

**SPAIN: MARINE SCIENCES INFORMATION ACTIVITY REPORT FOR SPAIN
1999/2000**

Enrique Wulff-Barreiro
Marine Sciences Institute of Andalusia
Spanish Council for Scientific Research. ICMAN (CSIC)
Polígono Río San Pedro, s/n
11510 Puerto Real (Cádiz). Spain.
Phone: 34-56-832612
Fax: 34-56-834701
E-mail: enrique.wulff@icman.csic.es
URL <http://www.icman.csic.es/>

Introduction

Interest of the scientific community in marine sciences-related research has been growing in 1999 and 2000. Many solutions to sea-related problems have been interesting in the context of marine biology and chemistry, big science areas like oceanology, aquaculture, fishery and ecology. A number of studies have been conducted in 1999, 2000. The Spanish aquaculture directory (1999), the report from the Ministry of Education "Marine science research in Spain (1981-1998)" (1999), the report from the Ministry of Agriculture "Evaluation of the activities of research and technological development in aquaculture on the (1982/1997)" (1999), the "White book on Aquaculture in Spain" (1999) outside of the follow-up surveys contrasting topics shown to be of concern to marine sciences in Spain. During the 1999 Congress of the Spanish society for the history of science and technics, a study was presented on "The Cádiz laboratory of the Spanish council for scientific research fisheries research institute, between 1957 and 1966, a research "arena"" (1999).

Several congresses and conferences have been held in Spain. The Spanish leadership in view of the European program Aquaflow, has been purposely added to this paper (Flos 1999). An additional bibliographical tool is, the latest report from the Iberoamerican Scientific and Technological Development Program (CYTED), relevant to aquaculture through its Subprogram II (Programa iberoamericano de ciencia y tecnología para el desarrollo (CYTED) 1998-99). Also discussed here is the Coastwatch Europe network 1999 report recently produced by the government of Andalusia (*Cuidemos la costa, informe resultados de la campaña 2001*). The report is finalized with a discussion on the most widely recognised electronic journal and forum of marine science in Spain.

As the result of the follow-up survey for foregoing issues of the ASFA database between 1999 and 2000, 838 articles were identified as published in Spain. The bibliometric analysis of these publications has been found useful to enlighten the peculiarities of the Spanish research system in this academic territory. It includes the communication

channels used by the scientists, the authorship background and the unbalanced distribution of the research throughout the country.

The intended goal of the marine sciences information activity report for Spain 1999/2000 is to fuse all the informative perspectives of the cited documentation into one overall mental map, wherein each source is by its common focus, the marine sciences.

1. The Spanish aquaculture directory (ed. 1999). (Spanish only)

Produced by the Scientific Documentation and Information Center, Spanish Council for Scientific Research (CSIC, Madrid). Its last edition was published in 1999. The directory is divided into two sections: Research Centers and Firms.

The research centers section shows those research institutions, founded by the government, the University; the Ministries; the Regional and local authorities; the International organism working in Spain. Information available from each entry includes: address, phone, fax, e-mail; main person at charge; subjects and/or species focused; and the courses related with aquaculture.

The section dedicated to business is listed alphabetically and by subject. Each entry in the alphabetical list supplies the consultant with the name and acronym of the firm; the address, phone, and fax of the central headquarters; the name of the person responsible; the animals cultured, techniques employed and annual estimated production; the products marketed; the I&D activities developed. The subject-oriented section lists firms under the headings: the cultured species alphabetically ordered; the pharmaceutical and chemical products elaborated; food for aquatic species; aquaculture equipment; engineering and installation design; aquatic health, quality control and analytical chemistry; consultancy; life animals transport; reintroduction of populations; production and marketing of food; production and marketing of drugs; finance, assurance; contamination and environmental studies; association of producers.

Two printouts are available from the Spanish Aquaculture directory: 1. A comprehensive list of the scientific names (and their common equivalences) of the species cultured alphabetically ordered, 2. a list of the common names (and their Latin equivalents).

The publication closes with six indexes. The indexes are listed under: 1. the regional center authority in charge; 2. the research centers listed alphabetically; 3. the courses they teach; 4. index of courses offered; 5. researchers working at the centers; and 6. final list of the business by regions. All the entries are indexed in the Directory by page number where the complete data are available.

