities is very limited. DKP tried to make clearer the functions and tasks among institutions on marine and fisheries researches. They released a matrix of institution's tasks. The matrix shows that LIPI has tasks conducting basic and strategic researches; Universities focused in basic, strategic, applied, adaptive and engineering researches; BPPT focused on applied researches; and BRKP conducted on strategic, applied, adaptive researches. In fact it is difficult to implement it.

### *Conclusions*

We tried to apply co-word technique of bibliometrics to evaluate the collaboration research among Southeast Asian countries (Indonesia, Vietnam, Thailand, Malaysia and Philippines) and institutions in Japan on Marine science. This project is a part of Multilateral Cooperative Research Program (MRCP), called Core University Marine Science Program, sponsored by JSPS (Japanese Society for Promotion of Science).

The core topics of MRCP's researches were on marine biology. The topics are proper with the sub-programs of P2O-LIPI and the need of Indonesian marine researches development. There are no research priorities in Indonesian marine biology in national level.

Bibliometrics is an emerging topic in Indonesia. PDII-LIPI has conducted several researches using this method since 2000, but it has not been applied yet periodically for evaluating research programs. We imply going deeper by combining between quantitative and qualitative methods. Besides getting confirms, comment and ideas in related to the result of bibliometrics analysis we intend to socialize this method.

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