



HAL
open science

Crustacea Decapoda: problem choices implemented from the literature. A worldwide bibliography from Andalusia

Enrique Wulff-Barreiro

► To cite this version:

Enrique Wulff-Barreiro. Crustacea Decapoda: problem choices implemented from the literature. A worldwide bibliography from Andalusia. People and technology: Sharing knowledge and shaping the future of aquatic information in Europe. Proceedings of the 7 th Biennial Meeting of EURASLIC, 6-8 May 1998., , 1998, 960-85952-4-X. hal-01235907

HAL Id: hal-01235907

<https://hal.science/hal-01235907>

Submitted on 30 Nov 2015

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

EURASLIC

**Seventh Biennial Meeting
of the European Association of Aquatic Sciences
Libraries and Information Centres (EURASLIC)
6-8 May 1998, Athina, Greece**

PEOPLE AND TECHNOLOGY

**Sharing Knowledge and Shaping the Future of
Aquatic Information in Europe**

Proceedings

'98

National Centre for Marine Research

Crustacea Decapoda: problem choices implemented from the literature. A worldwide bibliography from Andalusia

by

Enrique Wulff-Barreiro

Marine Sciences Institute from Andalusia. ICMAN (CSIC), Polígono Río San Pedro s/n.
11510 Puerto Real (Cádiz). Spain

ABSTRACT

A database has been constructed compiling virtually all the worldwide known larval developments of the Crustacea Decapoda. 4031 entries list this morphologic analysis. The criteria of relevance, comprehensiveness, and reliability applicable to this bibliography permit an objective evaluation of the relative importance of scientific research problems in the area. The data structure of the database is spread over the scientific literature to see what falls into the grid. All the data from a specimen, a gender, a family, and an infraorder have been introduced. The literature coverage is described with a special field. The practical foundation for a problem choice activity is focused on the field where the controlled stages of the evolution of the larvae are recorded. Zoel stages names result from the application of knowledge procedures deriving in morphologic attributes. Until the Last Stage is attained the distributive lattice between the considered attributes defines a logically inconsistent situation. This must be discerned in terms of fuzzification. At least two such criteria are present in the initially defined stage with no idea of the last stage, and the changes of names along time. In terms of the material properties of the database it is said that the condition of reliability may be expressed in terms of the "density" of the distribution of the attributes. A theory of the specimen described, in the sense of finally giving it a name, must be a conjunction of data from the Lab (L) and from the plankton (P): (L+P). And this will be the criteria of quality when solving problems. The impasses detected when trying to attain this ideal would identify possible research questions. An integrated set with the names of the most important journals and authors, and results on the more informative years in the discipline are also included.

INTRODUCTION

How large is the bibliography on Crustacea Decapoda? When we have to deal with such a question, we are aware of the need to characterise it in terms of databases. A complete database would provide a decisive overview when an answer is decided upon. Naturally, in order to determine the definite establishment of a life history, the standard way is to use the bibliographic reference, as there is unanimity about its value as public recognition of a scientific event.

This study describes the database produced in the Marine Sciences Institute of Andalusia (CSIC) containing the complete set of literature references on Crustacea Decapoda. The precedents of this bibliography could be searched between the information supply arrangements authored by

Gurney in 1939, and by Soltanpuri-Gargari, Engelman and Wellerhaus in 1989. The existing financial limitations are responsible for the delay in publishing this professional collection.

The present contribution an attempt to cater for all possible audiences in all situations related with zoea. The analysis will proceed to draw attention, and to convince that this information is important. With these competing demands borne in mind our contribution has tried to follow the procedure to search for data generally in terms of a dictionary search for keywords and predicates places occupied by the nouns defining the stages of the development (Semenova, 1994).

The general research question concerns the expectations of future solutions related to the scientific problems in the framework considered. The very notion of cognizability of the object of research is a function of the salary-based labour remuneration system (Malevinskii, 1992). The problem scope needs long-term planning. Considering if the number of publications expressing their views on it is growing over time could assess the current importance of a problem. We study the publication flow for the period 1767-1996, almost from the "origin of time" of this field. This publication stream and its structure and dynamics are indicative of the shifts of interest of scientists working in the area. We search for criteria for the support of the research subject based on substantiated (and unauthorative) claims to current importance, also trying to enforce the incentives to minimize the error.