107 research centers, 728 researchers, 179 businesses are the sources available for the future of marine science in Spain. A new directory, with updated data including many

more resources, will be available soon from the Spanish Council for Scientific Research (CSIC) Publication Service.

2. The report from the Ministry of Education "Research in marine science in Spain (1981-1998)" (ed. 1999). (Spanish only)

The report from the Ministry of Education "Research in marine science in Spain (1981-1998)" was recently published (1999). The contributors to this report are among the most prolific Spanish authors of the scientific literature, and among the unique publishing in the journal *Nature*, contributors were also from the delegation to the V EU Framework Program.

This government-sponsored report was edited reflecting the Spanish effort to the EU IVth Framework Program, and the Spanish national interests on EU Vth Framework Program related topics. It is also a result of the Spain's IIIrd National Plan of R&D, a government effort for a rapid progress in Science & Industry.

Five crucial trends are surveyed.

The European funds related to the marine R&D. Spain (with Ireland) is ranked in 10th position, of the 14 EU countries regarding R&D funding available for marine science research. Also the analysis indicates that the Spanish governmental financial effort related to R&D in marine sciences is considered to be 30 times than the real impact on the Spanish economy of all the sea-related Spanish activities.

The survey of the development of the National Program in R&D in Marine Science and Technology (P.N.CYTMAR). The analysis includes an estimation of the Spanish population of scientists working on marine sciences-related topics. It reflects the competitive effort of a small community. Some 135,600 Euros funded the three Spanish P.N. CYTMAR programs, between 1988 and 1997.

The examination of the Spanish partnership into the EU MAST III program, lists the shortage of scientific resources including scientists. The need to promote a greater number of research groups in Galicia, Murcia and the Basque Country. A better policy would need more viable projects and "market analysis." A reduction of the bureaucratic policy-associated duties required of the Spanish leaders in R&D proposals must be undertaken. The R&D inside the business sector must be more frequently added to the R&D Spanish national plan (only 10% of the Spanish MAST proposals were from the private sector). The expansion of the technical staff must be promoted. The design of a R&D National Plan in Marine Science and Technology is readily accepted. In conclusion, data are offered that show the Spanish rate of funding amounts to 1/3 of the total, as opposed to 2/3 coming from Europe; the improvement of the Spanish contribution is advised.

An examination of the Spanish scientific production in marine science and technology R&D, clearly states the leadership of the university. The Spanish Council for Scientific Research's (CSIC) contribution were the most prolific in aquaculture and marine ecology. The Spanish Oceanographic Institute (IEO) provided a wider information channel to the fisheries-oriented subjects. Between 1981 and 1995, 4,604 documents were produced (75% journal articles, and 25% books and book chapters). Only one out of three documents was published in Spanish, 65% of the total production was published in English. The data from researchers working in Antarctica are not reflected in 99/2000.

The Oceanography Research Cruiser "Hespérides." Launched in 1991, built with a budget of 54 MEuro, has two expeditions annually to the Spanish research mission in Antarctica. Between 1991 and 1998 the ship has been involved in 50 oceanographic cruises, and 41 research projects have been accomplished. The users of this scientific resource have come mainly from Spanish Council for Scientific Research (CSIC) (52%), the University (27%); the Spanish Oceanographic Institute (11%); the Naval Forces staff (10%). The bibliographic production from the Antarctic expeditions amount to 53.7% of the total, and the articles on Mediterranean topics amount to 37.1% of the total, although the ship works there only 14% of its operative time. Two web sites are designed for those interested in "*Hespérides*": <http://www.cicyt.es/hesperides/> and <http://www.igbo.icm.csic.es>.

3. The report from the Ministry of Agriculture "Evaluation of the activities of research and technological development in aquaculture into the 1982/1997 period" (1999). (Spanish only)

The report from the Ministry of Agriculture "Evaluation of the activities of research and technological development in aquaculture into the 1982/1997 period" extends the chapter on R&D in the "White Book on Aquaculture in Spain" (Borrador del libro blanco de la acuicultura en España 1999) published in 1999. The authors come from the Social Advanced Studies Institute IESA (Spanish Council for Scientific Research, Madrid), and from the Galician University-Firm Foundation (FEUGA). The period studied is 1982-1997. Two volumes are available: the first one with the evaluation, and the second with the directory of the publications of the Spanish researchers in aquaculture. The data have been edited with the cooperation of the financing institutions in aquaculture in Spain: Interministerial Commission for Science and Technology (CICYT), Center for the Industrial Technological Development (CDTI), General Secretary for the Maritime Fishery, Regional Authorities, European Union, and Spanish Oceanographic Institute.

