Fishery Technology 55 (2018) : 212 - 217

Aquaculture Database System for Culture Practices

P. Mahalakshmi[1*], A. Panigrahi, T. K. Ghoshal, G. Biswas, R. Ananda Raja and Sujeet Kumar
ICAR-Central Institute of Brackishwater Aquaculture, 75, Santhome High Road, R.A. Puram, Chennai - 600 028, India

Abstract

Aquaculture Database System was developed for the management of information on aquaculture practices collected by the research institutes and other organizations using Integrated Development Environment of software. In this system, 29 tables and their corresponding relationships were designed by one-to-one mapping cardinality. The main screen was designed into four modules namely, Entry, Search, User Manual and Exit. The entry module allows the user to add culture practices information into their corresponding table for storing. The search module allows the user to retrieve the required information from their corresponding tables. The results can be displayed in the report format and also it can be exported to MSWord or MSExcel. In addition, the basic statistical analyses like frequency, percentage, mean and standard deviation was designed in the output screen based on their requirements. The system has been tested using the farm data collected from the brackishwater aquaculture area in West Bengal. Although illustrations are based on the brackishwater, ADS is general and can act as a model to capture and analyze the data for all other aquaculture practices.

Keywords: Database, Aquaculture, relationship, software

Introduction

Aquaculture has emerged as an important area in the global food production agenda. A vast amount of data in aquaculture and fisheries becomes available especially while capturing the existing and evolving culture practices. It is imperative to involve computer user based inference to store, retrieve selectively, and display items of possible interest. The storage of such data in a common location and the indexing arrangement that enable the users to quickly find them is called a database. The database system represents data and relationships among data by a collection of tables, each of which has a number of parameters (or attributes) with unique names.

According to Consultative Group of International Agriculture Research, "sustainable farming is the successful management of resources to satisfy the changing human needs, while maintaining or enhancing the quality of environment and conserving natural resources". Farmers' satisfaction includes issues such as 'productivity', 'profitability', and 'social acceptability' (Katyal, 1997). The farming/culture practice data in any geographical area or the inherent heterogeneity can have wider scope to define sustainability and farmer's perception. Due to the importance of the information on culture practices research institutes/organizations carry out farm survey for collecting the required information using questionnaires (Mahalakshmi et al., 2012). Since large volumes of questionnaires based data is collected, the task of sifting through this information, documenting it and analyzing the same it for further use is a formidable task.

The existing database/information system in fisheries/aquaculture sectors are PISCES (Providing Information for Socio-Economic Catch and Effort Fisheries Surveys) Fisheries information management system (Halls et al., 2000), Fish Base (Forese & Pauly, 2000), Global Mangrove Database and Information System-GLOMIS (Baba et al., 2004), FiRST (Garces et al., 2006), Pond Dynamics/Aquaculture (PD/A) CRSP (http://pdacrsp.oregonstate.edu/) and Reef base (Vergara et al., 2000). Software tools which are useful for compiling and analysing of culture practices survey data are almost non-existence in aquaculture

Received 23 June 2016; Revised 17 July 2017; Accepted 01 July 2018

*E-mail: maha@ciba.res.in

© 2018 Society of Fisheries Technologists (India)

(Mahalakshmi et al., 2012). With these objectives in view, the software called Aquaculture Database System was developed for the management of information on aquaculture practices collected by the research institutes and other organizations.

Materials and Methods

The system has been designed and developed using water fall model of software development life cycle. This includes requirement analysis, design, coding, testing and maintenance (Royce, 1970; Horner, 1993). Model structure and the explanation of each phase are depicted in Fig. 1.

Based on the requirement of a system for the management of information on aquaculture practices collected by the research institutes and other organizations, the present system was analysed and further based on the results, in practice, a user-friendly application software was designed and developed using Integrated Development Environment of Access.