Accordingly, the individual contexts whose interpretation may be connected with the dynamics of the scientific reproduction of the area of study may be expressed in a way that involves the communication problems posed by its representation in a database. Theoretical schemes of (essentially) bibliometric indicators of a scientific discipline have been proposed (Mateev, 1995).

The quality of the information provided by the data collection from the literature and input to a database (Kuhn, 1994), is based on nonquantitative features in a parametric environment. Our discussion, in this case, would be addressed to the attributes assigned to the different stages in larval development and to its values.

The reliability of this insight is developed by means of a special formalism. The attribute here is a property of a structural entity, which is extracted from the viewpoint of organic synthesis (Nakayama, 1994). If some properties may be designed for the sake of notation with numeric parameters, this information is not here expressed to assess the statistical significance of any theory with high aggregate score (Karlin, 1990).

The degree of uncertainty is relatively high, and the choice of the dynamic trajectory conducted by the research is targeted by examining the presence/absence of the presumed attributes; and this, it is proposed, could be formally posed through fuzzy representations (Nissam, 1992). The reliability of research line's self-preservation and self-reproduction is thus exposed to the complexities of the evolution of meaning (Sharov, 1990).

METHOD

The primary concern of the author (González-Gordillo, 1996) has been the inclusion of the descriptions of larval development, i.e. raw references only mentioning the presence of larvae have not been accepted (a useful instrument to assess this problem has been created, it is not a "check-list"). Defined on the basis of a Dbase IV data model, 4031 entries list this complete morphological analysis of the Crustacea Decapoda.

The reason for defining stage meanings is larval developments matching. The definitions of this meaning are complex, because they are under specific constraints derived from the experimental conditions. They have to be given a matching mechanism of their own. Verbal expressions for the temporal-dependent relationships thus to be considered are supported in a Dbase IV system.

The structural entity of the database is based upon the systematic classification of Bowman and Abele (1982) and Burkenroad (1983), which is to say that generic structures are represented with the accepted procedures used to call the infraorders, the families, and the genera.

Under each structural context, operating on the general basis of the ordering systems, the independent module appears with the features for matching the progress in morphological studies research of the larval development. The entries holding this information are prepared for various types of fields. Not all the items are meaningful to each situation, and some of the items may be omitted. With the intent to arrive at a clear representation of the data an example search will be provided in this contribution.

Each individual field has the following meaning:

1. Crustacea decapoda accepted specimen name. A headwork for the accepted denomination of the Crustacea decapoda larval development.

Example: *Eriphia gonagra*

It is finally fixed through the evaluation of the author and the date of its description. The authors of the first description, and the date, will be enclosed in parentheses, as usual in taxonomic studies, as a simple approach to express that the acknowledged researcher having first observed the specimen called it a name not completely representative. This initial lack of effective verbal designation has actively stirred up new reactions, from the scientific community, resulting in an exact and particularly well-coined term for the live organism (Brett, 1996). On the contrary, the absence of this procedure must be regarded as stating that the registered name by the discoverer was valid from the beginning.

Example: (Fabricius, 1781)

2. Cited Crustacea Decapoda name. Here the kind of definition of the larval development is referred as determined inside the text by the author responsible for the bibliographic contribution subsequently mentioned.

3. Author. The field provides the name of the scientist to be regarded as main contributor in the larval development available from the article referred.

4. Year. The specific temporal instance when the larval development attained the public arena via its publication in a scientific journal.

5. Stages. These are the structural entities for which it is possible to specify the category known as larval development. The stages will be registered under the following initials, PZ for Protozoa, Z for Zoea, and M for Megalopa. The Last Stage previous to the Megalopa is labelled with a LS. The succession of stages identified is to be expressed using an alphanumeric code, like Z1, Z2, etc.

