

# Underwater Video Digitization Procedures Guideline

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## Acknowledgements

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## Publisher's Preface

After the “National Digital Archives Program” was implemented in 2002, members of numerous institutional projects and request-for-proposals projects joined our team to engage in digital work that covered countless categories and massive amounts of content. The first phase of the five year project was successfully completed in 2006. The following year, the “National Digital Archives Program” and “National Science and Technology Program for e-Learning” were integrated into the “Taiwan e-Learning and Digital Archives Program (TELDAP, <http://teldap.tw/>)”, striving to achieve the ultimate goal of “presenting Taiwan’s cultural and natural diversity” as it continued to expand digital resources in various fields, and systemically promoted digital achievements in education, research and industries. TELDAP is preparing to actively collaborate with the private sector to drive growth in related industries, not only preserving important cultural assets, but also accelerating the development of a new culture in the digital age of today.

Originally named the “Content Development Division” during the first phase, we were renamed “Taiwan Digital Archives Expansion Project” (<http://content.teldap.tw>) as a subproject of TELDAP, and took more active measures to expand the sources of digital content, extending our reach to the collections of private institutions and even individuals. We have widely requested proposals for digitization projects related to archives, archeology, philology, geography, ethnicity, art, daily life, animals and plants, and hope to better integrate digital content with different characteristics, to develop them into fun and inspiring digital materials, and to provide them free of charge to the public for education and research; this will also help firms and public or private holding institutions to find cooperation opportunities in value-added applications. Collaboration between the “Taiwan Digital Archives Expansion Project” and other projects under the “Taiwan e-Learning and Digital Archives Program” will help speed up development of educational, research and commercial value-added applications of digital content, which will benefit the presentation of Taiwan’s cultural and natural diversity, and allow people everywhere around to understand and appreciate the richness of our history and culture, as well as the beauty of our natural ecology.

While collecting and developing value-added applications of digital content, whether it may be during the “Content Development Division” or “Taiwan Digital Archives Expansion Project” period, members of this project have continuously followed up on digital workflow related technologies used by public and private institutions and open request-for-proposals projects, and compiled a series of “Digitization Procedures Guideline Books” that introduce various international standards and provide information on digitization technologies and workflows. Since 2005, we have written 20 digitization procedures guidelines on different themes (the full text of all of the 20 books can be downloaded from the “Taiwan Digital Archives Expansion Project” website under “Digitization Books”), selecting exquisite digital objects, such as ceramics, paintings, calligraphy, and string-bound books, combining the experiences of different institutional projects, and supporting them with domestic and foreign theories and practice results.

Since 2008, we have continuously revised and expanded our “Digitization Procedures Guideline” book series, hoping to expand distribution channels so that

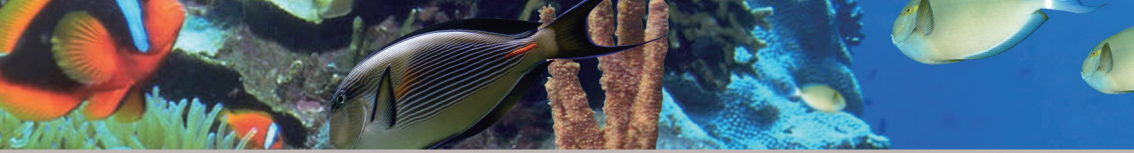


they may be provided to even more museums, libraries, institutions and individuals for reference. Our preparations are mainly divided into revising existing guidelines for “selected objects” and compiling new guidelines on “common principles”. The former refers to revising the existing 20 guidelines with a focus on introducing new digitization technologies and specifications, more practical software and hardware, and digital content protection mechanisms; we expect to complete the publication of all 20 books by the end of this year. As for compiling guidelines on “common principles,” our emphasis will be on the introduction of key concepts, such as the “life cycle” of digital information and quality control, studying multiple types of objects instead of a single type of object, and adopting common principles as the guideline framework. The so called common principles refer to project planning, integrated workflow, audiovisual data, text data, color management, outsourcing management, and digital content protection and authorization. We will investigate, study, and write guidelines for these eight common principles, and expect to complete the publication of all eight guidelines by 2012.

While planning and writing guidelines for selected objects and guidelines on common principles, we set a complementing relationship for them. Guidelines on common principles emphasize on the analysis of important topics in digitization work, guiding readers to thoroughly consider the advantages and disadvantages of digitization. Guidelines on selected objects describe practices and techniques for digitizing specific objects, helping readers to select the most suitable, most effective digitization workflow. By publishing this “Digitization Procedures Guideline” book series, we believe that we are providing institutions and individuals with the intention to engage in digitization work with a series of practical guidelines that provide an overall view, while guiding them step by step through the digital workflow. Here we must stress that the theoretical foundation of this book series is the precious experiences of institutional and request-for-proposal project teams accumulated throughout the years. These experiences allow higher quality digital content to be produced, presented and maintained with less cost, further enriching our digital archives and e-learning content. As we continue to publish our “Digitization Procedures Guideline” book series, we must give special thanks to working partners who were interviewed and colleagues who were a part of writing the guidelines, and are grateful to the scholars and specialists that reviewed and provided their advice on the book series. Finally, we hope that readers will not be reluctant to correct any mistakes or make recommendations that will help us be even better.

Taiwan e-Learning and Digital Archives Program  
Taiwan Digital Archives Expansion Project  
Digital Archives Sub-project of Project Integration

Project Director  
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# One. Introduction

Most people are probably familiar with the Discovery Channel, which contains science, history, culture, nature, technology and adventure. Aside from natural ecology, the Discovery Channel launched a new program called Animal Planet, which provides knowledge on animals and communicates the importance of ecological protection in a relaxed way, not only serving entertainment purposes, but also educational functions.

In the case of Taiwan's fish species, there are currently research records of over 3,000 species, but most are specimen and appearance description records, less than one third of fish species are recorded using ecological photos and videos, and records of many rare fish species can only be found by chance, not effort. Now that the natural habitat of these organisms is being polluted and destroyed, even common fish species are becoming rare. Therefore, it is necessary to actively record information of Taiwan's fish species.<sup>1</sup>

There is a group of people quietly but diligently researching Taiwan's ecology and nature. Their enthusiasm does not fall behind the Discovery Channel as they go up mountains and out to sea to preserve the diverse appearance of our natural environment, using video cameras, audio recorders and cameras to record the beautiful appearance of insects, fish, birds, animals, flowers, plants and trees in Taiwan. These records are shared via the internet for others use in learning and studying growth; they are no longer limited by old standards, and have become more diverse and popular.

The "Taiwan Digital Archives Expansion Project" under the Taiwan e-Learning and Digital Archives Program divides research results of domestic academic institutions into 6 thematic groups,<sup>2</sup> in which the "Biosphere and Natural Thematic Group" has gained remarkable results with the efforts of its fauna, flora and geology teams. The teams have not only accumulated immense digitization results, but are also actively searching for integration methods that accelerate data exchange and provide more convenient user access.

Ecological photography is a unique link in the digitization of biological collections. Ecological data, such as birds singing in the woods, fish swimming

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<sup>1</sup>"Introduction to the Taiwan Fish Ecology Image Gallery," The Fish Database of Taiwan, Search: December 22nd, 2009, <http://fishdb.sinica.edu.tw/chi/gallery.php>.

<sup>2</sup>Originally the "National Digital Archives Program" in 2002-2007, the program was integrated with the "National Science and Technology Program for e-Learning" in 2008 and renamed "Taiwan e-Learning and Digital Archives Program." TELDAP consists of eight divisions, separately responsible for contents, technology, industry, academic education, international cooperation...etc.



in the ocean, small animals running and jumping, and the natural habitat of animals, are not only an important foundation for academic research, but also arouse interest in learning and deepen users' impression through videos and sound. Therefore, many scholars have lent the aid of professional photographers for recording clear images or sound, and have uploaded the files to satisfy both research requirements and knowledge popularization.

Generally speaking, ecological photography can either be still images captured by camera or videos recorded by video camera. Besides some artistic creations, the main purpose of these images or videos is to record activities of organisms in nature. The thesis "A Study on the Environmental Education Function of Teaching Media – Using Natural Ecology Videos as an Example" mentions: ".....to summarize the opinions of scholars and experts, ecological videos convey the interaction between organisms in nature, and mainly serve teaching or scientific research purposes. In terms of photography themes, there isn't much difference between natural photography and ecological photography....."<sup>3</sup> In the book "Natural Photography" by the Chinese Society of Natural Photography, themes include natural landscape (landscape, mountains, snowy areas, sky, astronomy), fauna and flora (plants, flowers, birds, insects, micro organisms), and underwater photography (marine ecology, lotic ecology).

Different photography equipment is used for filming ecological videos under different environmental conditions, and there are different requirements for each condition. Underwater videos are relatively simple because they only require video and not audio. For this reason this guideline first introduces underwater video, hoping to help units or divers that intend to film underwater videos gain a basic understanding of how to plan and implement ecological video digitization, as well as purchase equipment. We hope that this book will help save time and money spent on trial and error, and that contents on video digitization can serve as reference for workers also engaged in video recording.

At present, members of the Biosphere and Natural Thematic Group already engaged in underwater video filming include the "Inventory Studies of Taiwan Fauna: Digital Archives of Fish from Taiwan" of the Biodiversity Research

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<sup>3</sup>"A Study on the Environmental Education Function of Teaching Media – Using Natural Ecology Videos as an Example," Thesis of Yen Li-Ting at the Graduate Institute of Environmental Education, 1997.

Center, Academia Sinica, “Digital Archives of Freshwater Organisms of Taiwan” of the Department of Life Science, National Tsing Hua University and “The Digital Collection Study of Fish Specimens and Natural Habitat Records of Fishes in National Taiwan Ocean University” of the Institute of Marine Biology, National Taiwan Ocean University. This guideline introduces underwater video digitization based on the experiences of these units and related books.



