

A data repository website on marine ornamental fin fishes and shell fishes from Indian waters

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An online data repository on marine ornamental fin fishes and shell fishes of Indian waters was developed in the form of interactive web-database using SQL Server 2008 relational database management system integrated web interface using Microsoft's .NET technology. The website of the database provides information on classification, synonyms, distinguishing taxonomic features, biology, distribution and other key references for 333 species of ornamental finfishes, 121 molluscan and 84 crustacean species. Data on these groups of species were collected through primary surveys from Indian coastal regions followed by Andaman, Nicobar and Lakshadweep islands, published literatures and other databases. The website also includes the multimedia digital photo library of the species that displays the pictures of the fishes along with few important details.

[Keywords: Online data repository, Database, Species, Finfishes, Shellfishes]

Introduction

In a pioneering study of ornamental fish resources of the country, the Central Marine Fisheries Research Institute, Kochi, India carried out the study for Lakshadweep islands. One hundred and sixty five (165) species were identified from this region and the biology and stock of 40 species studied and documented in the publication "Marine Ornamental Fish Resources of Lakshadweep". In Gulf of Mannar, a total of 113 marine ornamental finfish species, have been recorded and their biodiversity and standing stock biomass were also assessed¹. The fish fauna of Andaman and Nicobar Islands contributes more than 1200 species of which over 250 species are of ornament in nature.

With the rise of computer systems and information technologies, databases are playing key role in storing the large amount of information and making such information easily accessible to the end users to link to knowledge. A database is convenient method of vast amount of information that allows for proper storing, searching and retrieving of data. Biological databases represent invaluable resource in support of biological research and have also been invaluable for managing biological data/data sets and making them accessible². This paper describes about one of the categories of biological database on marine ornamental finfishes and shellfishes of Indian waters integrated with web interface.

Materials and Methods

Data source

The data on classification, synonyms, distinguishing taxonomic features, biology, distribution and other key references corresponding to each species of different groups were collected from Indian coastal regions followed by Andaman, Nicobar and Lakshadweep islands. We also used the online FishBase, well known fisheries database of ICLARM for collecting information. The publication "Marine Ornamental Fish Resources of Lakshadweep" published by Central Marine Fisheries Research Institute, Kochi, India was also used as viable data source for ornamental fishes of Lakshadweep islands.

Implementation and architecture

The architecture of the database consists of a relational database developed using SQL Server 2008 integrated with Microsoft's .NET technology framework for developing the database-backed web application. The Microsoft's .NET technology framework provides ideal grounds for efficient development of user-friendly and attractive web applications. This application operates on Internet Information Web Server on Windows 2008 Server Enterprise edition system. The system is running successfully on the intranet of NBFGR and only the authorized users are allowed to view the database. Following fig. 1 shows the screen print view of the