6. Source. With this instance the origin of the material assessed in the article is represented. If it is extracted from Plankton, it is noted with a "P". If the descriptions are based on larvae completely reared in the laboratory, then the letter "L" is employed in the field.

7. Title. With the complete title of the article having contributed the larval development, in particular.

8. Journal. The field serves to communicate the title, volume, issue, and pages of the journal where the paper was published.

Example search: The most effective criteria to understand how to work with this database are to provide an example. The topic selected is that of *Eriphia gonagra*; this is just the set of terms to be used for an English language search. When computing this search it is of course necessary to design the best view. Once the search is conducted, specialists in the field commonly use two print layouts. Normally, in the first imprimatur the first six fields would be obtained. The second print product applies to the fields 3, 7 and 9. As stated in the following example:

Case one:

Eriphia gonagra – (Fabricius, 1781)

Eriphia gonagra: Lewis, J.B. 1960.- Z1. (P)

Eriphia gonagra: Franzoso, A. 1987.- Z1.Z2.Z3.Z4.M. ()

Case two:

FRANZOSO, A. 1987.

Desenvolvimento larval de *Eriphia gonagra* (Fabricius, 1871) (Decapoda, Xanthidae) em laboratório.

Revista Brasileira de Zoologia, 4(3): 163-179.

LEWIS, J.B. 1960.

The fauna of rocky shores of Barbados, West Indies.

Can.J.Zool., 38: 391-435.

ANALYSIS OF THE DATABASE QUALITY CRITERIA

The key issue to be addressed is the criteria for the quality of the database. One way of interpreting it is that relevance, comprehensiveness, and reliability must be reflected. Thus, in our example, it must be guaranteed that what is obtained is highly related to the user's question (relevance); that the measure of how many data are found is maximised (comprehensiveness); and, last, that the highest degree of how feasibly the data can be accessed is attained (reliability).

The relevance of the information communicated by this device is closely associated to the context of use of the data inside a publication and to the motivation of the author of the article referred to report them. The data are taken from the current and past literature. In fact, questions asking whether the development is "slow" or "fast", whether the signification is defining a normal development, whether the variables are of controllable nature, and asking about the notion of regularity, all affect the status of whatever kind of idea of relevance is employed. They will all be briefly detailed.

The comprehensiveness is an indicator of the degree of completeness of a database. That means that the question on which the last overview on a Crustacea Decapoda larval development is produced can be answered interacting with the database. In addition the most frequently asked questions (if not all) can intentionally occur enclosing the security of a relevant answer. The user can

judge by examining how many primary sources can be accessed via the database, a total figure that amounts to around 469; and accordingly, it must be added that the database is updated until 1996.

From these two former criteria then formulations arise: the presence of the genuine problems in the database and the perceived volume of data managed.

Reliability. Facing the exploratory needs of a user searching for reliable information, what else besides relevance and comprehensiveness is practically controlled at the level of data input? We will answer by developing the idea of a verbal copy of a situation. The ability to be used as a tool for select research problem choices would be reported as the key when relevant data are identified. The largest volume of data is needed to assure the broader range of choices.

DISCUSSION

A taxonomization of information significations is often identified as belonging to biological systems. The signification of morphologic information is manifested not only in the last stage in the larval development, but also in the entire development. Each stage of ontogenesis is a separate layer of signification.

The examination of the correctly characterized "critically important problems" will reveal a number of histories of the subject erected by the carcinologists themselves and by neighboring specialists; i.e. the determination of a set of "pure" histories of zoea research as carried out by practitioners, would give the result that research fronts being written out of these histories might possibly be determined. And these "current topics" are assumed to be composed of two essentially divergent issues: impasse and threshold situations (with a strong preponderance of the first one).

Problem choice, in the sense that it represents those aspects of activity which are related to internal factors of the acting persons, their motivations and plan of actions is, therefore, diagnostic. It results from the interplay of various factors, such as self-evaluation of competence, and perceived risk and profile (ex: possible biochemical skills).