## Two. Digitization Flowchart

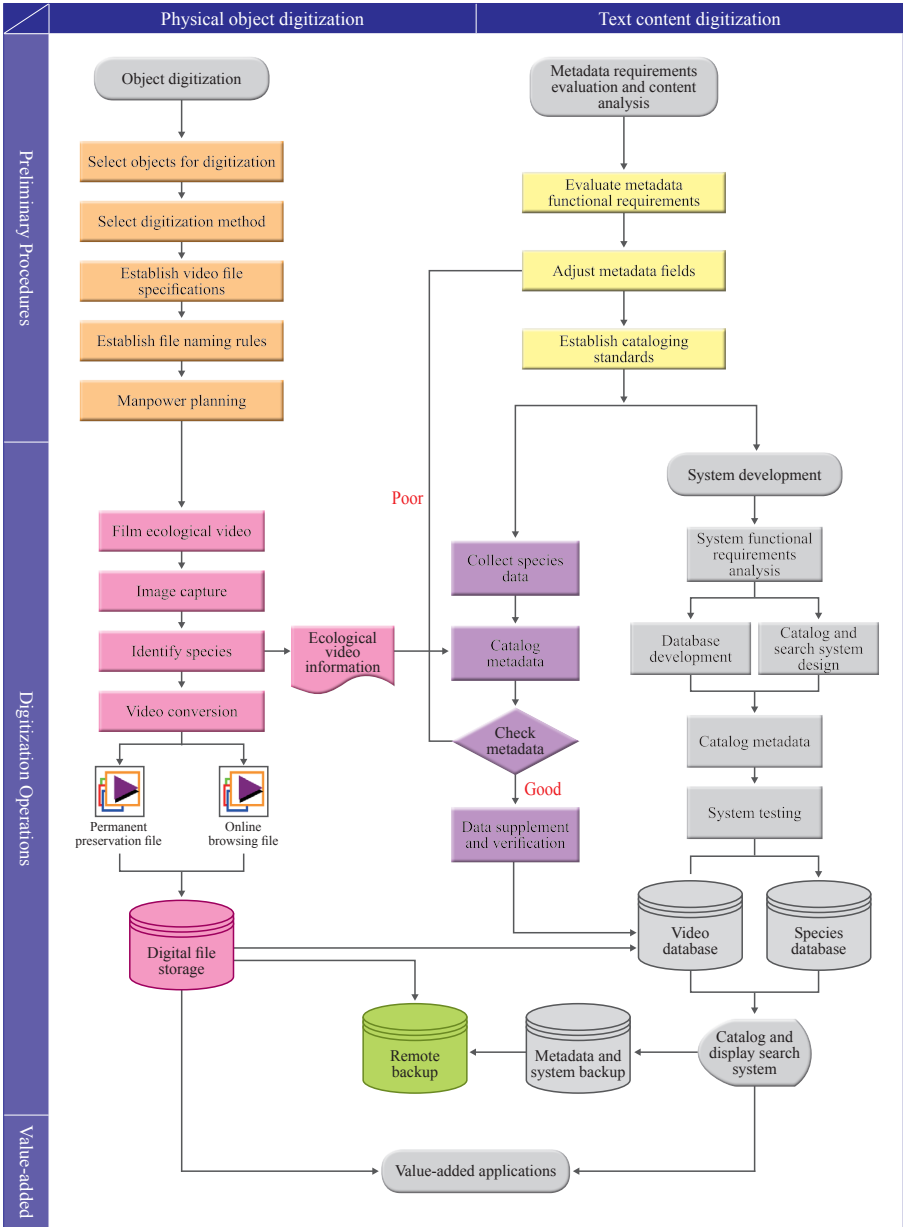


Figure 2-1 Underwater video digitization flowchart



### **Three. Preliminary Procedures**

Project planning is a constraint in project implementation, but it is this constraint that allows details to be effectively controlled and results to be output efficiently. Before formally implementing digitization operations, it is necessary to first understand the purpose of digitization and the quantity and characteristics of objects so that suitable formats and digitization methods and equipment may be selected. This is crucial to the quality and benefits of digitization results.

## **I. Digitization Goal Setting and Object Selection**

Due to the great variety of aquatic organisms, effects of weather and season, changes or destruction of the ecological environment, there is no way to predict what types of organisms will be recorded each time personnel go into the water. Underwater it is even harder to film the required species due to the limited recording time. These factors are all key considerations for goal setting and object selection. Before going into the water we recommend that units first understand which species may appear under the current conditions, and that personnel try their best to record all of those species when they are underwater.

Object digitization is followed by website construction and value-added applications. Goals should also be set for these stages in advance, and suitable operating procedures and implementation methods planned accordingly.

## **II. Digitization Method Selection**

Plan and select suitable digitization methods after digitization goal-setting.

### **(I) Equipment**

Video cameras used to film ecological videos are divided into traditional video cameras (e.g. V8 and Hi-8) and digital video cameras (e.g. D8 and DV). Traditional video cameras are not as convenient, compatible and operable as digital video cameras, and if the videos are to be played on the internet, conversion of analog video recorded by traditional video cameras is more complicated. Therefore, we recommend directly using a digital video camera for filming ecological videos because it will accelerate subsequent processing time.

Table 3-1 Comparison of digital video camera and traditional video camera

Digital Video Camera	Traditional Video Camera
Small and light	Large and heavy
<ol style="list-style-type: none"> <li>One DV tape can record 60 minutes (SP mode) or 90 minutes (LP mode)<sup>4</sup>; tapes are relatively small</li> <li>Hard disk or memory card DV cameras are able to record longer videos non-stop compared with DV tapes. A DV camera with a 120GB hard disk can record 14.5 hours of Full HD video.</li> </ol>	One tape can record 60 or 120 minutes; tapes are relatively large
Digital recording method	Non-digital recording method
Able to record motion pictures and photograph still images	Only able to record motion pictures
The video camera already has numerous functions and special effects that can help users record high quality videos.	Hard to learn. Only experienced photographers are able to film high quality motion pictures
Transmitted via IEEE 1394 or USB	Transmitted via an AV terminal or S-terminal, so video information is easily lost
Distortion does not easily occur in the transmission process	Distortion can easily occur in the transmission process
IEEE1394 or USB is cheap and popular	High definition transmission lines are relatively expensive
Digital files are easy to preserve and edit.	Traditional tapes are easily damaged by moisture or after long time.

Source: VideoStudio Operation Manual,<sup>5</sup> revised by Taiwan Digital Archives Expansion Project

D8 is a video camera with both digital and analog modes, and is compatible with V8 and Hi-8 tapes, making it very popular when it was first launched. However, DV cameras are now the mainstream as new technologies have been developed to produce better quality videos; DV cameras with hard disks or memory cards gradually replaced those using tapes, and are able to record images in 1920×1080dpi. Therefore, this guideline mainly introduces how to implement digitization using DV cameras. Considerations as to purchasing DV cameras are described more in detail in a subsequent chapter.

<sup>4</sup> SP mode refers to standard time, while LP mode can record 1.5 times longer than SP mode. Therefore, if a DV tape can record 60 minutes of video, then it will be able to record 90 minutes of video in LP mode.

<sup>5</sup> “VideoStudio Operation Manual,” Search: December 22<sup>nd</sup>, 2009, <http://student.spjh.tp.edu.tw/computer-center/%E7%A0%94%E7%BF%92%E8%AC%9B%E7%BE%A9%E8%81%B2%E5%BD%B15.doc>.

## **(II) Implementation Method and Manpower Arrangements**

Underwater videos are recorded under much tougher conditions than other types of digitization objects. At present, not many academic institutions or business units are engaged in such work. Institutions under the National Digital Archives Program have all purchased their own photography equipment, but still require personnel with a professional background and diving skills to handle video recording, organize data and convert digital files. This shows the importance of personnel training, a relatively time consuming task.

An alternative is outsourcing, and according to Mr. Kuo Tao-Jen, person in charge of the Love Sea Diving Station, there are only two or three professional photographers engaged in underwater photography, so their schedules might not be able to meet requirements of digitization projects. Furthermore, as mentioned above, there are many situations underwater that cannot be predicted, consensus building in planning is extremely important, otherwise ecological videos filmed under inappropriate limitations might be too far from expectations for adequate viewing. Outsourcing projects usually plan specific targets over a certain time period, e.g. diving times, hours of video, number of fish species, and length of video for each fish species.

Although institutions have different administrative systems, funding and human resources, manpower arrangements can be based on the following two categories:

1. Staff members: Researchers or assistants should be familiar with the institution's digital file management, and have related professional knowledge to more effectively implement digitization operations; they are especially beneficial to preliminary procedures and metadata planning.
2. External personnel:
  - (1) Technician: Mainly refers to people with an expertise in digitization technology or information technology, e.g. professional photographers, database and web designers.
  - (2) Cataloging personnel: After the database is completed, data has to be keyed into the system one by one. This task can be executed by staff members or additionally recruited personnel with related backgrounds.



Photographers require professional knowledge, e.g. identify species, categories and habitual behavior, to film ecological videos. They also need a diving license and underwater photography skills to film underwater videos.

### (III) Establishing Video File Specifications

Purposes of digital files are generally preservation, display and application, and video file specifications should be planned accordingly. A few video formats currently in use are introduced below:

#### 1. Video System Specifications

Video system specifications (or television system) are mainly specifications for transmission and video equipment, such as broadcasting stations, television sets and video recorders/players. There are currently three analog video system specifications, namely NTSC (National Television Standards Committee), PAL (Phase Alternation Line) and SECAM (Sequentual Couleur Avec Memoire), in which Taiwan, U.S.A., Canada, Japan and Korea use NTSC (Table 3-2). In addition, video equipment and software that use different specifications are incompatible, and should be noticed when purchasing equipment or converting digital files.

