

## LINKING THE TAIWAN FISH DATABASE TO THE GLOBAL DATABASE

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### ABSTRACT

*Under the support of the National Digital Archive Program (NDAP), basic species information about most Taiwanese fishes, including their morphology, ecology, distribution, specimens with photos, and literatures have been compiled into the “Fish Database of Taiwan” (<http://fishdb.sinica.edu.tw>). We expect that the all Taiwanese fish species databank (RSD), with 2800+ species, and the digital “Fish Fauna of Taiwan” will be completed in 2007. Underwater ecological photos and video images for all 2,800+ fishes are quite difficult to achieve but will be collected continuously in the future. In the last year of NDAP, we have successfully integrated all fish specimen data deposited at 7 different institutes in Taiwan as well as their collection maps on the Google Map and Google Earth. Further, the database also provides the pronunciation of Latin scientific names and transliteration of Chinese common names by referring to the Romanization system for all Taiwanese fishes (2,902 species in 292 families so far). The Taiwanese fish species checklist with Chinese common/vernacular names and specimen data has been updated periodically and provided to the global FishBase as well as the Global Biodiversity Information Facility (GBIF) through the national portal of the Taiwan Biodiversity Information Facility (TaiBIF). Thus, Taiwanese fish data can be queried and browsed on the WWW. For contributing to the “Barcode of Life” and “All Fishes” international projects, alcohol-preserved specimens of more than 1,800 species and cryobanking tissues of 800 species have been accumulated at RCBAS in the past two years. Through this close collaboration between local and global databases, “The Fish Database of Taiwan” now attracts more than 250,000 visitors and achieves 5 million hits per month. We believe that this local database is becoming an important resource for education, research, conservation, and sustainable use of fish in Taiwan.*

**Keywords:** Biodiversity, Digital Archive, Fish, Database, Taiwan

## 1 INTRODUCTION

Taiwan, an island located at the junctions of the Kuroshio, China Coastal, and South China Sea currents, is abundant in biodiversity, especially in marine animals. More than 2,900 species of fish, about one-tenth of the world’s total species number, have been recorded although the land area of Taiwan only comprises 0.03% of the

world's total area (Eschmeyer, 1990; Eschmeyer, 1998; Nelson, 2006). The Research Center for Biodiversity Academia Sinica has been collecting and conducting research about the fishes of Taiwan for more than 20 years. To aggregate the large amount of fish faunistic data accumulated, the first version of the Fish Database of Taiwan was established in 1988 (Chiu & Shao, 1991).

Since then, the contents of the database have become more and more substantial after the completion of several large and small-scale research projects. Two long-term projects granted by the National Science Council (NSC) (1989-1994) and the Council of Agriculture (COA) (1991-1996) collected a large amount of specimen and underwater observation data. The former project focused on coral reef and non-economic fish species, and the latter project gathered data mostly from the questionnaires of fishermen. Various ecological monitoring and environmental impact assessment projects conducted at Nuclear Power Plants, Kenting National Park, artificial reefs, etc. also allowed us to accumulate fish spatial and temporal distribution data. Literature reviews and information collected from anglers, divers, and fishermen were also collected (Shao, Hsieh, Wu, & Wu, 2002). Moreover, under the support of a five year long project of the National Digital Archive Program from 2002 to 2006, the data contents of our fish database can be quickly filled and well organized under the technical support of IT support staff.

Furthermore, in response to the trend of global data integration and sharing, the developed Fish Database of Taiwan began to seek local and international collaborations; for instance, the information of fish specimens at seven different academic institutes in Taiwan had been successfully integrated by the year of 2005. The Fish Database of Taiwan also periodically provides data to the global FishBase as well as the Global Biodiversity Information Facility (GBIF) through the national portal of the Taiwan Biodiversity Information Facility (TaiBIF, <http://taibif.org.tw>). By continuous internal improvements and outward local and international cooperation, the Fish Database of Taiwan is becoming well developed in contents, functions, and service.

Nowadays, the Fish Database of Taiwan (<http://fishdb.sinica.edu.tw>) is the database that integrates information on all the native fishes in Taiwan. A total of 2,902 species in 292 families has been included. It is composed of five sub-databases: basic information, distributional databases, specimen database, bibliographic database, and other related information (Figure 1). Detailed contents for each sub-database are discussed below.