A total of 361 parameters on various aspects of aquaculture practices such as farming system; pond preparation; stocking; feeding; water and aeration system; disease, diagnosis and health management aspects; disease outbreak; biosecurity measures; use of chemicals and medication; harvesting; production; Better Management Practices (BMPs); social participation; mass media exposure (MME); credit orientation; training programme; information seeking behaviour; production constraints or problems; and economics were used for the development of the software (Mahalakshmi et al., 2012). Visual basic application was used for the creation of interface in the software. The developed software was tested and verified for its working efficiency.

Results and Discussion

The database structure was designed in MS Access. The system contains 29 tables and each table was defined with identified parameters and its corresponding data type. The retrieval of data from the

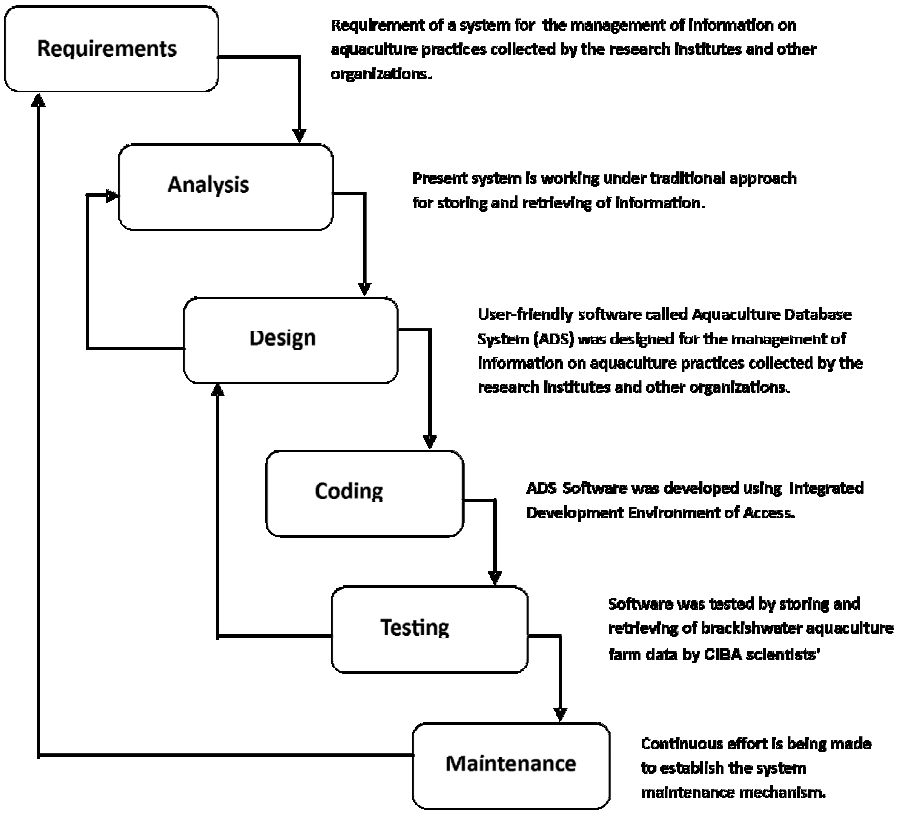


Fig. 1. Water fall model structure and the explanation of each phase based on the Aquaculture Database System (Modified from Horner, 1993)

database can be faster with the help of a primary key, which is an attribute or combination of attributes that distinguishes one record from another (Cox & Urban, 1996). In this system, 'farmer identification number' was designed as a primary key that stores and retrieves the information for a particular farm. The binary relationship set between the two tables was defined by one-to-one mapping cardinality. Primary key for the relationship set is simply the union of the primary keys of all the tables, because each table can have only one type of relationship with another table (Korth & Sliberschatz, 1991)

In this system, 29 entry modules and 25 search modules were designed for users to store and retrieve the information on aquaculture practices. The search module was designed based on boolean logical operators 'AND' or 'OR. The user manual was designed inside the system for step-by-step execution of the software.