The information boundary of the description and identification procedures for the larvae stages are determined by the set of attributes describing them. This set defines the finest levels of partitions, when the partition is into singletons. As the issue often concerns the unexplored, the digression attached with the treatment of ambiguity is denoted with the expression "be removed".

Let us affirm that a situation is an "object" consisting of relational systems of other objects. Each object is understood as a stage and constitutes a basic element of a unique process called a complete development. A stage in fact could ultimately be reduced to a tree, with its name at the top and a conjunction of any concepts constructing the subsequent stock of involved expressions. The verbal copy, as reflecting the state of a situation, can be regarded as an end product of a dynamic process of classifying the object X. If a set describing a situation as a verbal copy composed by a string of values of attributes has attained its last degree of admissibility, it results in a name for the specimen. Let us now interpret its composition as a set whose elements will be labels of concepts. Each label denotes a stage of development. Under these conditions we assume that the conjunction of all the labels need to have its own name; thus the closure under conjunction of the concepts implied in the series of attributes (as showed by successive stages) should finally be asserted. That each concept understood with a label result from a value for an attribute at last determining a stage is derived from the representability of its fuzzy nature. When a situation is faced where a determined stage is identified but the total size of the development is unknown or when changes of names along time are detected, are for instance fuzzy situations. When fuzzyfication is applied, the development is described by a vector of attributes, all increasing in a continuous way from 0 to 1 supporting this way, evidence of the exact recognition of the stages in the larval development.

It is also possible to face the practical question of introducing a configuration of possibly new problems with the dilemma between a classification yielding complete possibility, which is parsimonious, and then deterministic of a well solved situation (the zoea stage has been attained; and almost surely the systematic research problem is ended, but obscure possible logical interrelations between the different stages would not be characterized?) and a classification string which does not give complete possibility, i.e. which is less parsimonious, in other words, leaving one or more stages unmapped.

Case One:

Brachynotus atlanticus – Forest, 1957

Brachynotus atlanticus: Rodríguez, A.; González-Gordillo, J.I.;

Cuesta, J.A.

1992. – Z1.Z2.Z3.Z4.Z5.M (L)

Case Two:

Cancer bellianus ? – Johnson, 1861

Cancer sp.: Rice, A.L.; Williamson, D.I. 1977.- Z5. (P)

Pattern recognition is of fundamental importance in morphological studies. The dynamics of such perception assumes the relations between the perception of the specimen, as expressed by its stages (measuring the number and nature (the importance) of those stages for the recognition of the meaning of the specimen, as expressed when finally named), and the structural properties of the tentative description proposed for the specimen over the time.

Have we got a problem of time effects when evaluating the problems of changes of names? What are the criteria of goodness? Are they typical situations?

One has to take into account the fact that different persons may recognize the same sign, and when observing it using the appropriate techniques, at different “stages” of completeness.

Let us say that the “resistance” to adopt a definitive taxonomic definition of a specimen takes the form of successive “deformations” of the name (or of the description) under consideration.

Example:

Necora puber (Current designation, 1998)

Cancer rhomboidalis (Ancient designation, 1804)

Portunus puber (Ancient designation, 1811)

Macropipus puber (Ancient designation, 1975)

Liocarcinus puber (Ancient designation, 1984)

The notion of semantic equivalence, when established between successive denominations of a specimen, is used through the concept of admissibility distribution. The last would refer to the act of all possible states of an object. The admissibility as a separate problem may be conjectured at such times, called decisive moments, when the attainability of some particular outcome disappears.

The essential changes of meaning determining new morphologic stages are times of resolution of some internal conflicts derived from the restrictions on observability. These conflicts arising in the situation would likely be basic shift moments, as moments of transitions between stages.

Example: *Cancer borealis*: Ingle, R.W. 1981. – Z1.Z5.M. (P)

Are they values of attributes defined as a pivot? The pivotal value is such, that before it is given the string conformed as description is still not able to be named as a specimen and such that after it is appropriately employed the string is unambiguously understandable as a complete name for a larval development.

At some moment, the incomplete stage will be recognized, and the last fragment added before recognition is a pivot.