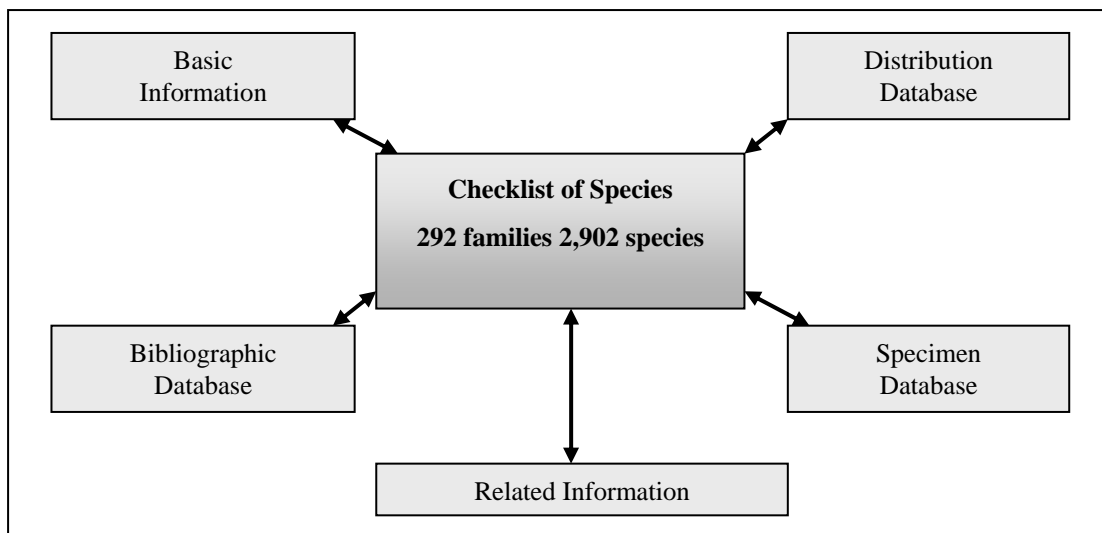


Figure 1. The infrastructure of the Fish Database of Taiwan

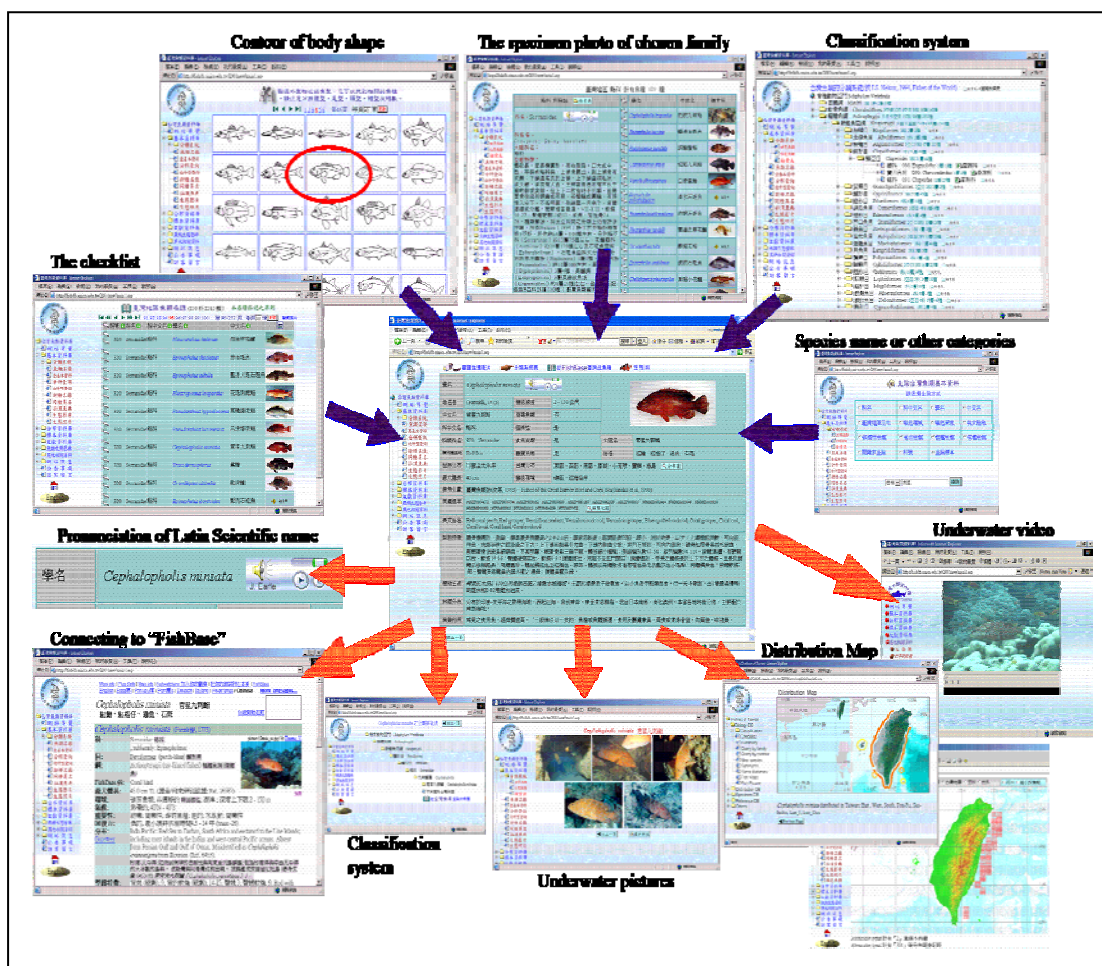


Figure 2. An overview of the available data for a species in the Fish Database of Taiwan. Blue inward arrows refer to different inquiry methods for the detailed information of a particular species. The red outward arrows refer to then further extended information obtainable from the webpage of the particular species.

## 2 COMPONENTS OF THE FISH DATABASE OF TAIWAN

### 2.1 Basic Information

This sub-database contains morphology, ecology, and distribution data as well as a photo and video of each species of fish. So far, 2,583 specimen photos and 399 videos of 283 species have been accumulated, including 379 specimen photos supplied by fish photographers of FishBase (Froese & Pauly, 2005). Users can find the detailed information searching by family name, scientific name, Chinese name, classification system, contour of body shape of each family, and even by the categories of ecological habitats (Figure 2). In addition, the database also provides pronunciation of Latin scientific names and transliteration of Chinese common names by referring to the Romanization system used for all Taiwanese fish. An online Latin-Chinese fish name dictionary is available as well (Wu, Shao, & Lai, 1999). The dictionary contains more than 29,000 fish names with both Latin and Chinese script. More than 12 thousands data of synonyms are also provided.



**Figure 3.** Distribution databases are the assemblage of seven research projects, whose data were reserved separately in seven databases.