The software was developed on a platform of windows XP or Vista, and best viewed at a screen resolution of 1366 by 768 pixels. The relationships of the 29 interrelated tables are illustrated in Fig. 2. The home page of this software was developed into four modules namely, Entry, Search, User Manual and Exit (Fig. 3). Steering links to main page of Entry, Search and User Manual and also the required navigation buttons are designed in system for effective and easy navigation.

The entry module consists of 29 sub-modules and each one allows the user to add or delete farm/culture practices information into their corresponding tables for storing. The 'Farmer information form' and 'Farm information form' contain the basic farmers and farm level information respectively. The 'Farming system form' contains details of farming practices in their farms. The 'Pond preparation form', 'Stocking form' 'Feeding form', 'Water and aeration form' contain the technical specifications of

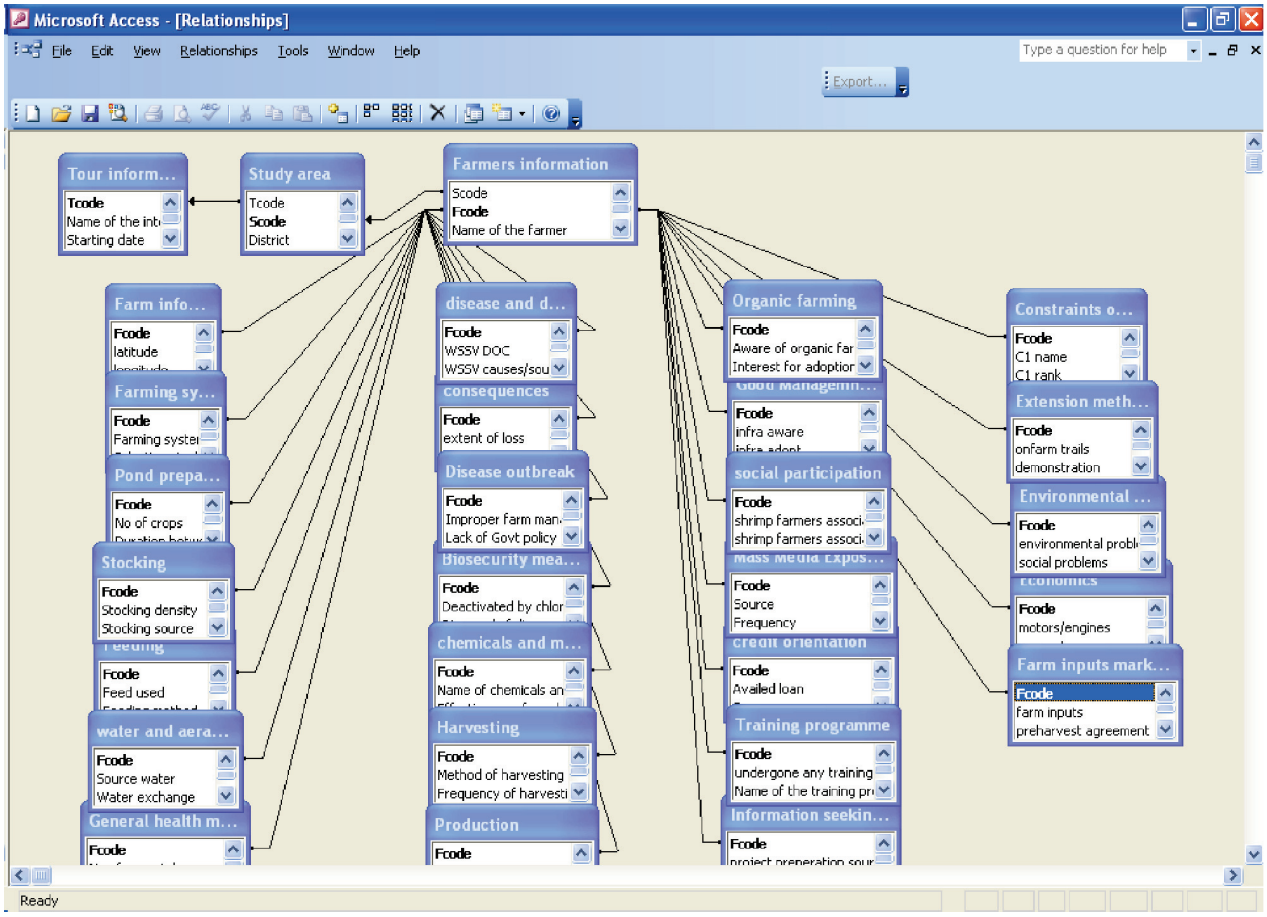


Fig. 2. Schematic representation of the detailed relationships between the tables