The determination of pivotal fragments (assumedly, Last Stages) in the course of pattern-recognition-oriented morphological studies would require experiments in which the observer would ask himself about meanings (recognition) of incomplete descriptions.

CONDITIONS OF OBSERVABILITY

Are they criteria of observability according to which components of the morphologic entity in a stated stage are separately or jointly observable, in a distinct way?

It is said that full observability is gained only as a pre-condition for distinct mapping of the considered stage. Until then we have only maximally observable set of attributes in a time-dependent way. And by that we mean that, on each successively increasing series of moments, all the elements of the increasing collection of attributes are observed in such a way that one cannot make any other observations on the remaining co-ordinates.

Referring to classification acts, the same object may be classified to one category on one occasion and to another category on a different occasion. Thus, inconsistency in the classification, has been produced. This means that loss and gain are only two types of changes of classification; it is possible, also, that the observability network becomes re-structured.

Connected with the possible establishment of internal or external controls in or around the observation there are two sources of changes of observability. External changes occur if a new tool is discovered, then, assuming that a definite denomination has not been enough consolidated for the specimen; the status of previously unobservable variables should possibly change the final name associated with the conditions of the experiment. Internal changes of observability should be associated with appropriate changes in the observed object depending, for instance, on the fact that some variable cannot be observed unless it exceeds some threshold.

The normalised number of differences of values of attributes (in terms of attributes which are representable on interval scales) is due to the density of necessary extensions of classificatory schemes. The times, collected from shifts moments, when it changes its attributional structure defined for each stage expresses the requirement of a new classification incipit. And connected with the pertinency of the relationship between dynamic classification and the theory of observability, the question could be: What is the degree to which a stage is in a development?

CRITERIA ON RELIABILITY

We will consider a development as a relationship between the time lapse and the description, a trajectory able to regularly stratify times and stages, in such conditions that the first value is Z1 and the last one, LS. We say that Z1 precedes Z2 (Z1, Z2 being two stages of the same larval development), such that the trajectory must pass through Z1 and then through Z2. The sign LS is sufficient and necessary. Indeed, the incomplete sign LS is sufficient due to the fact that it allows the recognition of the meaning of the string, and it is necessary because the lack of it prevents

recognition. Which means that the notion of normal evolution is introduced in parallel with the notion of regularity. Let us think of the operator “?”.

Example:

Plagusia chabrus: Wear, R.G.; Fielder, D.R. 1985. – Z1.Z5?.Z12?.M2?

With this it is possible to represent the degree to which the available selection of stages expresses the meaning introduced by the maximally observable set in terms of a defined name for the specimen.

To realize the factual nature of the considered stages, what would we define as a normal development? The identity of the stage is closely related to the stating of a time interval. So a normal stage does exist from its determination into a periodisation of time series; and a stage possesses, for some time without interruption, identity. In fact, the decisive moment when it is suggested that a new stage has been attained could be sketchedly defined as such a time when some particular previous string of stages disappears as the proposed model for the larval development in question.

Then, if two successive moments are considered, the evolution will be called regular with respect to the established denomination of the specimen if the degrees to which the stages corresponding to each moment express the name accorded to the specimen in a well-ordered way; that includes the increasing or decreasing ordering adopted. Eventually, if this relation ever disrupts, it may result in a change of meaning, a change of name for the specimen. This is a way to explore the strategies of description from the bibliographic database and to formulate testable hypotheses relating the choice of some features of the described picture (e.g. the dichotomy: static vs. dynamic).

A string of descriptions that can be characterized as a verbal copy of a situation is called reliable if it is highly concentrated. This condition of reliability may be expressed in terms of the “density” of the distribution of the attributes. When facing the situation where a determined stage is identified but the total size of the development is unknown, we refer the notion of the stage of development to the degree to which the trajectory is in this phase (stage) Z^* . A membership function could be defined in a time-dependent way. The fragmentary aggregation of attributes able to configurate a phase to be viewed as a stage would constitute a fuzzy set, and the membership function should take values from it. The intended minimum of the function under each period of observability might be treated as the criterion for the choice of a well-based stage definition.