## **2.2 Distribution Databases**

These distribution databases are a group of databases that allow the query of spatial basis and whose data are obtained by GIS. They comprise The Distribution Database of Taiwan Coastal Fish, the Distribution Database of Taiwan River & Estuary Fish, the Tzeng-Wen River Fish Distribution Database, the South China Sea Fish Distribution Database, the Taiwan Bottom Trawling Database, and the Database of Taiwan's Deep-Sea Fauna (Figure 3). The raw data of all the above databases have been integrated. The relation between the distribution of each particular species and the water surface temperature (from remote sensing maps of NOAA satellites) can be inferred by using the GIS system of ArcView/MapInfo, which has been incorporated into the database. Therefore, users can access these observational distribution data of each species on the map (in a grid system, 10' each) or obtain a total list of species for each grid based on the selected conditions of fishing gear, month, and abundance.

## **2.3 Specimen Database**

This database contains more than 32,000 records of fish collections from seven major museums of Taiwan and also provides an integrated query function, the GIS Map, the Google Map, and the Google Earth query function (Figure 4). The seven major museums are the Research Center for Biodiversity of Academia Sinica (RCBAS), the National Museum of Marine Science & Technology (NMMST), the National Taiwan Museum (NTM), the National Taiwan University Museum (NTUM), the National Museum of Marine Biology & Aquarium (NMMBA), the National Museum of Natural Science (NMNS), and the Fishery Research Institutes (FRI). The number of individuals of specimens collected is 11,543 of 3,013 species, 1,230 of 1,099 species, 1,470 of 808 species, 8,629 of 1,758 species, 5,809 of 1,692 species, 1,542 of 619 species, and 1,720 of 1,036 species respectively.