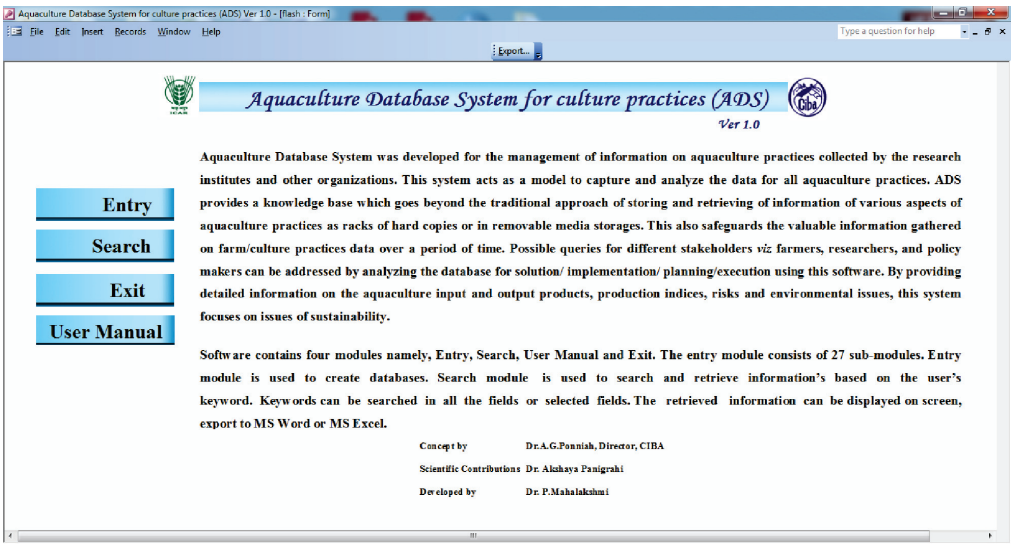


Fig. 3. Home page of Aquaculture Database System for culture practices

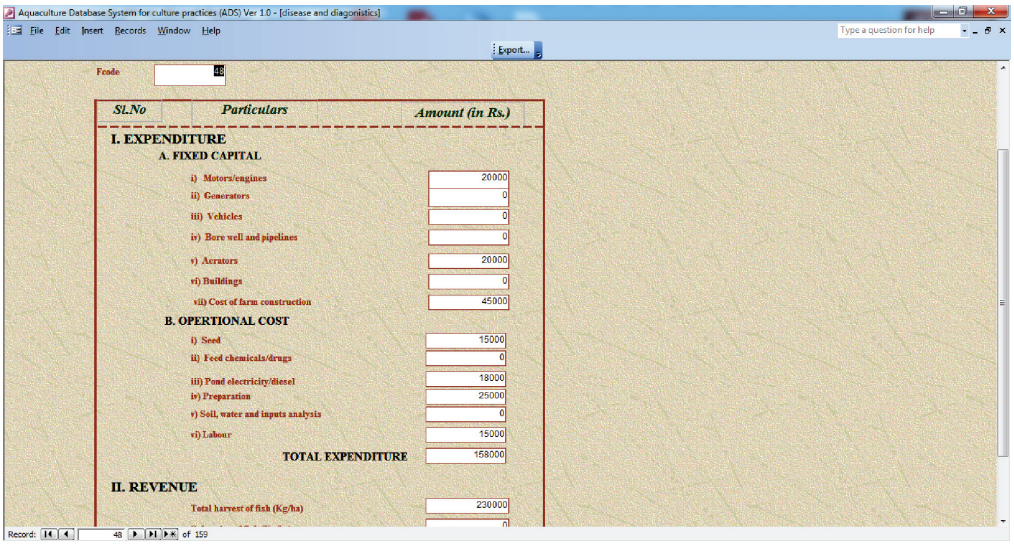


Fig. 4. Economic entry form of ADS

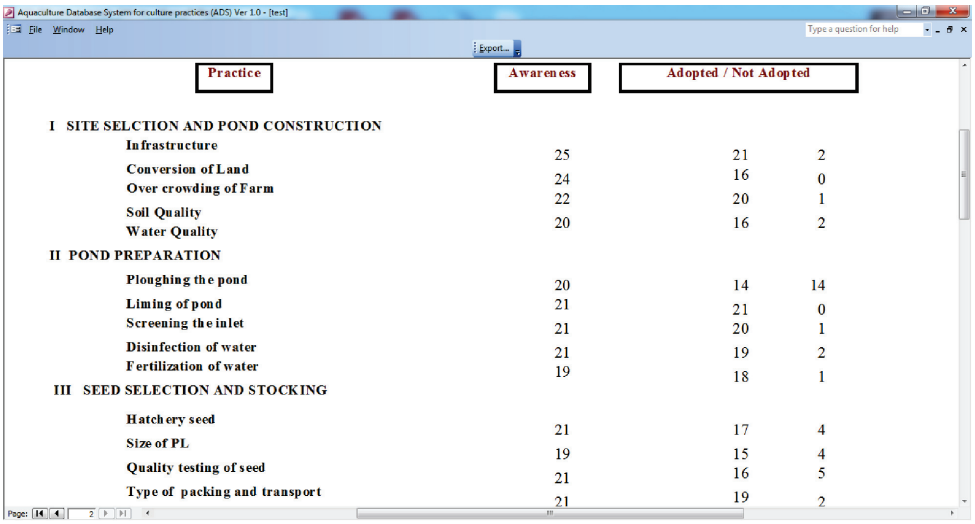
the culture practices. The 'Health management form', 'Disease and diagnostics form', 'Consequences of disease form' and 'Disease outbreak from' contain the disease management information. The 'Biosecurity measures form' contains adoption level information. The 'Chemicals and medications form' contains the details of chemicals and antibiotics usages in culture practices. The 'Harvesting form' and 'Production form' contain the yield related information. Both the 'Organic farming' and 'Better Management Practices' forms contain their corresponding awareness and adoption level information.

The 'Social participation form', 'Mass media exposure form', 'Credit orientation form', 'Training programme form', 'Information seeking behaviour form' and 'Extension methods and materials form' contain the extension oriented information of the farmer. Within the culture practices, there may be one or many constraints and the details of these are captured in the 'Constraints / crop diversification form'. It also allows the storage of the crop diversification information. There may be environmental and social problems in the culture practices and the details of these are captured in the 'Environmental/social problems and ITK form'. This

form also allows the storage of ITK related information such as beliefs perceived benefits, and comparison with conventional methods. Automatic calculation of total expenditure, revenue and profit are included in the 'Economic form' (Fig. 4). The 'Farm inputs marketing form' contains information such as the model of payment for farm inputs and details of pre-harvest agreements for marketing the shrimp/fish.