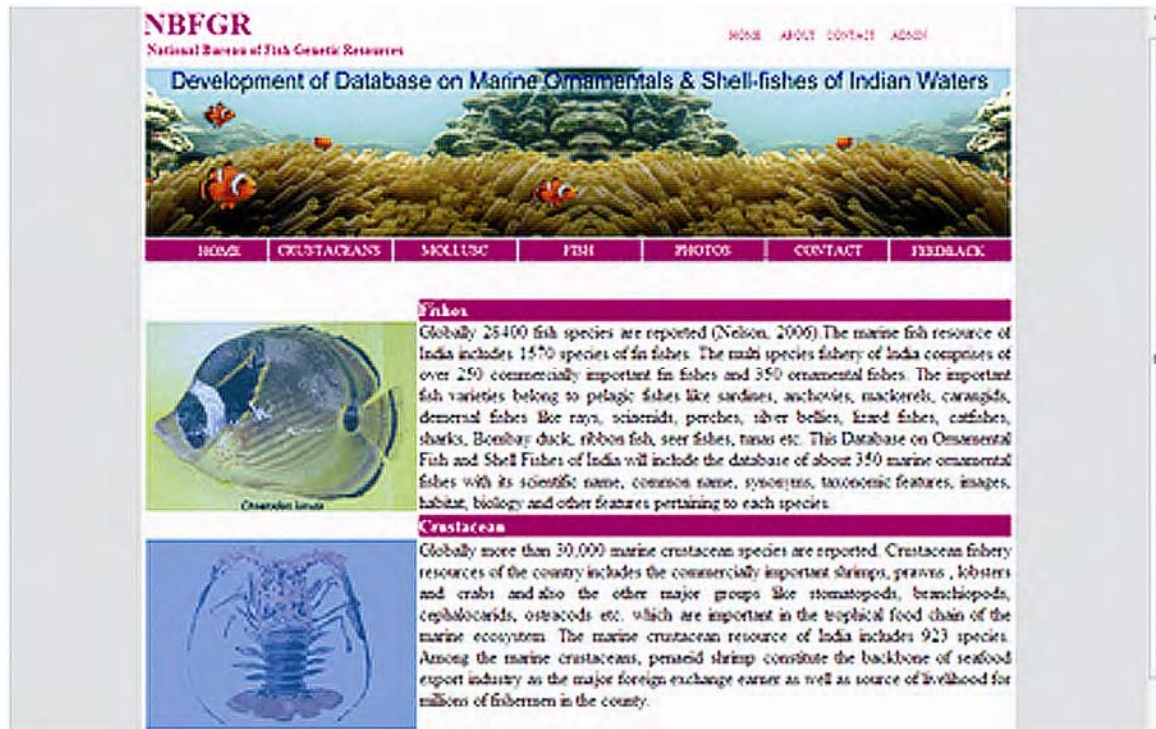


Fig. 1—The screen print view of the home page of the web application

home page of the web application developed for database.

Database content

The framework of the database was designed using SQL Server 2008 to store the data on classification, synonyms, distinguishing taxonomic features, biology, distribution and other key references corresponding to each species of different groups. The framework of the database is scalable thus allowing widening the scope of the content. The database has 333 species of ornamental finfishes from 41 families, 121 molluscan species from 7 families and 84 crustacean species from 11 families. The crustacean includes species of crabs, shrimps, lobsters, hermit crabs and stomatopods. The database has three different tables for three different groups' finfishes, crustaceans and mollusks. Data collected on the number of species under different families of each aquatic group was organized into different tables. Each table of groups contains data on general, taxonomy, biological and geographical attributes. The general attribute includes data on morphomeric characters, scientific name, common name, local name, synonyms, economic importance, nature, feeding habit, latitude/longitude of occurrence, artificial feed, disease control, water chemistry and temperature range. The taxonomy attribute includes data on taxonomical classification of

each species using Nelson's classification. The biological attribute includes data on biological features food/feeding habit, breeding, spawning and life cycle. The geographical attribute includes data on geographical distribution of species in India and abroad across different coastal regions. Following fig. 2 provides the glimpses of tables showing data on general, taxonomy, biological and geographical categories for each species for each different group.

Group library table

Only one table was made for each group to store the data on general, taxonomy, biological and geographical categories corresponding to each species. The different group tables were interlinked through the group table based on the group_id primary key. Multiview feature of Visual studio 2008 was used to extract the fields along with data for creating the view tables to be used for querying through user selection process. The ornamental fin-fishes group table has thirty-five attributes (fields) including fish_id as primary key. The mollusk group table has twenty-eight attributes including mollusk_id as primary key. The crustacean group table also holds twenty-eight attributes including crustacean_id as primary key. These primary keys are unique and serve as secondary key for the group table.