The abstract representation of the description of a situation ($\dots, Z_{i-1}, Z_i, Z_{i+1}, \dots, LS$) is said to be faithful if the values on all the attributes could be included in the intersection of all the fuzzy subsets of the sets of attributes. In fact, a faithful verbal copy (an abstract representation of the description of a situation) is said to have exact representation of support if in all cases the supremes of altogether considered fuzzy subsets intersected is the same as the one of all the values in all the attributes. The whole discussion permits the affirmation that Zoéal stages names result from the application of judgmental procedures. They constitute knowledge attributes.

Can it be judged whether the development is “slow” or “fast”? Let us, once more, focus on the changes of names. As a standard name does exist at last, the trajectory representing the actual name could be the average one. The “distortions” around this name could be “slow” or “fast”. It proceeds along the regularities observed in the use of other denotations. The movement developed accumulating the times a name has been used would detect if this quantity is higher than corresponding to the current name. This should be designated as a “fast” speed of the distortion along the normal route continuously proposing the final name. The contrary case would result in a “slow” speed situation.

The growth curve of a larvae is attached to a stochastic process. This is because it must take into account the fact that, under the same initial conditions, one may still have different trajectories. This means that equations of differential nature are needed.

The variables of controllable nature would be temperature, alkalinity. The objective would be to use the controllable variables in such a way so as to reach a pre-assigned stage before a given time, etc. The larval development would be opened to the manipulations of different points of maximum sensitivity, where the placing of the points of application of the controls could be qualified as optimal. The function expressing the influence of all the co-ordinates on the growth rate depends here on what variables are inhibited, and to what extent by uncontrollable events. It could be mentioned that the fuzzy membership operator “?”, acts on the set of non-fuzzy values of attributes.

When a fuzzy situation is solved, the main issue is that the specimen may be named. Two desirable properties in this sense are that one would like to be able to make distinctions between situations within the limitations imposed by the language, that is, transmit the information sufficient for identification of a class, despite the imperfection of the description.

Also desirable is the exact representation of each attribute. Such a description provides information about those values of the attribute which have perfect “negative” knowledge of the situation, and about those with sign “?” of ambiguity attached.

CONCLUSION

In general, along the larval development identification process, what proceeds is an unambiguous and non-fuzzy status determination for the precise name of the specimen. Though this is the ideal, as in the first instance only a stage is known, and until the last stage (LS) is attained, because of not knowing of the mother and consequent indeterminacy around the specimen, the issues are referred to a fuzzy set. Zoal stages reared in laboratory are the substantive level.

Collected samples are “baffling”, larvae reared in the laboratory are not. Thus, the samples from the plankton are difficult to explain, in the sense that the identification of the stages cannot be built.

Could a “baffling” situation be solved when fixing a level of admissibility? Is it possible to introduce the notion of representation of the considered object? Could a designation be assigned from the systematics? Could the strings of characterization of each species be said to be partially common or partially complementary? Could it be said that a more complete description “is richer than” another one less complete? What kind of complementary relations could be traced between the descriptions. Are all the attribute sets which finally attain their own names, as zoea, the most precise description allowed?

Could it be said the the zoea stage forms a filter as a genuine characterization of a specimen, and that this is not the case necessarily with lower bounds?

Are there distributive lattice properties between the considered descriptions?

The sample is large enough to involve a too fuzzy class of situations, and we say that the number of facts left unexplained would be inadmissible. All what has not been performed at the laboratory is able to be questioned. Once the laboratory situation is deciphered, it is complemented with the observations made from the plankton.

The nature of future, past and present is not totally determined until the larvae reared under laboratory conditions complete its development. This lack of knowledge on the temporal proximity between the stages makes ordering difficult. At present a larval development would have attained a stochastic model for a development.