Table 3-2 Format of three video systems

Format	Horizontal Scanning Lines	Frames Per Second (fps)	Area
NTSC	525	30 (29.97)	U.S.A., Canada, Japan, Korea, Taiwan
PAL	625	25	Europe, Australia, Brazil, China, Hong Kong
SECAM	625	25	France

#### 2. Video File Format

Videos are either captured from a DV tape into the computer, or directly recorded into a digital file using a hard disk DV camera. If the source digital file is stored in an uncompressed format, no distortion will occur when it is converted in the future. However, using a tape DV camera as an example, one second of video in NTSC format with 29.97 fps takes roughly 20MB of storage space, meaning that a 60 minute tape will require roughly 70GB of space when converted into a digital file,

forcing project units to directly face the issue of storage space.

Many video compression technologies have been developed to gain smaller files without damaging the quality of the original video file, thus benefiting its storage or dissemination; the quality of the video is decided by the CODEC (compression and decompression)<sup>6</sup> and compression ratio. At present, common video file compression formats include MPEG, AVI and H.264; each format is briefly introduced below:

- (1) MPEG (Motion Picture Experts Group): This compression technology was developed for motion pictures and is further divided into MPEG-1, MPEG-2 and MPEG-4.
  - a. MPEG-1: This is the standard used by VCDs in the past. It has a resolution of 352×240 pixels and transmission rate of 1.5Mbps.
  - b. MPEG-2: This is the standard used by DVDs and High-Definition TV (HDTV). It has a resolution of 720×480 pixels and transmission rate of 3~10Mbps.
  - c. MPEG-4: The main advantage of this standard is that the compressed video has a resolution and quality equal to MPEG-2. It is mainly used for mobile applications and online videos and has a transmission rate of 28~384Kbps.
- (2) AVI (Audio Video Interface): This file format was developed by Microsoft, and has the best compatibility among all file formats, but the downside is that its files are all extremely large. Compression formats that it can choose from include Microsoft's Video1 and RLE and Intel's Indeo Video, IndeoR and DivX.<sup>7</sup>
- (3) H.264: This is a new standard of high definition digital videos. At present, many computers without hardware decoders are unable to smoothly play Full HD videos of DV cameras. The videos can be compressed into very small video files using the H.264 compression standard without losing video quality. For example,

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<sup>6</sup>Most CODECs require dedicated decoders in order to be normally played on the computer, or else there might only be sound but no image. There are also different compression methods for audio and also require corresponding decoders to be normally played, or else there might only be image but no sound.

<sup>7</sup>Refers to AVI video files created using DivX MPEG-4 coding, in which the video is in MPEG-4 format and audio is in MP3 format. Image quality is almost comparable to DVD and has small file size, but currently can only be viewed on computers and requires a dedicated decoder.

a 4.5GB DVD can only store roughly 2 hours of MPEG-2 video, but can store up to 4 hours of H.264 video while retaining its high definition.

Streaming technology is required to smoothly play videos online; video data is transferred in segments to the user, so the user doesn't need to download the entire video and can watch it while downloading it.

The three streaming media platforms – Real Networks, Microsoft and Apple have developed their own streaming formats and technology (Table 3-3). In terms of video, common formats on the internet include \*.rm, \*.asf and \*.wmv.

Table 3-3 Streaming video format of three platforms

Streaming Media Platform	Real Networks	Microsoft	Apple
File formats	<ol style="list-style-type: none"> <li>1. Real Audio File, *.ra</li> <li>2. Real Media File, *.rm</li> <li>3. Real Media File Variable Bit Rate, *.rmvb<sup>8</sup></li> <li>4. Real Picture File, *.rp</li> <li>5. Real Text File, *.rt</li> </ol>	<ol style="list-style-type: none"> <li>1. Advance Streaming Format, *.asf</li> <li>2. Advance Streaming Extend File, *.asx</li> <li>3. Windows Media Audio File, *.wma</li> <li>4. Windows Media Video File, *.wmv</li> </ol>	<ol style="list-style-type: none"> <li>1. QuickTime Movie File, *.mov</li> </ol>

The streaming format selected here requires a corresponding video database platform system. Adobe Systems developed the streaming media format – Flash Video (\*.flv) to make up for the disadvantage of files that are too large for circulation via the internet when video data is put into Flash. At the same time, its technology protects video files from being downloaded, a number of well known video sharing websites, including Youtube, Google Video, Yahoo! Video and MySpace all use this format.<sup>9</sup>

In 2005, the project invited Professor Li Tao-Ming of the video archive team of the “Digital Museum of Taiwan’s Humanities and

<sup>8</sup> RMVB was derived from RM, in which the VB represents Variable Bit Rate, and significantly reduces the video size by sacrificing a portion of video quality that is hard to detect; retains audiovisual data with near DVD quality.

<sup>9</sup> “Flash Video,” Wikipedia, Search: December 15<sup>th</sup>, 2009, [http://zh.wikipedia.org/w/index.php?title=Flash\\_Video&oldid=11676387](http://zh.wikipedia.org/w/index.php?title=Flash_Video&oldid=11676387).

Social Video Archive Project” to serve as convener of the videography team. The digital video file specifications he planned based on past experiences (Table 3-4) can serve as reference for project units.

Table 3-4 Digital video file specifications

Purpose	File Specifications
Permanent preservation	File format: MPEG-2 Image size: 720*480 pixels Dual channel audio decoder Data transmission rate: 8Mb/sec
Streaming video (Internet browsing)	File format: WMV Image size: 320*240 pixels Data transmission rate: 150-300kbps File time: 1-5 minutes or complete (displays a representative frame)

Source: Videography Team Digitization Workflow, Academia Sinica Institute of Ethnology Digital Archives of Formosan Aborigines, page 61

Although current DV cameras are able to film Full HD videos, which can be stored on Blu-ray discs, there still aren’t many options in terms of software and hardware equipment, such as Blu-ray recorders, and they are all very high priced. For this reason, such equipment still isn’t very popular, and the Philology, Videography and Journalism Thematic Group of TELDAP haven’t planned incorporating related specifications. Therefore, units can select the specifications listed above based on their own work conditions.

#### (IV) File Naming Principles

After referring to the file naming principles of the “National Repository of Culture Heritage<sup>10</sup>,” there are two matters that require special attention – “File Management” and “Computer System Restrictions.”

##### 1. File Management:

In order to implement effective file management, even allowing file contents to be determined from the filename, the following principles can be used for planning filenames:

<sup>10</sup>“Digital File Naming Principles of the National Repository of Culture Heritage,” National Repository of Culture Heritage Knowledge Management System, Search: December 22<sup>nd</sup>, 2009, [http://km.cca.gov.tw/download/數位檔案命名原則\\_v20\(20040608\).pdf](http://km.cca.gov.tw/download/數位檔案命名原則_v20(20040608).pdf).

- (1) The filename should allow the unit that provided the data to be identified, e.g. use the abbreviation of the unit.
- (2) The naming method should support multiple file formats and purposes of the same object. For example, if a video has two purposes – permanent preservation and internet browsing, it will be stored in two different file formats. Besides different file extensions, one English letter can be added at the end of the filename to represent the purpose of the file.
- (3) Each filename should be unique in the entire system.
- (4) The filename should be combined with metadata. If the ecological video is integrated with a species database, then the filename should be planned along with the entire species database.

## **2. Computer System Restrictions:**

Digital files must be accessed through a computer system, so the computer system's restrictions must be considered when planning filenames. These restrictions generally include the following rules:

- (1) Use ASCII code.
- (2) Filenames should consist of half-width lowercase English letters and digits. Chinese characters or full-width letters must not be used due to coding issues, or an error might occur when displaying the filename online.
- (3) Each operating system has its own unique naming rules. In addition to the 5 rules listed below, avoid using characters or filenames that are not permitted. Basically, filenames must not contain the following characters: / \ : \* ? " ' < > | ! @ # \$ % ^ & ( ) + = { } [ ] , .

Table 3-5 Naming rules of different operating systemsTP

	DOS and Windows 3.1	Windows 95/98/Me/XP/NT/2000	Mac OS (Standard)	UNIX/Linux
Maximum length of filename	Filename must not exceed 8 characters with a 3 character file extension	The filename and file extension must not exceed 255 characters	1-31 Characters	14-256 Characters (depends on the UNIX/Linux version), includes file extension of any length
Are blanks permitted	No	Yes	Yes	No
Are digits permitted	Yes	Yes	Yes	Yes
Characters not permitted	*/[ ] ; ' = \ : ,   ?	* / < > " \ :   ?	:	* ! @ # \$ % ^ & ( ) { } [ ] ' ` ? ; < >
Filenames not permitted	Aux, Com1, Com2, Com3, Com4, Con, Lpt1, Lpt2, Lpt3, Prn, Nul	Aux, Com1, Com2, Com3, Com4, Con, Lpt1, Lpt2, Lpt3, Prn, Nul	All filenames are allowed	Depends on the UNIX/Linux version
Are uppercase and lowercase different	No	No	No	Yes (use lowercase letters)

Source: Computer Concepts, Parsons, June Jamrich, Oja, Dan, page 4-4.

Using ecological videos produced by the Biodiversity Research Center, Academia Sinica as an example, the filename can start with “as” to stand for “Academia Sinica” followed by “brc” to stand for “Biodiversity Research Center.” If the ecological video was produced by a specific unit in the Biodiversity Research Center, then the unit’s number or abbreviation can be added after the “brc.”