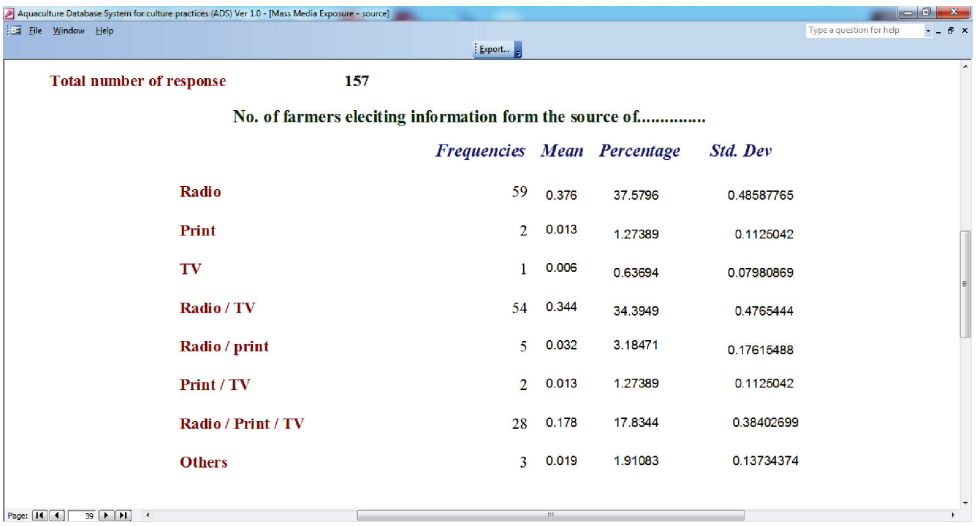
The search module consists of 25 sub-modules. Each sub-module allows the user to retrieve the stored information on any field combinations according the requirements from the corresponding tables based on the keywords. Basic statistical analyses like frequency, percentage, mean and standard deviation were calculated in the output screen based on their requirements. The retrieved information can be displayed on screen in the report format and also exported to MS Word or MS Excel.

The system was tested by storing and retrieving the brackishwater aquaculture farm data by researchers at ICAR-CIBA (Central Institute of Brakishwater Aquaculture) scientists and was found that the performance of ADS was accurate. The users could retrieve the data from an individual table or from the combinations of more than one table, which can



Practice	Awareness	Adopted / Not Adopted	
I SITE SELCTION AND POND CONSTRUCTION			
Infrastructure	25	21	2
Conversion of Land	24	16	0
Over crowding of Farm	22	20	1
Soil Quality	20	16	2
Water Quality			
II POND PREPARATION			
Ploughing the pond	20	14	14
Liming of pond	21	21	0
Screening the inlet	21	20	1
Disinfection of water	21	19	2
Fertilization of water	19	18	1
III SEED SELECTION AND STOCKING			
Hatchery seed	21	17	4
Size of PL	19	15	4
Quality testing of seed	21	16	5
Type of packing and transport	21	19	2

Fig. 5. Summary report generated based on the better management practices



Total number of response 157

No. of farmers eleciting information form the source of.....

	Frequencies	Mean	Percentage	Std. Dev
Radio	59	0.376	37.5796	0.48587765
Print	2	0.013	1.27389	0.1125042
TV	1	0.006	0.63694	0.07980869
Radio / TV	54	0.344	34.3949	0.4765444
Radio / print	5	0.032	3.18471	0.17615488
Print / TV	2	0.013	1.27389	0.1125042
Radio / Print / TV	28	0.178	17.8344	0.38402699
Others	3	0.019	1.91083	0.13734374

Fig. 6. Basic statistical analysis report generated by the system

be carried out by one-to-one mapping cardinality. In the system, the summary report can be automatically generated from the query based on the requirements. For example the number of responses of the better management practices followed by the farmers is summarized in the table format in the output screen (Fig. 5). The system can generate the similar summary report for details of mass media exposure, constraints & problems faced by the farmers, information seeking behaviour, and economics etc. Fig. 6 shows the number of farmers eliciting information from the mass media sources of radio, print, TV, radio/TV, radio/print, print/TV, radio/print/TV and others along with the value of mean, percentage and standard deviation.