Crucially important conclusions raised in the domain of information seem to be that:

The Regional Authorities spend so many funds on R&D in aquaculture that an in-depth revision of their whole policy is necessary, to equate it to the real needs of industry in their territory;

Databases from financial organisms must be uniformly refined and even in some cases created. CICYT and CDTI databases seem to be able to be interpreted as the models;

The development of standards attracting economic-funding for researchers optimization of the experimental plants;

Sinergies for improving the degree of transfer and exploitation of research results must be put in work (17 national and two international recognised patents, have been produced in the period);

Permanent evaluation programmes of the activities performed inside the research centers must be conducted;

The bibliographic production is oriented to the production of personal resumes (curriculum vitae). A reorientation of the recognition of the scientist-work towards the topics related with consultancy must be the factor;

The international ranking of the Spanish bibliographical production in aquaculture is around 10th. But marine biology topics like genetics, biochemistry and molecular pathology of marine organisms need to be promoted.

Because of their size and absence of technical staff the results from the researchers inside private firms are weak on innovation; firms are only able to perform the work themselves in 20% of the cases. The areas need an 80% of collaboration (from the universities or other high research institutions).

4. White book on Aquaculture in Spain (ed. 1999) from the Ministry of Agriculture. (Spanish only)

The report was undertaken by the general secretary of maritime fisheries, and is available through the Internet. Its main conclusions on R&D are published and analysed in the above commented report.

In the White Book we find an introduction to aquaculture and a structural analysis of this industry. The introduction uses historical criteria to present an initial view on the situation of the sector in Spain. The structural analysis affords the administrative and technological framework, environmental management, the markets of aquaculture, and a set of proposals for determining the immediate priorities.

5. Marine sciences Congresses and conferences in Spain : 1999-2000.

The number of congresses and conferences in marine science for 1999/2000 in Spain, has been derived from RedIRIS (the Spanish academic Internet network).

In 1999:

1999 Canigo Project Conference. The subjects of the conference were the marine systems of the Canary Islands-Azores-Gibraltar region. It was organised by the University of Las Palmas de Gran Canaria, and held between September 12-14, 1999, at Las Palmas de Gran Canaria. Its electronic address is:

<http://www.cccb.ulpgc.es/canigofc>.

In 2000:

The following list is a RedIRIS network printout of all the congresses and conferences offered in 2000 (http://tierra.rediris.es/marinet/marinet_english.html).

III Workshop on the Sea. Galician Professional Association of MD in Sea Sciences. Vigo. Internet address: <http://www.uvigo.es>.

10th Iberian Seminary on Marine Chemistry. Cádiz, June 1-3, 2000. Internet address: <http://www.uca.es/grup-invest/ole>.

Second International Conference on Maritime Research and Innovation. Cádiz, November 9-11, 2000. Internet address: <http://www3.uca.es/facultad/nauticas/english/default.htm>.

2nd Workshop on variable analysis and numeric simulation caused by the exchange of water masses through the Gibraltar strait. Cádiz, June 28-30, 2000. Internet address: <http://www3.uca.es/otros/anasim-gibraltar/>.

International Congress "Authenticity of species in meat and seafood products." Vigo, September 18-20, 2000. Internet address: <http://www.iim.csic.es/~qpmtsi/noflash.html>.

Workshop on spatial objective analysis for diagnostic studies in meteorology and oceanography. Menorca, 18-22 September 2000. Internet address: <http://campanilla.uib.es/workshop>

6th International Congress of Medmaravis, "Fisheries, marine productivity, and conservation of marine birds of the Mediterranean". Benidorm (Alicante), October 2000. Internet address: <http://www.seo.org.es/es/todoaves/medmaravises.html>.

3rd International Conference Coastal Environment 2000. Las Palmas de Gran Canarias. September 2000. Internet address:
<http://www.wessex.ac.uk/conferences/2000/coastal2000>.