Next is the files serial number. Use English letters, such as “u” or “t,” to represent whether the file is for permanent preservation or online browsing, and use “-” in between different parts of the filename. Therefore, a complete filename should look like asbrc-00001-u.mpg or asbrc-00001-t.wav. However, adding “-” is not entirely necessary, and all parts of the filename can be linked together, e.g. asbrc00001u.mpg or asbrc00001t.wav.

The above uses a simple example to explain file naming. However, units must make proper plans based on their own data.



## Four. Object Digitization Procedures

## I. Filming Underwater Videos

Photography equipment used underwater is not very different from that used on land, but is not as convenient to operate and produces poorer image definition. Pay attention to the following matters to film videos as clear as possible:

### (I) Photography Environment Survey

Whether you are diving or scuba diving in the ocean or river, there are many factors that affect the filming of underwater videos, including weather, terrain, water flow, water temperature and pollution. Therefore, it is necessary to first conduct a survey of the area, weather, sea conditions or river conditions to ensure work safety when filming underwater videos.

### (II) Light and Color Temperature

Only a portion of light above ground enters the water because some of it is reflected,<sup>11</sup> ripples further weaken the brightness and greatly lower visibility underwater. The spectrum underwater is somewhat different from on the ground, as water becomes deeper, some wavelengths of light disappear, which is why the ocean always looks bluish (Figure 4-1).<sup>12</sup> Therefore, an artificial light source is required for filming underwater videos; proper distance must be maintained with the fish being filmed to avoid scaring it, but not over two meters to avoid filming a video that is not clear enough. It is best to film underwater videos between 10:00A.M and 2:00P.M, when the sunlight is strongest and can directly reach the ocean bottom (10m~20m). Of course, the time should be adjusted according to the species' habitual behavior.

### (III) Suspended Particles in Water

Water has higher density and floating power than air, making it easy for small particles to be suspended in it. When natural light or the photography light reflects of the suspended particles, it causes the image to become foggy, so it is best to move less or move slowly to avoid raising the sand and come as close to the fish as possible to make the image clearer.

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<sup>11</sup> Depending on the angle that sunlight shines on the ocean surface, roughly 3~30% may be reflected.

<sup>12</sup> Red light gradually disappears at 5 meters below surface, yellow light gradually disappears at 18 meters below surface, and green light disappears at 21 meters below surface.



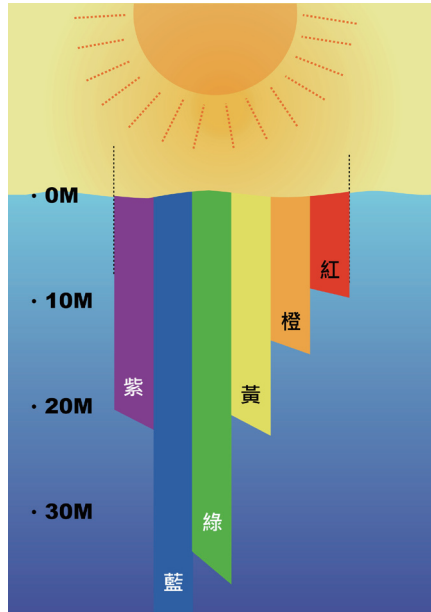


Figure 4-1 Water depth and light absorption

Source: “5つのポイントでマスター！デジカメダイバー上達BOOK 2008,”  
水中造型センター-Editorial Department, 2008 page 95.

#### (IV) Stability Control

Filming underwater is not like filming on the ground where a tripod can be used to fix the video camera. Waves, buoyancy and current can easily cause personnel to shake the video camera, so besides extending both arms straight forward when operating the video camera, personnel’s diving skill should be well practiced.

#### (V) Recording Time

Current hard disk DV cameras can record longer videos compared with tape DV cameras, which were only able to record 60~90 minutes (a DV camera with a 120GB hard disk can record up to 14.5 hours of video). However, since photography equipment can only be replaced at the surface and due to diving time limit, sea conditions and river conditions, personnel should gather as much data as possible once they are in the water, no matter what type of DV camera they are using. The videos can be edited later on.

## **(VI) Other**

Avoid gathering specimens and conducting ecological observations at the same time and place. This is to prevent inaccuracy in ecological observation results. After filming underwater videos, the video camera should be immediately immersed in clean water to prevent the equipment from being eroded by salt water.

## **II. Video Capture**

Since hard disk or memory card DV cameras are currently the mainstream, the following section will introduce video capture for not only tape DV cameras, but also new hard disk DV cameras.

### **(I) DV Tape Capture**

Before rewinding the video tapes after filming underwater videos, make a preliminary record of the location and time labeled on each tape for future preservation and management purposes. Next, connect the video camera to the digital video capture card or IEEE 1394 interface card<sup>13</sup> of the computer to capture the video.

There are two ways to capture the video, the first is to capture the entire tape into the hard disk, and then edit out the parts required; this method requires larger storage space and will take longer to convert the file into the permanent preservation format. This method is only recommended if it was planned during preliminary procedures.

The second way is to preserve the original DV tape and capture only the required sections of the video. This method requires the time code of the video and can be completed using the batch capture function of PowerDirector or Adobe Premiere (Figure 4-2).

After capturing the video, use Adobe Premiere or similar software to output a frame that best represents the video for the playlist that will be put online (Figure 4-3).

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<sup>13</sup> If you are using a traditional video camera, the video capture card has an analog capture function that captures the video into the computer via an AV terminal or S terminal.

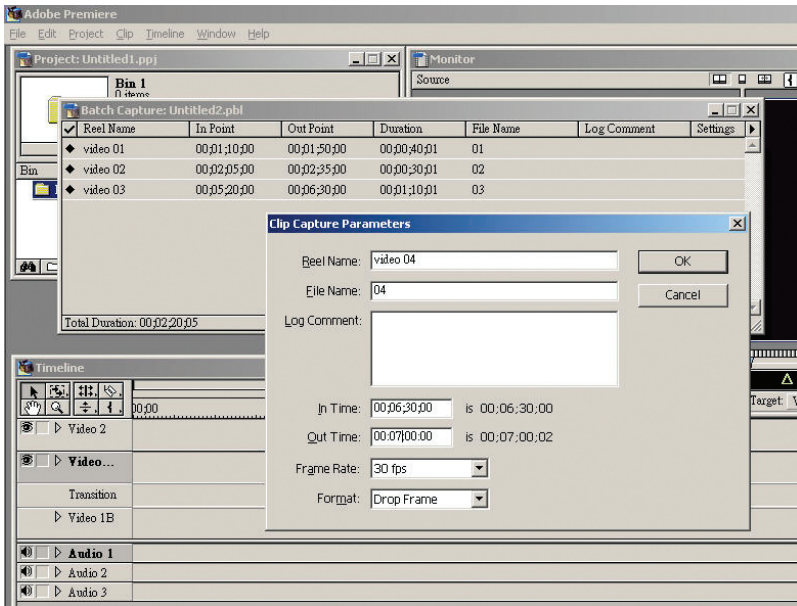


Figure 4-2 Adobe Premiere batch capture window

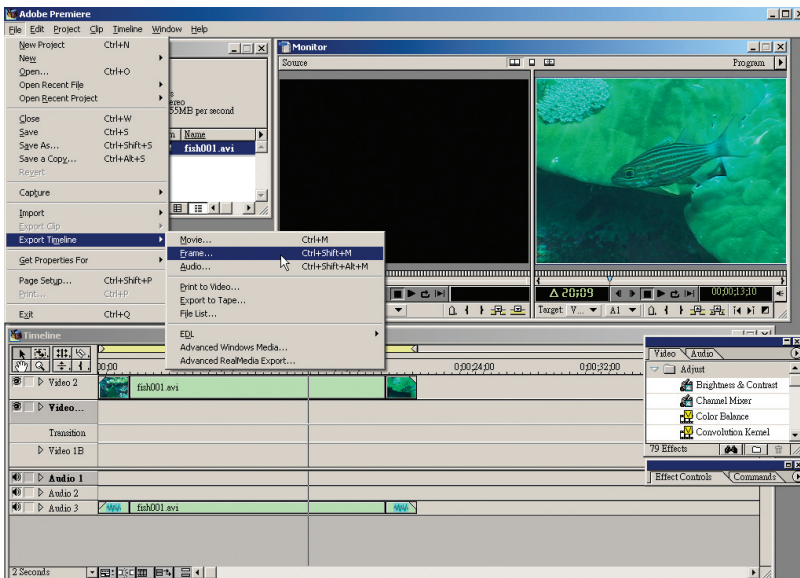


Figure 4-3 Adobe Premiere frame conversion function

Furthermore, an expert in hydrobiology is required while examining videos to keep records, these will be used for metadata establishment in the future.

## **(II) Hard Disk DV Camera Video Capture**

The main advantage of hard disk or memory card DV cameras is that videos are directly saved as MTS files, these can be copied to the computer via a USB cable, offering greater convenience and taking less time. In addition, many video camera manufacturers adopt AVCHD technology for video storage, reducing the size of video files by 50%, even a complete video takes less space than a 60 minute DV tape, making it into a good option for source file backup.

## **III. Video Converter**

Generally speaking, videos have two purposes – permanent preservation and online display. Therefore, videos need to be compressed and converted into different file formats using additional software. Below is an introduction to video file digitization, DV file conversion, and hard disk (or memory card) DV camera operating procedures planned by the Philology, Videography and Journalism Thematic Group of Taiwan Digital Archives Expansion Project.

### **(I) DV File Conversion**

1. MPEG-2: Besides the MPEG format hardware compression function<sup>14</sup> of video capture cards, this guideline introduces how to use CyberLink's PowerDirector for software compression and file conversion.
  - (1) Execute PowerDirector Express, select "File" / "Import" / "Media File," select the folder where videos are stored and then import the file (Figure 4-4)
  - (2) Drag the imported file down to the timeline in the lower half of the screen (Figure 4-5), right click on the image file under the timeline, and then select mute to remove sounds recorded in the video<sup>15</sup> (Figure 4-6).