At present the system is installed at Kakadwip Research Centre (KRC) of ICAR-CIBA, Kakadwip, West Bengal. However, continuous effort is being made to improve the layout of the system and for dissemination as well as its maintenance mechanism.

ADS provides a knowledge base which goes beyond the traditional approach of storing and retrieving of brackishwater culture practices information. This also safeguards the valuable information gathered on farm/culture practices data over a period of time. The retrieved information about the constraints or problems faced by the farmers, adoption / awareness levels of better management practices, details of disease outbreaks etc. will be useful for extension personnel, decision makers for providing the solution regarding the development of aquaculture practices, and associated livelihood options and policies for a particular area.

In future the user-interface modules for freshwater, pen and cage culture and other culture practices will be included into the system for the benefit of decision makers and aquaculture planners. Other potential areas for further scope include the development of on-line database system using the same procedure but through the web-based software techniques. This would be useful to decision makers across the world. Although illustrations are based on the brackishwater culture practices, ADS is generic and can act as a model to capture and analyze the data for all other aquaculture practices including mariculture system.

References

Baba, S., Gordon, C., Kainuma, M., Ayivor, J. S. and Dahdouh-Guebas, F. (2004) The global mangrove database and information system (GLOMIS): present status and future trends. In: Proceedings of the color of ocean data symposium (Vanden Berge, E., Brown, M., Costelo, M.J., Heip, C., Levitus, S. and Pissierssens, P., Eds).308 p, Brussels, IOC workshop report 188, UNESCO, Paris

Cox, J. and Urban, P. (1996) Quick Course in Microsoft Office of Windows 95 and Windows NT, 150 p, 1st edn., Galgotia, New Delhi

Forese, R. and Pauly, D. (2000) Fish Base 2000: concepts, design and data sources. 344 p, ICLARM, Manila, Philippines

Garces, L. R., Silvestre, G. T., Stobutzki, I., Gayanilo, Jr. F. C., Valdez, F., Saupi, V., Boonvanich, T., Roongratri, M., Thouc, P., Purwanto, Haroon, I., Kurup, K. N., Srinath, M., Rodrigo, H. A. B., Santos, M. D., Torres Jr., Tan, M. K. and Pauly, D. (2006) A regional database management system-the fisheries resource information system and tools (FiRST): its design, utility and future directions. Fish Res. 78: 119-129

Halls, A. S., Lewins, R. and Jones, C. (2000) Information Systems for the Co-management of Artsanal Fisheries, 165 p, Project R7042, MRAG Ltd, London SW7 2QA, UK

Horner, K. (1993) Methodology as a Productivity Tool. Software Productivity Handbook, pp 84-92, McGraw-Hill, New York

Katyal, J. C. (1997) Relevance of Integrated Concepts. The Hindu-Survey of Indian Agriculture, pp 25-31

Korth, H. F. and Sliberschatz, A. (1991) Database System Concepts, pp 115-126, 2nd edn., Mc Graw-Hill, New York

Mahalakshmi, P., Panigrahi, A., Ponniah, A.G., Ghoshal, T.K., Biswas, G., Ananda Raja, R. and Sujeet Kumar. (2012) Aquaculture Database System for brackishwater aquaculture, p 39, CIBA Special Publication 61. Central Institute of Brackishwater Aquaculture, Chennai

Royce, W. W. (1970) Managing the Development of Large Software Systems. In: Proceedings of IEEE WESCON, pp 1-9, Los Angeles

Vergara, S., McManus, J. W., Kesner-Reyes, K. N., Menez, L. A. B., Funk, R. Z., Evangelista, R. C., Noordeloos, M., Serrano, A. M. B., Rull, M. F. S. J., Alarcon, V. L., Meneses, A. B. T and Glorioso, J. R. (2000) Reefbase 2000: Improving polices for sustainable management of coral reefs (Ver. 2000). 164p, ICLARM, Philippines