2nd International Conference Oil Spill 2000. (Oil & Hydrocarbon Spills, modelling analysis and control). Las Palmas de Gran Canarias, September 2000. Internet address:
<http://www.wessex.ac.uk/conferences/2000/oil2000/>.

6. European program AquafLOW: Spanish initiative.

A development project supported by the European Commission DG12 was presented by Miss Rosa Flos, a Spanish Council for Scientific Research officer, at the 98 MAST conference Lisbon (proceedings published in 1999), and the project is presently implemented. The research results from the EU funded projects are being transferred to the end users (SMEs) as technical leaflets, by Internet and e-mail. Sixteen countries were initially involved, and the web content management brings together providers from the European Aquaculture Society (EAS), the Federation of European Aquaculture Producers and AquaTT.

7. The memo of the Iberoamerican Scientific and Technological Development Program (CYTED). Subprogram II Aquaculture. (Spanish only)

The Memo published in 2000 in Spanish, illustrates through the subprogram II the thematic network in Iberoamerica on aquaculture activities. With a total budget of US \$130,869 the subprogram has 18 (7.28%) Spanish research groups. It is the third largest number of research groups by country (only surpassed by Mexico and Brasil). Out of seven research projects concluded in 1999, the two directed by Spanish scientists, on *Artemia* and mussels received the largest founding \$35,000 and \$40,000, respectively. The *Artemia* project resulted in six dissertations, two books, 25 papers and six invitations to congresses.

No outstanding results were achieved, but the scientific and technological information transfer is notable, together with the research groups promotion between the participants, and the possibilities related with the transference of the results obtained by the project to industrial areas of productivity.

The mussel project resulted in one dissertation thesis, 19 scientific papers, and ten invitations to congresses. Its results are highly regarded concerning the exchange of information and technical and methodological capabilities of the participant groups.

The CYTED Conference on Coordination of the Programs was held in Santiago de Compostela, Spain, 3-13 November 1999.

8. The Andalusian government recently produced Coastwatch Europe network 1999 report. (Spanish only)

This report shows the results of the campaign Coastwatch 99 (an initial design based in the European Commission General Directorate XI) in Andalusia. The data, obtained from 399 inspections performed in November 25, 1999, amount to 24% of the Andalusian coastal littoral. Granada is the best studied littoral (50%), and Huelva the least (13%).

Professors from the Faculty of Sea Sciences of the University of Cadiz, conducted the inquiry and analysis of data from the Coastwatch campaign 99.

Aquaculture is said to be the least environmentally risky activity (3.95%) for the Andalusian coastal littoral. Dead worms (32.46%) and live marine birds (35.34%) were the animals most frequently detected in the coastline. Local explosions of algal growth were detected in 26% of the occurrences. Wild areas, such as dunes, are dominant in Huelva (76%). Cádiz is the dirtiest coastline in Andalusia, Málaga has the cleanest beaches. Erosion was considered the greatest risk to the coastal areas (24%), and coastal construction as second (16%).

9. A final note on the most known electronic journal and forum.

The university of Zaragoza supports Spain's best known aquaculture electronic journal: <http://aquatic.unizar.es>. The journal is of value to those with interest in the area of Spanish aquaculture. It is essential to reference the electronic journal for the sake of the aquaculture investigator.

The RedIRIS (the Spanish academic Internet network) resource in marine sciences, the Marinet Forum (http://tierra.rediris.es/marinet/marinet_english.html), offers the best information for those concerned with events in the area. It is structured into these sections: International programs; Guides and directories; Oceanographic research centers (all Iberoamerican countries, from Argentina to Venezuela); Research projects; Ships, harbours, and oceanographic expeditions; International organizations; Publications; Oceanographic data; Firms; Software; News; and Disclosure. A consistent addressing scheme is employed to distribute the resources. The massive production of online contents can be reused and adapted to fit the requirements of all interested parties thanks to the use of metadata facilities.

10. The follow-up survey of the ASFA database between 1999 and 2000.

The survey of ASFA 1 (Biological sciences & living resources), Cambridge Scientific Abstracts, detected 838 articles published in Spain, between 1999 and 2000. It is pertinent to make use of this kind of data, if not to answer the questions, then at least to forecast the difficulties with communication channels used by scientists, and the methodology of cataloging the authorship behaviour and the unequal distribution of the

research effort within Spain. This section investigates a panorama of the difficulties of making use of bibliometric methods in assessment, during the period of study (Sylvain 1993).