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<sup>14</sup>Hardware compression is when video is compressed by the video capture card before becoming a digital file. This retains image quality and compression speed is not affected by computer.

<sup>15</sup>Besides sounds made by some fish, underwater videos generally do not include sounds that were recorded as a part of post-processing.



Figure 4-4

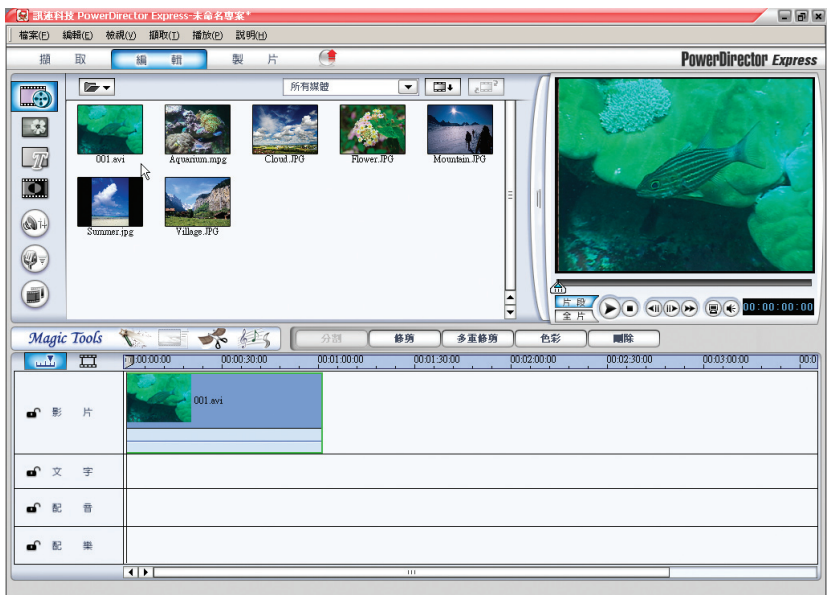


Figure 4-5

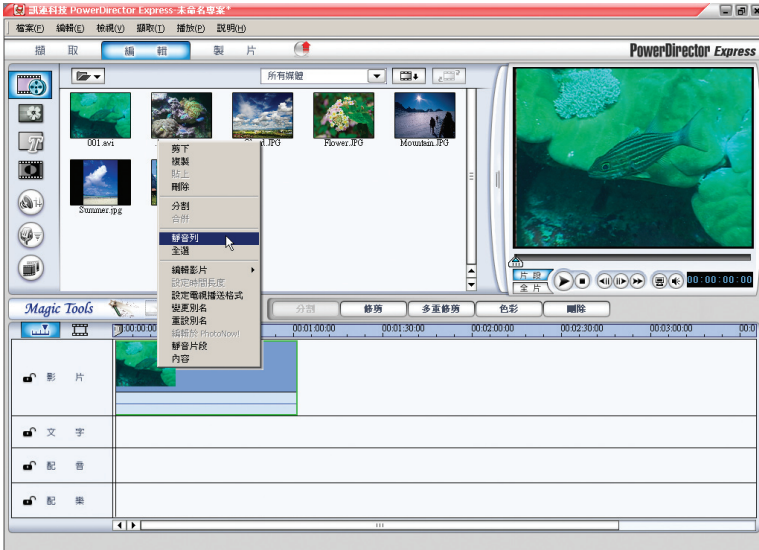


Figure 4-6

(3) Next, select, “Produce” / “Create File,” and then click on “Next” (Figure 4-7).

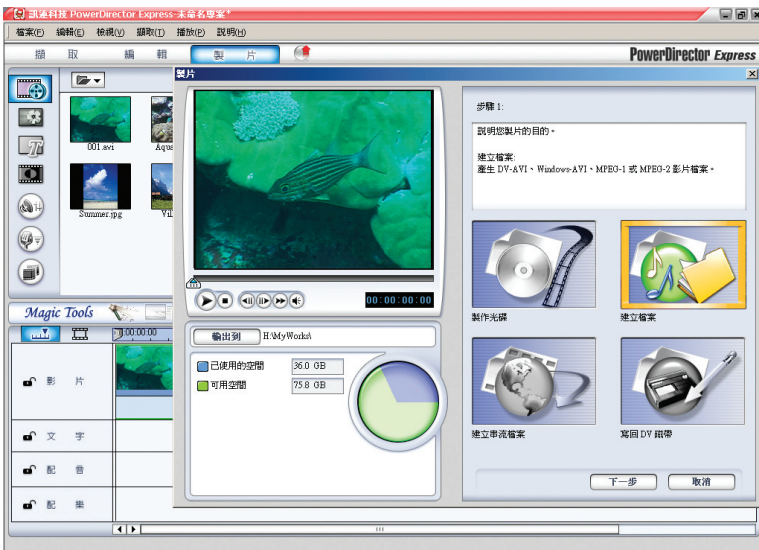


Figure 4-7

- (4) Select “MPEG-2” and select “Taiwan (NTSC)” under “Disc area/ Video Format.” For the template select “Default” and “HQ DVD NTSC” to create a 8Mbps high quality MPEG-2 file (Figure 4-8).

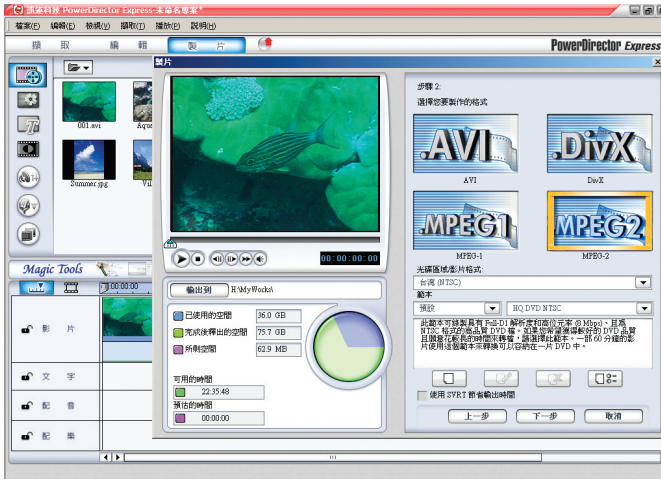


Figure 4-8

- (5) After verifying the files that were configured are correct, select the path and key in the filename to begin file conversion (Figure 4-9).

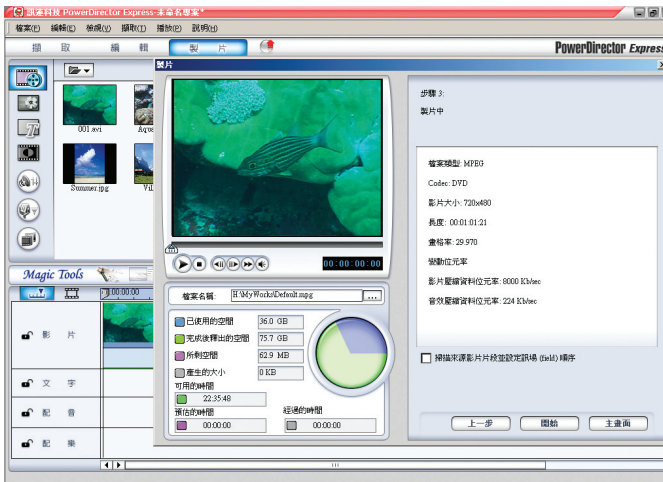


Figure 4-9

The software and file conversion method described above does not allow detailed adjustment of video format settings. Should the need arise, consider using professional audiovisual editing software, such as Adobe Premiere.

2. WMV: To convert into a WMV file, use the Windows Media Editor of Microsoft.

(1) Execute Windows Media Editor and select “File Conversion” (Figure 4-10).

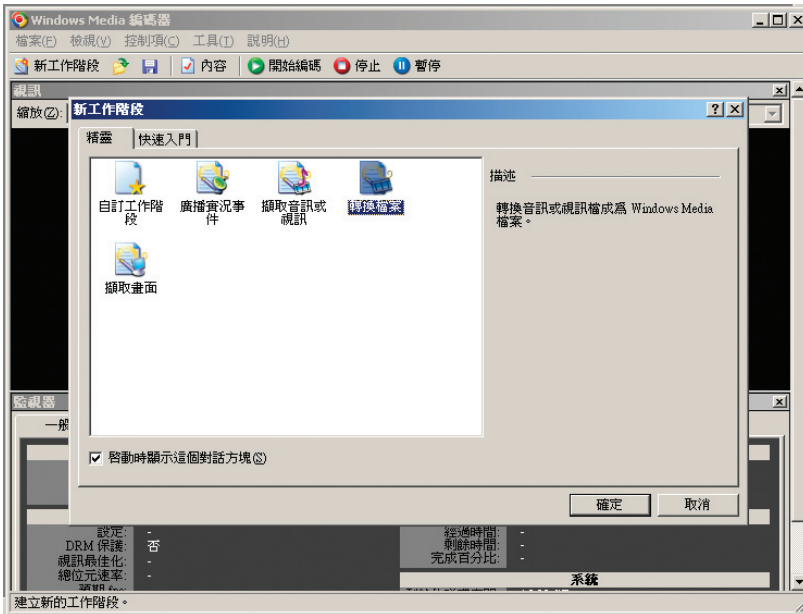


Figure 4-10

(2) Select the path of the source file and the output file field will automatically name the file according to the source file. Users can adjust the filename and path as they wish. After completing settings, click on “Next” (Figure 4-11).