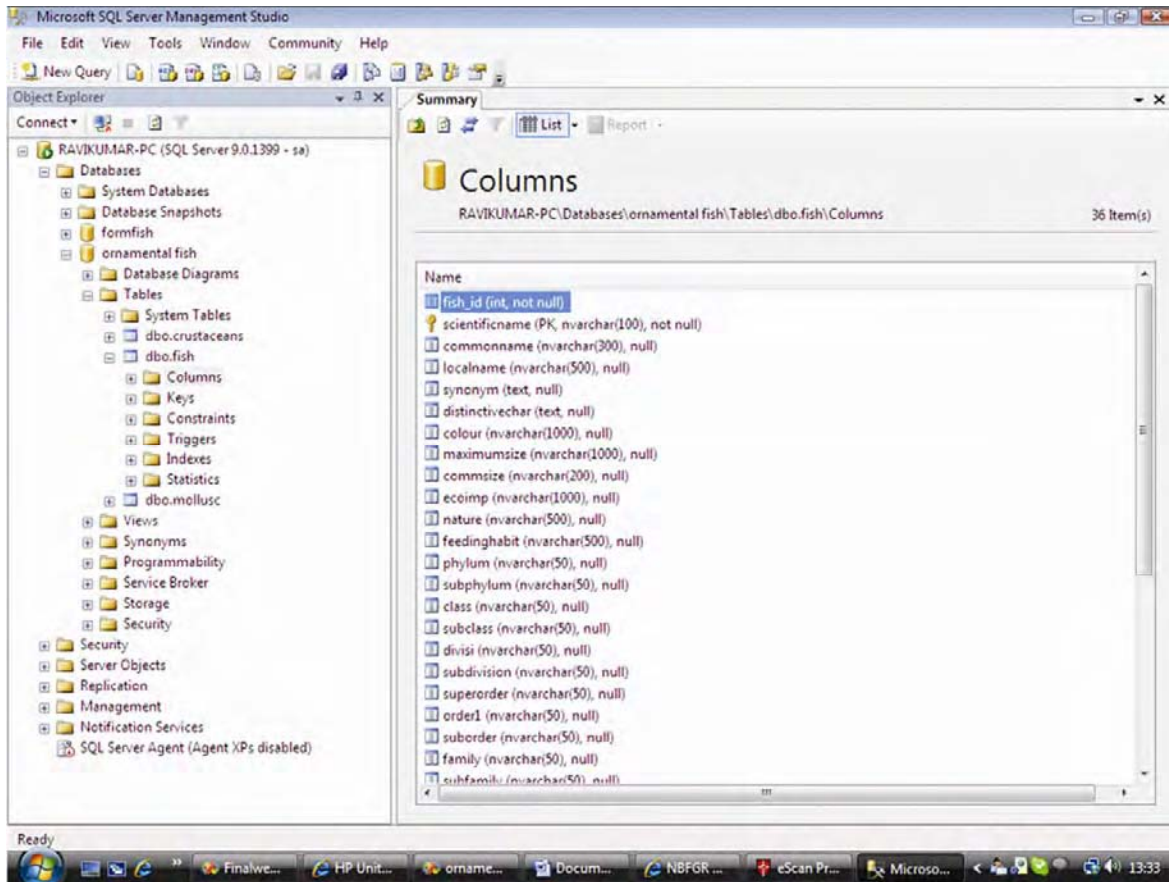


Fig. 2—The screen print view of the tables and their attributes prepared in the database



Fig. 3—The screen print view for querying the database by selecting scientific name and category of Information

Results

Querying the database

The web application of the database allows accessing the information group wise. Information for

every species under each group can be accessed by selecting the scientific name of the species and the category of information. Fig. 3 shows the screen print view of user’s selection. Fig. 4 shows the screen print

view of the result after user selection. Similar search results as shown in Fig 5 & 6 can be obtained by querying the database. The search queries have been programmed to search the species based on scientific name and thereafter to extract the data based on the information category. The extraction of data based on

the category of information creates a view table, which is further used for displaying the information. These view tables resides in the memory and provides rapid access of the information to the users in case of repeat searches. Further view tables do not require any space hence saving disk space also.