A theory of the object described, in the sense of finally giving it a name, could be described as a conjunction of data from the Lab (L) and from the Plankton (P): (L+P). This is a charismatic type of constraint. The paradigmatic complete larval development inside the laboratory is a case of full determination, the reciprocal influence between the complete stages string preceding the last stage and this one, is complete. We speak of enforcement in the sense of having located *a fortiori* the mentioned successive stages of the description in nature.

FINAL NOTE

Who are the people who have made important contributions to the field? Which are the more important years and journals?

Table 1. Ten people having made important contributions to the field

Gurney, R.	328	Larval developments
Williamson, D.I.	251	Id.
Lebour, M.V.	249	Id.
Heldt, J.H.	166	Id.
Aikawa, H.O.	155	Id.
Williamson, H.C.	149	Id.
Ingle, R.W.	133	Id.
Sars, G.O.	132	Id.
Barnich, R.O.	124	Id.
Wear, R.G.	96	Id.

Table 2. Ten important years in terms of amount of contributions

1960	153	Larval developments
1996	141	Id.
1915	137	Id.
1938	120	Id.
1995	119	Id.
1981	103	Id.
1984	101	Id.
1987	95	Id.
1967	92	Id.
1970	91	Id.

Table 3. Ten important journals in the research on Crustacea Decapoda
Larval Development

Crustaceana	272	Larval developments
Proc. Zool. Soc. London	179	Id.
Nordisches Plankton (Germany)	132	Id.
J. Mar. Biol. Ass. United Kingdom	98	Id.
Recueil Travaux Station Marine d'Eudome (France)	83	Id.
Discovery Reports	78	Id.
Bull. British Museum Natural History	74	Id.
Fiches d'Identification du Zooplankton	70	Id.
Acta Adriatica	68	Id.
Fishery Bulletin	68	Id.

REFERENCES

1. Bowman, T.E. and Abele, L.G. (1982) Classification of the recent Crustacea. In: Bliss, D.E. (ed.). *The biology of Crustacea, Vol.1: Systematics, the fossil record, and biogeography*, pp.1-27. Academic Press.
2. Burkenroad, M.D. (1981) The higher taxonomy and evolution of Decapoda (Crustacea). *Transactions of the San Diego Society of Natural History*, **19(17)**: 251-268.
3. González-Gordillo, J.I. (1996). Desarrollos larvares conocidos de crustáceos decápodos. Revisión bibliográfica. (Unpublished). [Known Crustacea Decapoda larval development. Bibliographic review.]
4. Karlin, S. and Altschul, S.F. (1990) Methods for assessing the statistical significance of molecular sequence features by using general scoring schemes. *Proceedings of the National Academy of Sciences USA*, **87**: 2264-2268.
5. Kuhn, P., Deplanque, R. and Fluck, E. (1994) Criteria of quality assessment for scientific databases. *Journal of Chemical Information and Computer Sciences*, **34**: 517-519.
6. Malevinskii, G.V. (1992) Objective evaluation of the relative importance of scientific research problems. *Nauchno-Tekhnicheskaya Informatsiya, Seriya 2.*, **26(12)**: 1-3.
7. Mateev, N., Mateev, P. and Shekerdzhiiska, I. (1994) A bibliometric approach to the analysis of classifications in chemical science. *Nauchno-Tekhnicheskaya Informatsiya, Seriya 2.*, **28(5)**: 1-7.
8. Nakayama, T. (1994) Semantic dictionary for substructure matching of chemical structures with general descriptors. *Journal of Chemical Information and Computer Sciences*, **34**: 845-853.
9. Nissan, E. (1992) For a computational metamodel of interpretation trials : the case of etruscan. Insights into the cultural dynamics of a research community. *Computers and artificial intelligence*, **11(6)**: 559-584.
10. Semenova, S.Yu. (1994) Parametric vocabulary in chemical carcinogenesis texts. *Nauchno-Tekhnicheskaya Informatsiya, Seriya 2.*, **28(4)**: 18-25.
11. Sharov, A.A. (1990) Biosemiotics: a functional and evolutionary analysis of the meaning of information. *Nauchno-Tekhnicheskaya Informatsiya, Seriya 2.*, **24(12)**: 10-20.