(3) When asked to select the form that the file should be output, select “Windows Media Server (Streaming)” (Figure 4-12).



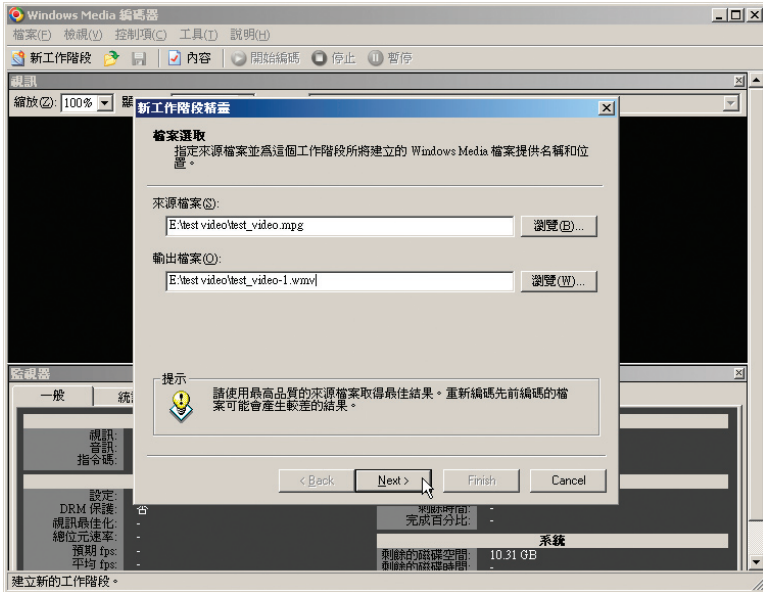


Figure 4-11

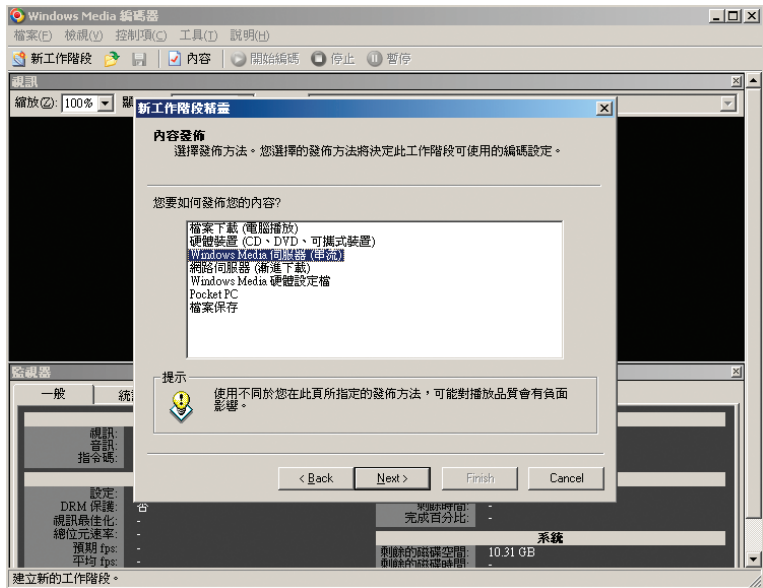


Figure 4-12

(4) Next, select a compression format for the streaming file. Basically, the default values of video and audio parts are kept the same and the “bit rate” is adjusted. Bit rate affects the quality of the compressed video and its file size; of course higher bit rate produces higher quality videos, but will result in latency if users don’t have enough bandwidth. Videos can be set with multiple bit rates by selecting more than one “rate” / “bit rate.” The file format planned by the videography team has a data transfer rate of 150-300kbps, so all bit rates within this range can be selected (Figure 4-13).

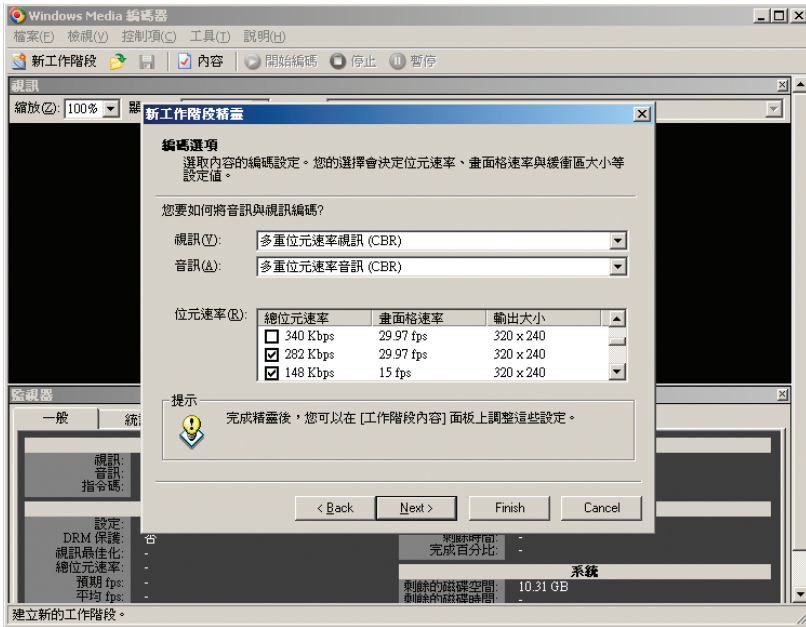


Figure 4-13

(5) After completing configurations, click on “Finish” to enter the file conversion window (Figure 4-14, Figure 4-15).



Figure 4-14

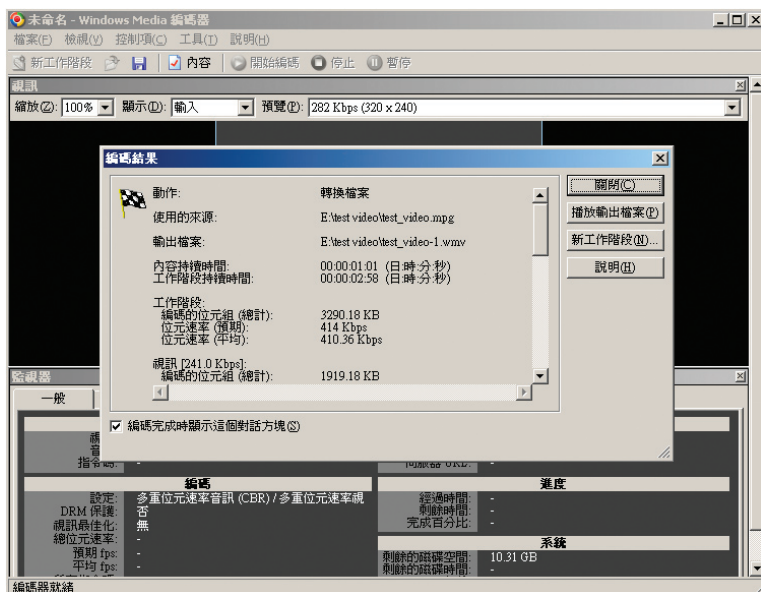


Figure 4-15

## **(II) Video File Conversion of Hard Disk DV Cameras**

Videos recorded by hard disk DV cameras are directly stored as digital files, so they can be edited and converted once the software is installed. However, video files stored by such DV cameras are in MTS format instead of the common AVI or MPEG format, not many applications are currently able to read MTS files, so in addition to the software that came with the video camera, also determine if the software you are purchasing can read HD video files.

## **IV. Video Quality Evaluation**

Besides controlling the consistency, integrity and reliability of the digitization process via a project, digital data that is produced should be evaluated, including verifying that the video contains the required species, that the image is clear and if it is cut, and if the video truly represents the original content.

## **V. Storage and Backup**

To prevent digital files from being damaged or lost due to artificial or natural causes, it is very important to backup files that are stored in the operating computer after naming them according to the file naming principles. Current backup methods include “different storage media,” “set up a PC cluster” and “remote backup,” each has its advantages and disadvantages (Table 4-1)<sup>16</sup> Repositories can choose one or multiple backup methods based on their data type, backup speed and data quantity. Naturally, the more methods that are used the higher the cost.

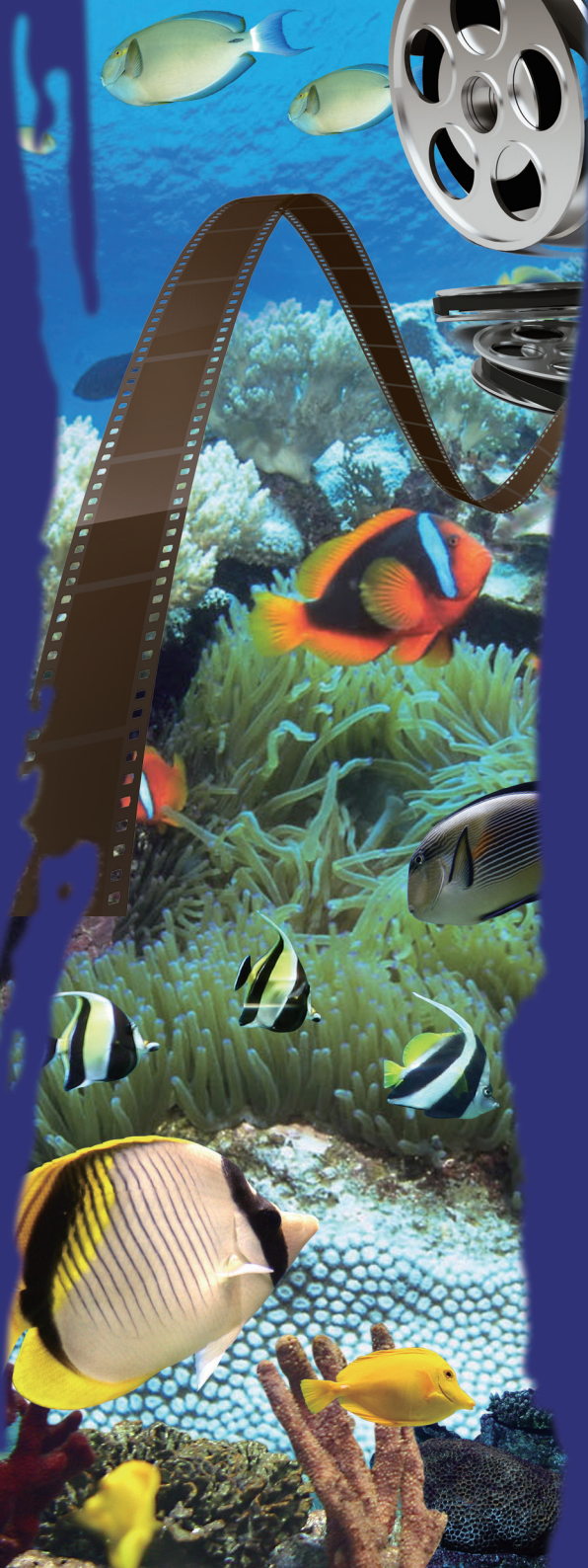
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<sup>16</sup>“How to Manage Data Backup” by Lai Wen-Cheng, “Connectimes,” January 2002, pages 24-30.