10.1. Relation of quantities of keywords assigned to journal articles to the number of authors. (Yitzhaki 1994)

Introduction.

The importance of the informative nature of an item inside a database could be detected by reporting the number of keywords used to index it. The assumption would be that to warrant the informativeness of a series of keywords is to assure that they fit their functions more closely. Are the quantity of keywords and the quantity of authors related or not? The present report tried to evaluate the hypothesis according to which an article with a great number of authors also contains a greater number of keywords.

Material & Methods.

One permanent standard bibliographic printout, such as is found on ASFA computerized information systems, can be taken directly in order to screen the two bibliometric traits (authors, and keywords) required to test the hypothesis. The data readily fell into an opposing pair for the bibliometric categories: authors vs. keywords.

The complete collection of 838 papers, published from 1999 through 2000, present in the Cambridge Scientific Abstracts database ASFA, was examined. Total duration of follow-up was defined as the interval between the last Aberdeen Euraslic Conference (1999) and the most recent material available from the utility at the campus in Puerto Real.

Results.

The curve for which meaningful results can be observed differed greatly from that expected. Thus, a remote relationship has been identified between the number of keywords employed to index an item and the number of its authors. Ultimately, some massively authored articles (17 authors) have demonstrated a single actuarial relevance after the number of keywords used (33 keywords). But the fact is fortuitous. Rather, the most common outcome is that it does not demonstrate the hypothesis.

Approximately 86% of the authors vs. keywords relations detected have been depicted between the cumulative incidences estimated between one and five authors. As far as the number of keywords employed is concerned, they present a mean of 12 words. This situation must be added to a concentration of 90% of the articles between one and 20 keywords.

Discussion.

The information available on the significance of the database keywords and their relationship with the number of authors presents an effective link. But at the time of diagnosis the incidence of the hypothesis tested seems to be inconsistent.

The curve presents a peak at three authors vs. 12 keywords. It becomes apparent that the hypothesis as such is unsound. But if our goal is to identify and treat with separate symmetries between these two bibliometric traits, some ideas on Spanish optimal size limited to authorship and indexing practices are attainable. Three authors is the best size for a Spanish unit of information production, and the three-author papers amount to 25% of the total. At the same time the total number of keywords assigned by paper peaks at seven keywords; it represents 10% of the complete set of publications analysed.

The unevenness of the distribution of authors vs. keywords is striking. Deviating from the hypothesis, the current status of information production in Spain on fishery and aquatic science presents patterns of absence of international funded research, assumed to correlate with multiple authorship (Heffner 1981). A model of team cooperativeness associated with such scarce behaviour of authorship is not available in Spain, and for this discipline. It is known that when research contribution is authored by two persons, the first is credited with 75% of the total work (Vinkler 1993).

The main finding of this study is that, if observed, collaboration eventually shows a reduced number of keywords, determining the qualitative measure linked to the indexing practice with multiple authorship. The assignment of author rank is a question not yet posed. In conclusion, no conjecture can be drawn, further study is required on the relationship associated with forecasting practices looking at novelty and international multiple authorship practices.

10.2. Distribution of scientific creativity among separate cities of Spain.

The next step of our investigation considered data at our disposal from ASFA to raise questions on scientific creativity in cities in Spain.

In comparing the data on the distribution of the scientific creativity of the different cities, the contribution by each of these cities to the volume of scientific data available in Spain, permits the examination of the way its scientific potential is distributed through its main cities. It is possible to point out those cities where it could be assumed that a considerable volume of the scientific search performed available would be different from that published through open publication (Price 1986).

Material & Methods

The database compiled after the ASFA resource, contains a field Notes ("nt"), where the scientists' addresses can be found. The software this author employed was unable to produce a list of addresses. The research scientist addresses have been found manually.

The data were processed as follows. The total number of contributions was determined for each city. Then the cities were ranked according to the number of contributions. To conduct a thorough comparative analysis of the availability of informational products in the scientific centers of Spain the choice was made to distribute the data according to the kind of organisational identity of the authorship. Then the observed data were distributed by the place where the scientific work was performed. Universities, the Spanish Council for Scientific Research, and the Spanish Institute of Oceanography were initially researched.