Fig. 4—The screen print view of the result of the query

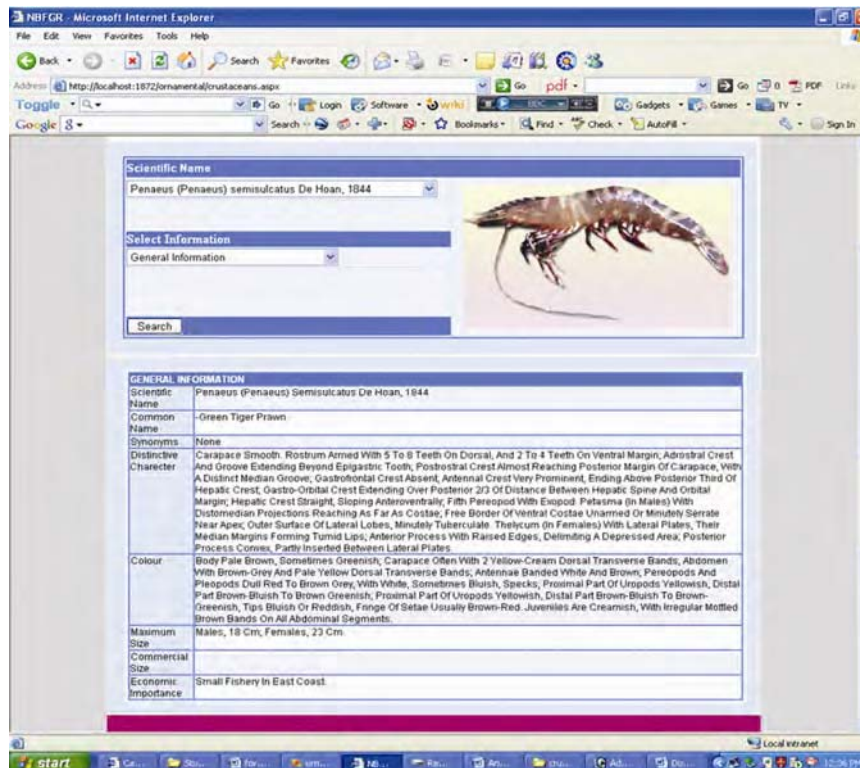


Fig. 5—Sample screen print of the display of the information accessed on *Penaeus semisulcatus* (De Hoan, 1984) species

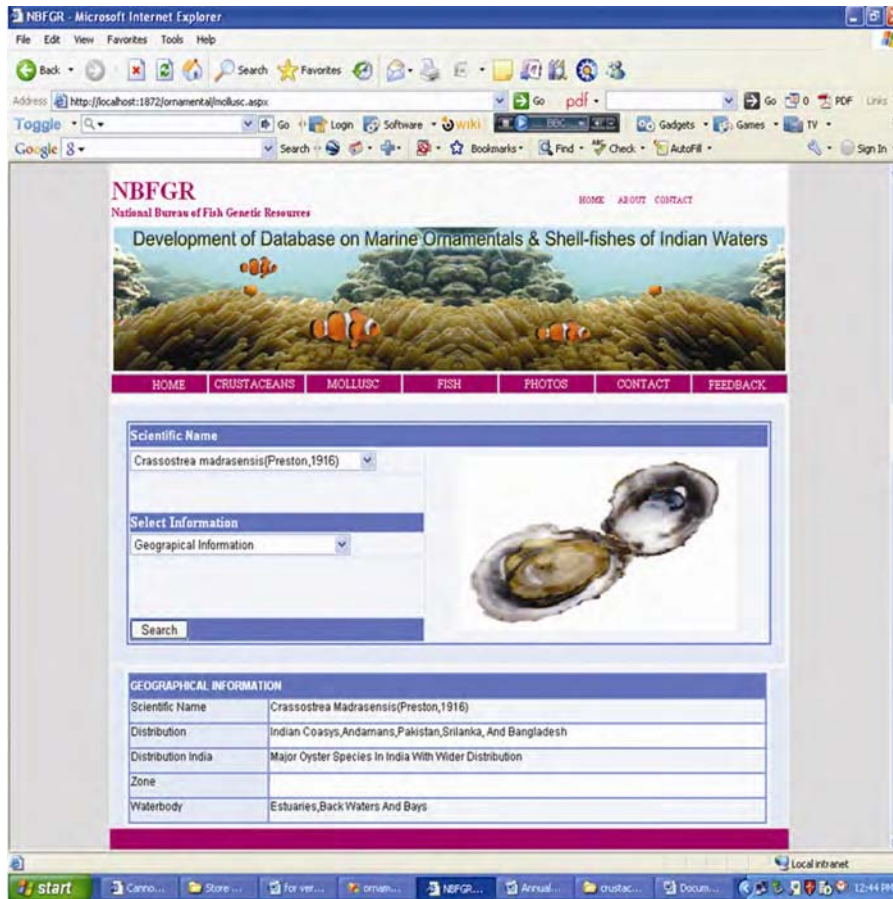


Fig. 6—Samples screen print of the display of the information accessed on *Crassostrea mudrasunsis* (Preston, 1916) species



Fig. 7—Sample screen print login window display for authenticated user for online data entry into the database