## **2.4 Bibliographic Database**

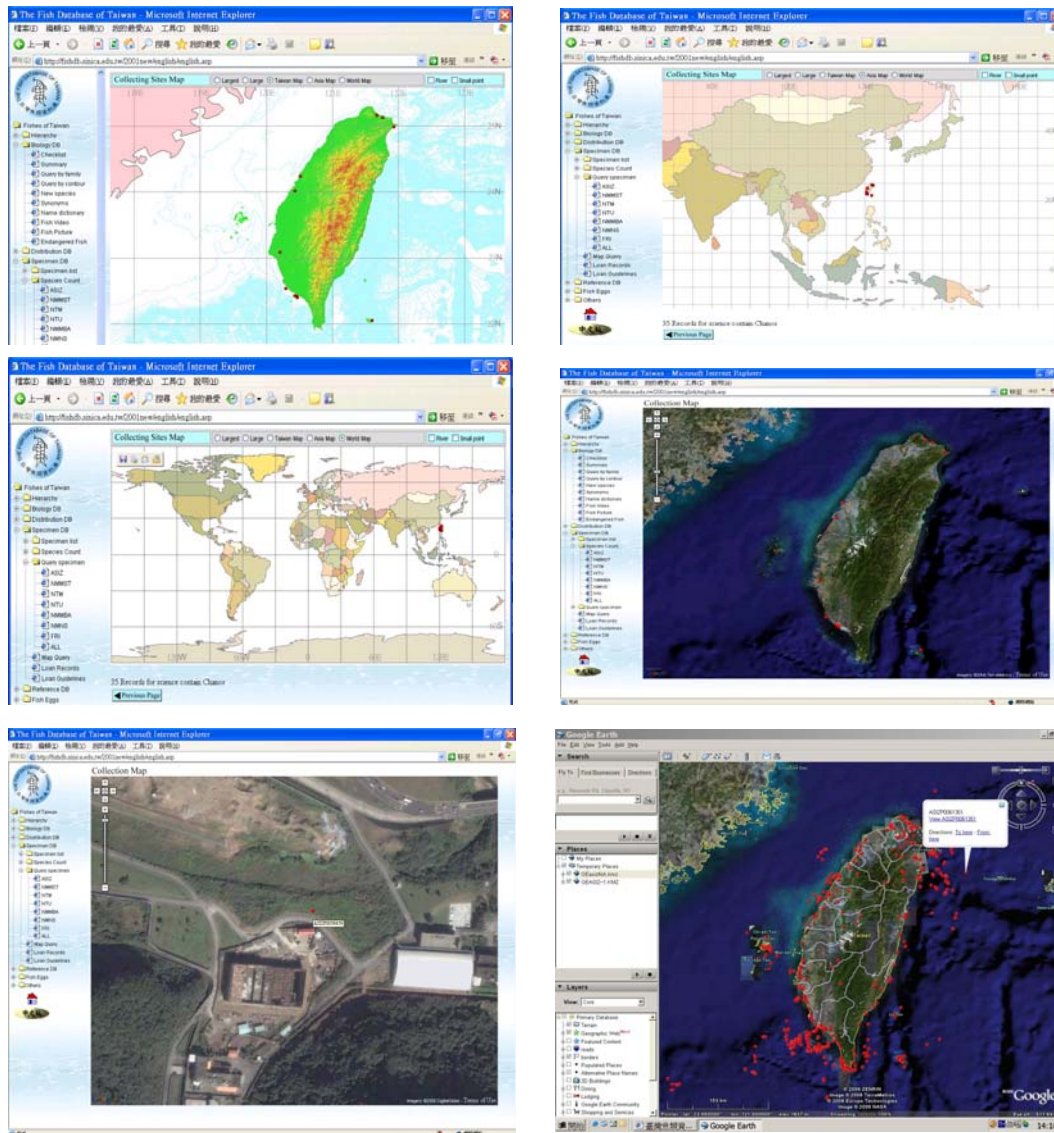
This database contains about 500 journal articles, books, and atlases about ecology, taxonomy, distribution, and conservation of Taiwan fishes, including local or non-SCI journal articles, some of them written in Chinese.