Results

First, it seems noteworthy that 60% of the data observed were from universities, 25% were from the Spanish Council for Scientific Research (CSIC), and 6% from the Spanish Institute of Oceanography.

It is interesting that Barcelona is the largest scientific city in the marine science with 16.5% of the data surveyed. At approximately the same level are Vigo (9.3%) and Madrid (10.7%). The Andalusian cities are far behind (Almeria 1.1%, Granada 1.8%, Málaga 3.3%, Cádiz 4.2%, Huelva 0.1%, Sevilla 4%).

In other words, the variety of scientific cities can be divided into separate subgroups. At first the number of contributions decreases quite rapidly; then there appears a small group at approximately the same level, and finally we again face a rapid decrease.

Discussion

The validity of the results obtained must be discussed. The mechanism controlling the decrease in the number of contributions can be seen by the analogy of an acute struggle for existence as a result of nutrient supply. When we analyze the way different scientific centers accord with total amounts of contributions assigned by city, the data present the view of science as a hierarchical self-organizing system. According to it, a model of information distribution is replicated in all the cities where the scientific centers exist. With the exception of Vigo where a slight optimability of the results from the Spanish Council for Scientific Research (CSIC), over those from the university, formalize to a certain degree a slow model of convergence to the general picture.

Scientists work under unequal conditions as far as information is concerned (Nalimov 1981). What this means is that different degrees of available information will have

essentially different scientific potentials. The stocking of the libraries with scientific journals, the distribution of foreign scientific journals among separate scientific centers, and the distribution of *Science Citation Index* inside Spain are manifestations of unevenness. It can also be seen, from the bibliometric point of view, the poor amount of contributions at the tail of the distribution nevertheless presents a constant quotient value between successive decreasing quantities. An intrinsic quality suggesting its adequacy for comparison (Ferreiro-Aláez 1993).

10.3. Centers ranked by number of papers of authors and journals.

The underlying section is a result of the number of authors of Spanish publications inside the ASFA database and the number of journals where these items have been published. As the multiple authorship problem requires the distinction between authors and collaborators, and the disadvantages of the counting method employed are closely attached to the ranking produced. To keep the same type of frequency function for different weight assignment methods implies that a Lotka-type frequency function must be fitted by the data. To predict the author's productivity strata, and to further discuss on stratification of marine science in Spain, the priority is to confirm that the choice of author counting confirm a Lotka-type law. An analysis on the journal's productivity is also carried out.

A list of the indispensable first ten essential journals where Spanish authors are published is offered.

Material & Methods

The data for the study has been derived from the comprehensive 1999-00 Spanish-authored bibliography. Compiled by the author from the ASFA database. The total number of authors covered in the entire bibliography are 2,022 who have published into 264 journals. We have explored whether Lotka's law should fit in the data of authors. We have identified the most representative authors and journals suggested by the literature (Fuseler-McDowell 1989).

Results

Lotka's law states that the number of authors which contribute one paper will constitute the largest group, around 60% of the total authors. In this study, this group of authors constitutes 75% of the total authors, and with authors of two to six papers, equals to 99.1% of all authors. A list of authors contributing seven or more articles has been elaborated, and is discussed below.

We computed the distribution of the data arising from the number of journals and the number of articles. 838 articles on marine sciences papers publishing in serials during the

years 1999-2000. Disseminated in 264 journals. 50% of these articles were found in 37 journals. The most preferred journal published a total of 38 papers.

Discussion

The phenomenon observed in this study is of stratification in marine sciences in Spain. This points out to an extreme concentration of authorship and a decisive dispersion of the sources utilized.

At the time of diagnosis, 1999-00, the applicability of Lotka's law is not viable, although one paper authors are the majority, and the two paper authors are less than the one paper authors but more than the three paper authors. The latter result, with its dimension of strong interdisciplinarity implied, in that there are many more collaborators than authors (surpassing the forecastings of the Lotka's law). A significant association recommending further analysis of productivity strata in marine sciences in Spain. The most dynamic authors, for the period 1999-2000, were Mr. Duarte (CSIC, Palma de Mallorca, 14 contributions), Ms. Zanuy (CSIC, Castellón, 11 contributions), Mr. Carrillo (CSIC, Castellón, 10 contributions), Mr. Delgado de Molina (IEO, Tenerife, 10 contributions), and Mr. Freire (University, La Coruña, 9 contributions).