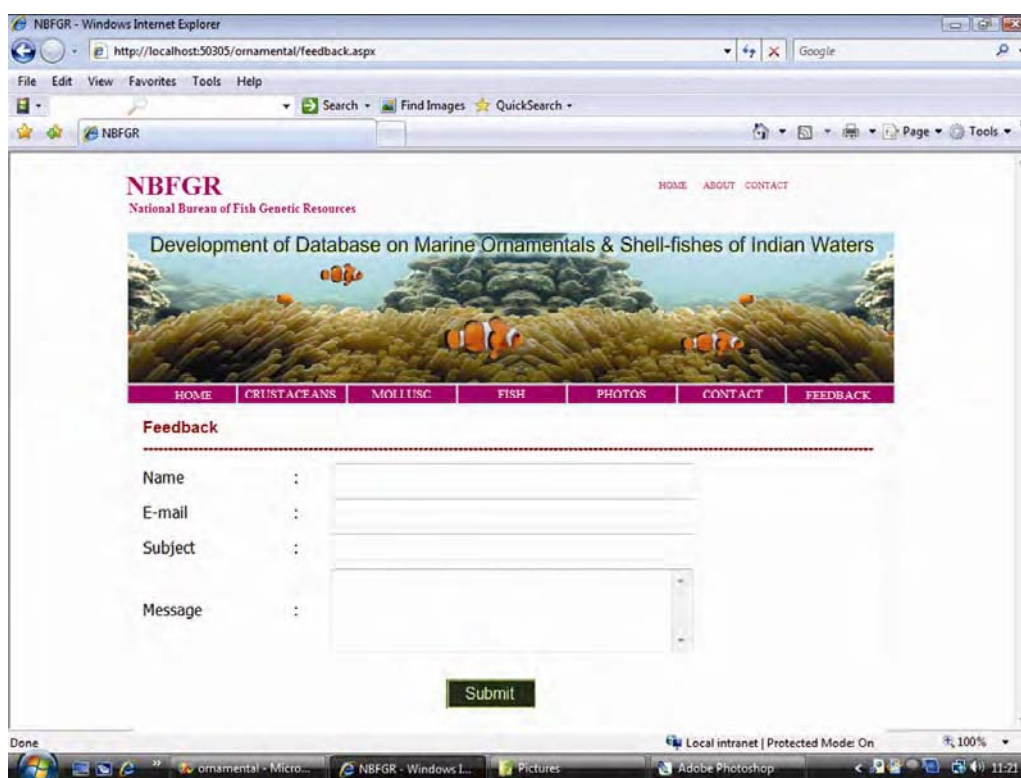


Fig. 8—Sample screen Print display for posting the comments and suggestions

Entering data in the database

The web application of the database also allows online data entry in the database. This facility has only been granted to the authorized users. The administrator of the database is authorized to create the data entry users and also grant the right and privileges. In the data entry section the data entry users can enter and edit the data. The editing allows user to modify, update and delete the record either navigating through the records or by searching the record based on the scientific name of the species. Fig 7 & 8 shows the screen print view of the online data entry sheet. All the data entered by the user are stored into a transaction table created in the database. The data enterer cannot make any changes in the data residing in the master tables of the database. The transaction table has verification flag. This verification flag, if checked allows automatic movement of record into master tables.

Comments and Suggestions for the database

The web application of the database allows users to post their comments and suggestions through the feedback form as shown in Fig. 9. The comments and suggestions posted by the users are recorded in a table in the database. Proper comments and suggestions bringing any significant improvement in the database

and its application are duly acknowledged by incorporating their name along with contact details in the website application of the database.

Digital Fish Photo library

A multimedia based digital fish photo library was also developed for the 117 fishes of the database and included in the web application. The digital photo library was developed using the Adobe Photoshop and Adobe Flash that displays the photograph of fishes along with details as depicted in Fig. 10 that shows the sample screen print view of the digital fish photo library. Alphabet indexing based on the scientific name of the fishes has been included to provide the convenience to the user to see the photograph of the desired fish by clicking on its scientific name. Like book the user also can scroll through the pages to see the photograph of fishes.