## **2.5 Ecological Gallery of Fishes**

This is an open gallery for amateur photographers of fish in Taiwan. More than 2,200 underwater fish photos and 399 videos have been included. Users can also reach FishBase, which has 43,600 fish pictures now, for photos unavailable in the Fish Database of Taiwan.

## **2.6 Related Information**

This database continuously collects related fish information in Taiwan, such as the online Ichthyology English-Chinese Glossary (3,960 terms), pronunciation of 963 Chinese characters with the "fish" radical, new species found in Taiwan, the Erratum of "Fishes of Taiwan," three electronic books, etc (Shen, 1993).



**Figure 4.** The integration of specimen data from seven academic institutions of Taiwan, combining the techniques of GIS Map, Google Map, and Google Earth, allows users to obtain native fish information through 2D and 3D maps.

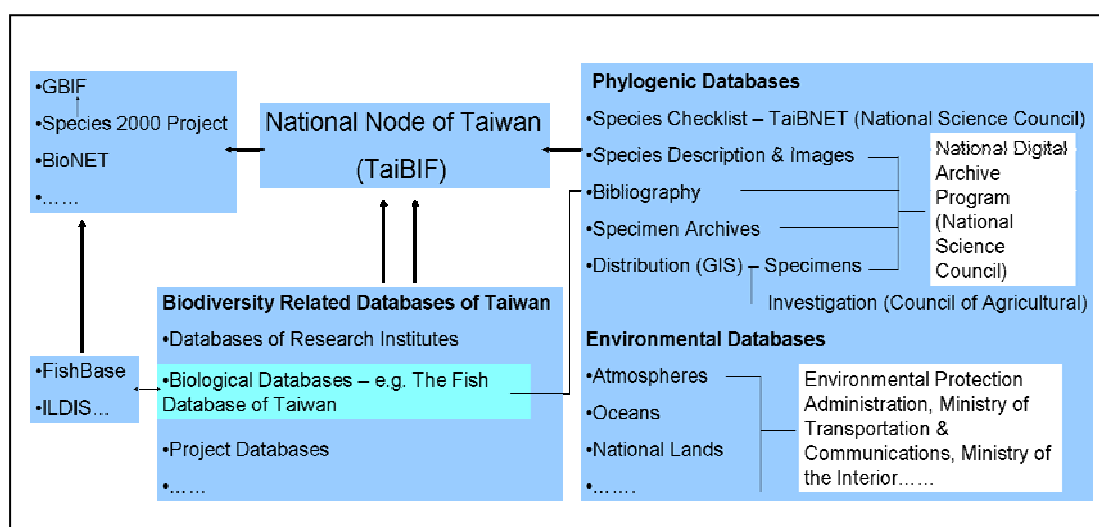
### 3 COOPERATION WITH FISHBASE & INTERNATIONAL PROJECTS

The Fish Database of Taiwan has been established for three main purposes: to provide the most up-to-date results of fish taxonomic studies in order to strengthen information exchange and research cooperation in research communities; to provide ecological data of the aquatic environment for assessment, conservation, exploitation, and management of marine biological resources; and to promote the unification of fish names especially for scientific Chinese fish names and Chinese and English common names.

For a better data sharing service, we currently provide both English and Chinese versions of the query system

for the convenience of academic research and amateurs around the world. The Fish Database of Taiwan can link directly by species to the global fish database, “FishBase” of the WorldFish Center. We have been translating all information about fish into Chinese and have established a mirror site of FishBase in Taiwan, so all Chinese people in the world can easily access all information in the “FishBase” without a language barrier.

The Taiwanese fish species checklist with Chinese common/vernacular names and specimen data has been updated periodically and provided to the global FishBase as well as GBIF through TaiBIF. Thus, Taiwanese fish data can be queried and browsed on the WWW. For contributing the “Barcode of Life” and “All Fishes” international project, alcohol-preserved specimens of more than 1,800 species and cryobanking tissues of 1,347 specimens of 828 species have been accumulated at RCBAS in the past two years (Figure 5).



**Figure 5.** The infrastructure of the international collaboration of the Fish Database of Taiwan.

Through this close collaboration between local and global databases, “The Fish Database of Taiwan” now attracts more than 250 thousands visitors and achieves 5 million hits per month. We believe that this local database is becoming an important resource for education, research, conservation, and sustainable use of fish in Taiwan.

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