Table 4-1 Backup Options

	Different storage media	Set up a PC cluster	Remote backup
Description	This backup method is a basic requirement and can be achieved using an external hard disk or DVD.	Consists of two identical sets of computer equipment and operating systems that are placed in the same room or building.	Places the operating computer, backup computer and data stored in different media in different locations, e.g. different buildings.
Advantages	The cheapest backup method and the simplest.	When computer A crashes, computer B can immediately take its place.	Prevents all data from being lost in the event one location encounters force majeure.
Disadvantages	Takes longer time to restore backup data in the operating computer.	If the site where the computers are placed encounters a disaster, then all backup data may be lost.	If this is achieved by setting up two computer systems that transfer data synchronously or asynchronously via the internet, it will require relatively higher cost.

The frequency that data is backed up and preservation period should be based on its importance and how often there are updates, i.e. how often should data be backed up and how frequently should it be deleted to avoid using too much space on ineffective data.



## Five. Metadata and Database Establishment

# I. Metadata Planning

Based on the methods of participants in TELDAP, most ecological videos are only one representation of data in biological databases. For example, when you search for data on a certain fish species, the search results might include a basic description, specimen data, specimen photo, literature, ecological photo and ecological video. Therefore, a relational database system can be planned and designed based on international metadata standards for biodiversity and audiovisual data (Figure 5-1).

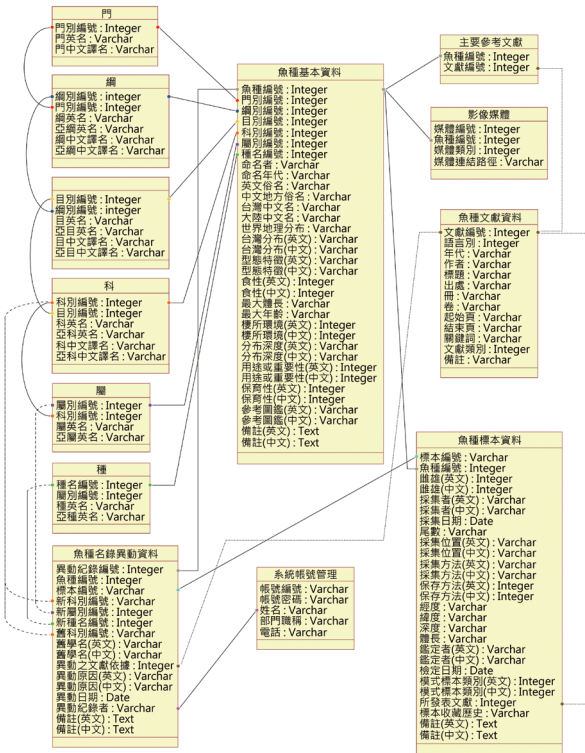


Figure 5-1 Fish database metadata definition

Source: Metadata Definition of the Fish Database of Taiwan of the Institute of Cellular and Organismic Biology, Academia Sinica<sup>17</sup>

<sup>17</sup>“Metadata Definition of the Fish Database of Taiwan of the Institute of Cellular and Organismic Biology, Academia Sinica,” MAAT website, Search: January 8th, 2010, [http://metadata.teldap.tw/project/filebox/animal/worksheets/animal\\_worksheet\\_ER-model5.pdf](http://metadata.teldap.tw/project/filebox/animal/worksheets/animal_worksheet_ER-model5.pdf).

The “Inventory Studies of Taiwan Fauna: Digital Archives of Fish from Taiwan” of the Biodiversity Research Center, Academia Sinica adopted the international standard – Species 2000<sup>18</sup> for information on biodiversity, so as to serve as a mechanism for international XML data exchange. Furthermore, in order to more effectively integrate, exchange and release biological data in a way that satisfies the special habits of users, the Biosphere and Natural Thematic Group adopted the Darwin Core (DwC), which is “a minimal set of descriptions for searching and accessing natural and historical collections and observation databases,” in hopes of providing guidance for others.<sup>19</sup> The Biosphere and Natural Thematic Group uses this standard to correspond to metadata established by different projects, and integrates them in the Taiwan Biodiversity Information Facility (TaiBIF) to make the representation of biological data more complete. This allows biology researchers to conveniently access data and enhances the results of integration, exchanges and release. Units that are establishing metadata for the first time should consider directly using the Darwin Core as a development standard.

Metadata standards for audiovisual data include ECHO (European Chronicles On-line), MPEG-7 (Moving Picture Experts Group 7) and SMEF-DM (Standard Media Exchange Framework Data Model).<sup>20</sup> The metadata standard designed by the EU sponsored ECHO divides audiovisual data into four layers: Work (AV document), Expression (Version, Video, Audio, Transcript), Manifestation (Media) and Item (Storage). This is also the standard adopted by the “Digital Museum of Taiwan’s Humanities and Social Video Archive”<sup>21</sup>; besides the title, description, location, theme and length of videos, how the video camera and lens should be moved and the position of the object is also planned.<sup>22</sup> Although ecological videos may have different properties than the project’s audiovisual objects, its methods provide valuable reference.

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<sup>18</sup> “Best Practices,” MAAT website, Search: November 21<sup>st</sup>, 2009, <http://metadata.teldap.tw/standard/standard-frame.html>.

<sup>19</sup> “Darwin Core Version 2.0 Introduction, Elements and Definition,” MAAT website, Search: November 21<sup>st</sup>, 2009, <http://metadata.teldap.tw/standard/specimen/Darwin-Core.htm>.

<sup>20</sup> “Best Practices,” MAAT website, Search: November 21<sup>st</sup>, 2009, <http://metadata.teldap.tw/standard/standard-frame.html>.

<sup>21</sup> “Metadata Elements of Digital Video Library Project,” MAAT website, Search: November 21<sup>st</sup>, 2009, <http://www.sinica.edu.tw/~metadata/project/work-status/electis/elements-video.html>.

<sup>22</sup> “Metadata Elements of Digital Video Library Project,” MAAT website, Search: November 21<sup>st</sup>, 2009, <http://www.sinica.edu.tw/~metadata/project/work-status/electis/elements-video.html>.



Whether you are establishing metadata for biological or audiovisual data, the Dublin Core can also serve as a basis for planning metadata. The Dublin Core is an interdisciplinary metadata standard that was established to make electronic resources around the world easier to maintain. The Dublin Core only defines 15 basic core elements<sup>23</sup> as an exchange format for different metadata, achieving openness and interoperability between disciplines.

Besides considering the possibility of bringing metadata in-line with international standards (Species 2000, Darwin Code, Dublin Core), repositories should design metadata fields based on the characteristics of their collections and information that should be recorded and presented to the public. This way collections may be more accurately described.

The Philology, Videography and Journalism Thematic Group of Taiwan Digital Archives Expansion Project planned the “audiovisual work metadata format (Beta)” based on experiences of the “Digital Museum of Taiwan’s Humanities and Social Video Archive” project. Although it still focuses on audiovisual data in the field of humanities, it can serve as reference for the design of metadata for ecological videos. Please refer to the attachment in the book “National Digital Archives Program Digital Archives Book Series – Videography Team.”

## **II. Cataloging Standards**

Although some units may designate a specific staff member to be responsible for cataloging species data, catalog contents will become disordered if several personnel are assigned to input species data into the database due to different perspectives. Cataloging personnel not only require a background in related disciplines, but the input method and content of each field should be defined before species data is cataloged; this can become a part of the system design, so the system can automatically restrict the input method and values of each field.

## **III. System Design and Establishment**

System designers establish the system based on metadata specifications

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<sup>23</sup> “List of Dublin Core Elements” translated by the MAAT, website of the MAAT, Search: November 21<sup>st</sup>, 2009, <http://www.sinica.edu.tw/~metadata/standard/dublincore-chi.htm>.

and cataloging plans, including database design, cataloging interface design and system design,. After developing the system, related personnel should test the system to see if it is consistent with plans, that the system has the desired operability, and if any part of the original plan was inappropriate.

## **IV. Data Backup**

Text data, the database and system should all be backed up on different storage media and placed in different locations like video data.



## Six. Digital Content Protection

To protect digital content from being illegally disseminated, used, altered or sold, digitization workers are all racking their brains to achieve copyright protection while releasing files for browsing, research, promotion and education purposes. Therefore, this guideline introduces a few digital content protection mechanisms below, including digital rights management, digital watermarks and creative commons.