Application

Other applications of the database include finding species and their natural range of distribution. The database provides a platform for better understanding the species in their occurrence region, which can be used by the managers and conservationists to effectively manage and conserve population of the

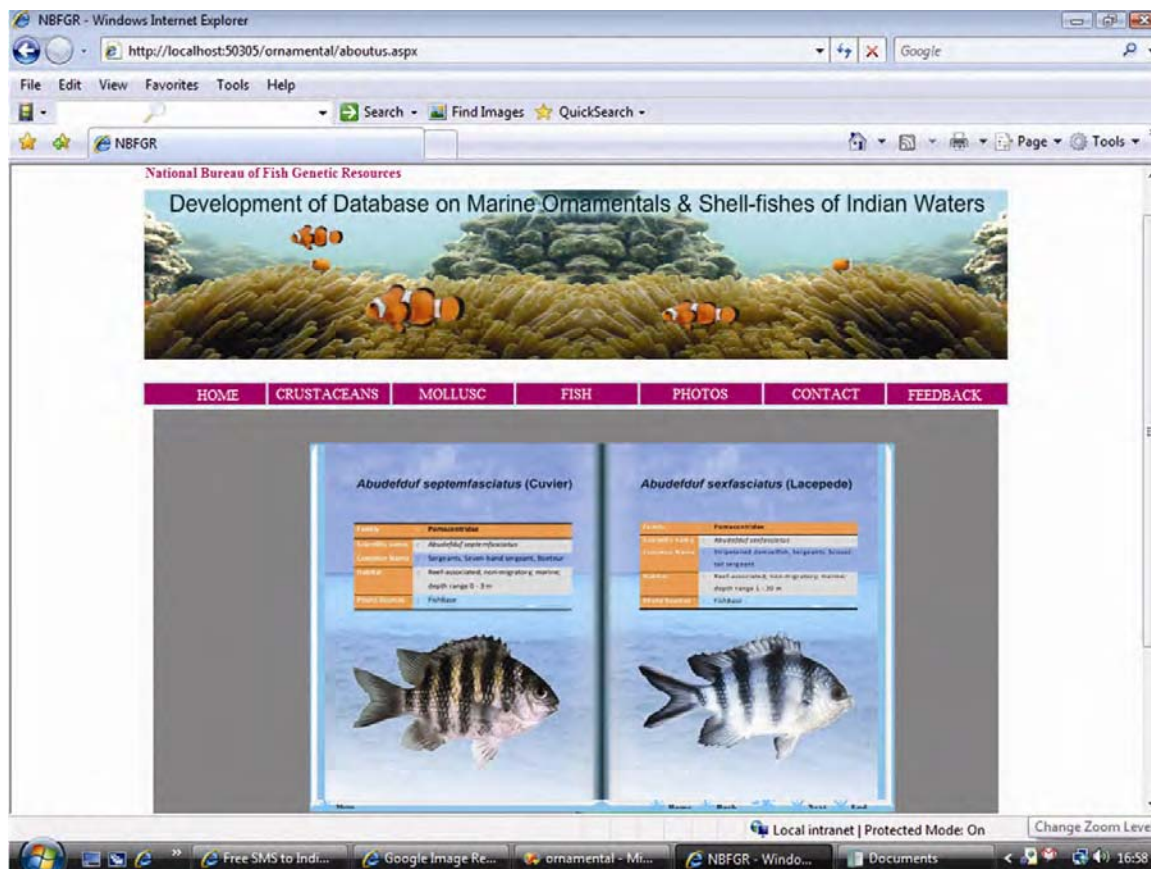


Fig. 9—The sample screen print view of the digital fish photo library

species. Since the database provides the baseline information on the geographic indication of these species it can be used to protect the future genomic rights. The research scientists can also find this database as viable source for identifying the species and carry out further research on life history traits and other biological aspects. Currently the application of the database is not much versatile since the available datasets are limited in respect of region and variable also. Several variables are needed to be incorporated such as spatial and temporal references, environmental characteristics. The work presented here demonstrates that significant insight can be gained with this limited dataset and that the described methods are in place for more comprehensive datasets that are expected in the near future for further applications.

Discussion

In addition to the economic importance of marine ornamental fin fishes and shell fishes to the human races, these groups of species provides extraordinary grounds for patenting the derived benefits and protecting the other intellectual property rights due to their specific inventory record. The results obtained

from the database will add the knowledge for analyzing the evolutionary history. Furthermore, the database provides knowledge in the identification of species and can also be used to find the loss of biodiversity, if damage occurs to the ecosystem. Such repository will be of high value in bridging the gap between ecosystem and its biodiversity. The database will be consistently updated and extended to broaden the content-scope through including data on existing species, and addition of more species. More comprehensive and detailed data on geographic indications, environmental and biological characteristics will also be added to the database as they become available. Such extensions mechanism will promote the usefulness of this data repository even beyond its current status.

Acknowledgement

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