The problems of merging editorial traditions are reflected in the analysis concerning domestic and international journals used by researchers. Scientists preferred to publish much of their works in serials publications of other countries. Although the main Spanish journal "Scientia marina" is ranked as fourth among scientific journals, only 5% of the articles were published in domestic journals. Characteristics of the publishing infrastructure of peripheral countries is verified also in this case. In fact, most contributors choice journals like: *Marine Ecology Progress Series* (29 papers), *Journal of the Marine Biological Association of the United Kingdom* (23), *Archiv für Hydrobiologie* (22), *Scientia Marina* (CSIC, Barcelona) (19), and *Aquaculture* (17). Between the less information source available for Spanish scientists is, interestingly enough, *Marine Chemistry* (two only admitted manuscripts).

The Spanish journals included in the database were: *Archivos de Zootecnia* (Córdoba, one time), *Boletín Real Sociedad Española de Historia Natural* (*Bulletin of the Spanish Royal Society for the Natural History*) (Section biology, seven times, Section geology one time), *Iberus* (Oviedo, 3 times), *Technical Reports from the Canary Institute for Marine Sciences* (ICCM) (one time), *Miscellanea Zoologica* (Barcelona, two times), *Scientia Marina* (CSIC, Barcelona) (19 times), *Thalassas* (University, Vigo) (two times).

10.4. Data on documentary typology and main research problems confronted after an analysis of key words employed in database records.

To estimate the short-term association between technical reports/conference communications and information reported through contributions to primary literature (journals), the quantities of each documentary typology available was obtained.

Conclusions derived from the above analysis resulted in very, few books (0.5% of the 838 total) available through the database. No technical report was admitted if not assimilable to a journal article. The only available report was from the Canarian Institute of Marine Sciences. The assumed value of the conference presentations and technical reports production was not able to be tested (Dizon 1985).

Some research questions are only able to be retrieved by using the keywords (Corcoran 1995) it can be accepted that those shown in Table 4 are substantial. Taxonomy (68), animal morphology (59), Biomass (53), Community composition (49), Feeding behavior (42), Fish culture (49) and Phytoplankton (42) present a better performance in estimating the maximum expected number of papers retrievable through keywords.

The effort of Spanish labs as seen through the ASFA database recovery priorities is in conformity with world standards of community compositions (see Table 4). Two Spanish papers concerning *Phytoplankton* were published in the journal *Nature* during the period 99/00. As in the average of the ASFA database *Community composition* is a result of a certain degree of relative effort of the Spanish labs; the aims *Fish culture*, *Taxonomy* (two bioinformatics devices from Spain, related with the taxonomy of fishes and algae have been accepted by CODATA (ICSU) (Wulff-Barreiro 1999; Wulff-Barreiro 2000), in 99/00) and *Biomass* are also a priority for all the countries. Spain's concern with *Animal morphology*, because of its geographical position, is not shared by people working abroad. Works dealing with *Fish behaviour* play a major role in Spain, a concentration which is not observed in the other countries.

The scarce number of information activity determined on *immunogenicity* (12 (1.43%) out of 838 contributions), *histology* (ten (1.19%) out of 838 contributions connected with this keyword) and *vaccines* (one (0.1%) out of 838 contributions) correspond to the global rank for the ASFA database 0.13%, 0.84%, 0.19% respectively. No information activity is available on *Endocrinology*; *Eggs* are only a research subject for 1.19%, contrasting with the world data on 3.32% articles.

As far as animals studied, the more prominent were: the Acipenser (ten papers), Brown trout (13), the *Dicentrarchus labrax* (22), the Gilthead seabream (67), *Mytilus galloprovincialis* (14), *Oncorhynchus mykiss* (16), Rainbow trout (13), *Salmo salar* (10), *Salmo trutta* (18), *Scophthalmus maximus* (13), Sea bass (22), Tuna (19) and Turbot (32).

11. Final note.

Documenting the state of the art information activity in the marine sciences of Spain 99/00, the best bibliographic resources have been compiled in evaluating books and in attempting to study research papers.

The electronic pursuit has given a portrait of research information available within Spain. From the least available electronic information on such subjects as vaccines to a flood of information on subjects as Spanish Antarctic research, the report is expected to provide an insight into Spanish 99/00 marine sciences-relevant activities.

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