## **I. Digital Rights Management**

Digital Rights Management (DRM) is a commercial protection method that encrypts files to limit access rights to digital content, e.g. limit the number of times a file can be accessed or copied, the file can only be opened using specific hardware and software, a password is required to open the file, or read only file. DRM also allows the utilization of digital content to be traced, thereby ensuring the file's safety and protecting the rights of the digital content's creator and provider. For example, the e-book of Amazon and iTunes Store of Apple<sup>24</sup> both adopt this protection mechanism to limit the access rights of users, thus protecting the rights of the creator and provider.

## **II. Digital Watermarks**

Digital watermarks refer to the technology that embeds information on intellectual property rights in digital files, including the name, address and trademark of the document's creator and copyright owner. Digital watermarks are divided into two types – visible watermarks and invisible watermarks. Visible watermarks can be directly seen on the image and are added using image software or audiovisual software, but might block the contents and prevent them from being read. Invisible watermarks cannot be seen on the image and therefore do not damage the image, but require specialized software to be added. Invisible watermarks require higher technology and only the party that embedded the watermark has the key to remove it.

Visible watermarks can be added while editing videos, and the Open Source Software Foundry (OSSF), which was established by the Institute of Information Science, Academia Sinica, has developed a video watermarking

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<sup>24</sup>Wikipedia, "iTunes Store," Published: December 17th, 2008, Search: December 20<sup>th</sup>, 2009, [http://zh.wikipedia.org/w/index.php?title=iTunes\\_Store&oldid=8777494](http://zh.wikipedia.org/w/index.php?title=iTunes_Store&oldid=8777494).

application that can be downloaded for free on its website.<sup>25</sup> The basic version works under Windows and can easily add images at the four corners of MPEG1 or MPEG2 videos; the depth of the watermark can also be adjusted. The full version not only allows watermarks to be added to videos, it also allows watermarks to be added to JPEG, BMP, GIF and PNG image files, and can add them in batches.

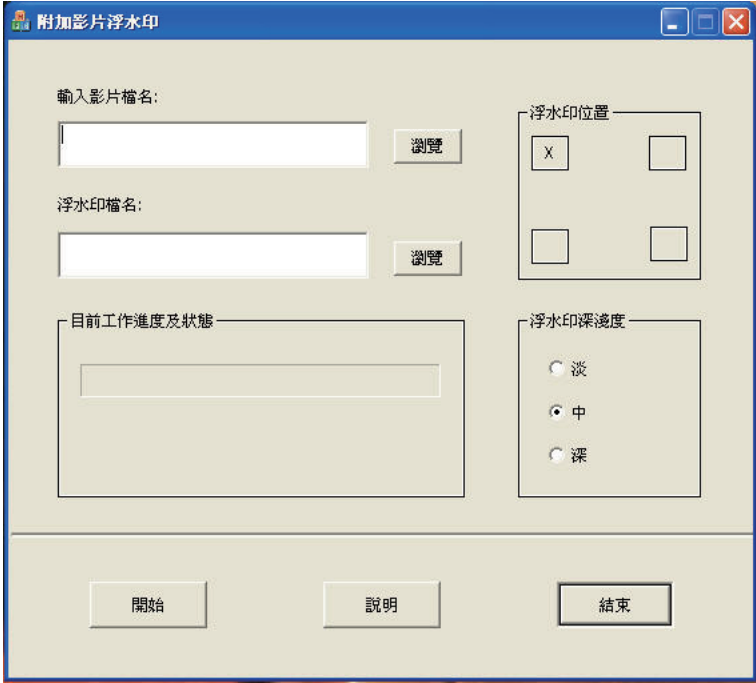


Figure 6-1 Window for adding a watermark to a video

### III. Creative Commons

Creative Commons is a project led by Professor Lawrence Lessig of Stanford Law School that was initiated in 2001, and became the iCommons project in 2003, for which cooperative units from around the world translated

<sup>25</sup> “Video Watermarking Software,” OSSF, Published October 17<sup>th</sup>, 2005, Search: December 20<sup>th</sup>, 2009, <http://of.openfoundry.org/projects/435/>.

the licensing terms into their respective languages, and then adjusted the terms according to local laws; the cooperative unit in Taiwan is the Institute of Information Science, Academia Sinica.

Creative Commons provides a simple and legally effective way for creators to declare the scope of which his/her digital creations may be freely used, while retaining partial rights. Creative Commons on one hand protects the rights that the copyright owner wishes to retain, and on the other hand shows good intentions towards the public, encouraging free access or derivative works. This is different from the strict access restrictions set by DRM to protect the copyright owner's rights. Creative Commons is applicable to an extensive range of works, including music, stories, dialogue, novels, pictures, website content, movies, sound effects, videos, books and articles. At present, a portion of results of projects under TELDAP have adopted Creative Commons licenses. As to the different licenses that can be adopted, visit the Creative Commons website for Taiwan,<sup>26</sup> click on "Choose a License," follow the instructions to select a licensing method, and then add the system generated code to your own website to complete the licensing of your own creations.

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<sup>26</sup> Creative Commons, Search: January 7<sup>th</sup>, 2010, <http://creativecommons.org.tw/static/choose>.



## Seven. Equipment and Cost Analysis

# I. Equipment Selection

## (I) Video Camera, Lens and Accessories

### 1. DV Camera

Besides budget considerations, there are a few matters concerning hardware specifications when selecting a DV camera:

(1) Size of light sensing device:

Light sensing devices detect external lights and convert the data they receive into digital signals. Therefore, a key consideration of DV camera selection is the size of light sensing devices; larger light sensing devices require larger aperture, which receive more light and produce better picture quality. At present, video cameras in the market are divided into CCD (Charge Coupled Device) and CMOS (Complementary Metal-Oxide Semiconductor) cameras; advantages and disadvantages of each type are shown in Table 7-1. All light sensing devices are currently capable of achieving the 1920×1080 resolution required for Full HD.

Table 7-1 Advantages and Disadvantages of CCD and CMOS

Light Sensing Device	Advantages	Disadvantages
CCD	<ol style="list-style-type: none"><li>1. Low noise</li><li>2. High sensitivity to light</li><li>3. Real-color performance</li></ol>	<ol style="list-style-type: none"><li>1. High power consumption</li><li>2. High technology requirement, high cost and relatively few additional functions</li></ol>
CMOS	<ol style="list-style-type: none"><li>1. Produces clearer images when filming dynamic pictures</li><li>2. Low production cost, relatively cheap products with more additional functions</li><li>3. Low power consumption, allowing longer filming time</li></ol>	<ol style="list-style-type: none"><li>1. Relatively low sensitivity to light, and relatively poor color performance</li><li>2. Easily heats up and produces noise</li></ol>

Source: "Introduction to DV Practices: Selection, Filming, Editing, Burning and File Conversion," Shih Wei Ming Laboratory, pages 1-35, 1-36; Compiled by Taiwan Digital Archives Expansion Project.

Due to environment limitations, pictures filmed underwater are not as clear, so when there is sufficient funding, institutes should consider purchasing a professional CCD video camera for digitization, which



will not cause noise as a result of overheating after working for long periods of time. Since videos are filmed underwater, it is necessary to purchase a pressure-resistant waterproof shell for the video camera being used.

At present, many DSLR (Digital Single Lens Reflex) cameras are capable of recording HD quality images. If filming ecological videos is not the main part of digitization, then such DSLR cameras can be purchased to handle both picture taking and filming operations.

### (2) DV, HDV, HD and Full HD

Many video cameras have the words DV, HDV, HD or Full HD labeled on them. These represent the maximum resolution of videos that can be recorded by the DV camera; higher resolution videos have more detail. If there is sufficient funding, then it is best to purchase high resolution video cameras, but in order to play videos with Full HD quality, then the LCD TV monitor should be at least 37 inches and computer monitor should be at least 24 inches.



Figure 7-1 Specifications shown on a video camera

### (3) AVCHD

AVCHD (Advanced Video Codec High Definition) is a video compression technology jointly developed by SONY and Panasonic, and stores 16:9 high quality videos at half the storage space, thus allowing extending recording time. Its features include:

- a. AVCHD technology supports different storage media, including DVD, memory and hard disk, and manufacturers have thus developed products with both SD card (Secure Digital) and hard disk.
  - b. Supports transfer requirements of HDV and Full HD videos.
  - c. Compatible with Blu-ray and videos recorded can be directly played in Blu-ray players.
  - d. Supports videos with 50~60 fps, offer far more exquisite image quality compared with 30 fps videos.
  - e. High audio recording quality up to 5.1 audio with Dolby effect.
- (4) DV pixels

In order to make the number of light sensing devices (CCD or CMOS) look better, manufacturers often use the terms total pixels, motion picture resolution and still image resolution, creating great confusion for consumers.

- a. Total pixels: The actual number of pixels of the CCD or CMOS.
- b. Motion picture resolution: The number of pixels used when recording videos.
- c. Still image resolution: The number of pixels when photographing still images.

From the definitions above it is not hard to discover that you only need to notice the total pixels and motion picture resolution when purchasing a DV camera.

(5) Zoom Function:

Although optical zoom and digital zoom both achieve zoom effects, digital zoom only magnifies and cuts the image of produced by optical zoom, so it does not gain better image quality and also magnifies noise. Therefore, it is better to choose video cameras with high optical zoom rather than high digital zoom.

## 2. Lens and Focal Length

Due to refraction of light by water, the object being filmed looks 25% closer and 33% larger than it actually is. Therefore, the lens used on land will magnify objects when underwater. For example, a standard 50mm lens might produce results of a 30mm~40mm wide angle lens. Moreover, due to the relatively low visibility in water, objects are generally filmed as close as possible, and unless filming a commercial video or scenery

under the ocean, additional lenses usually are not required.

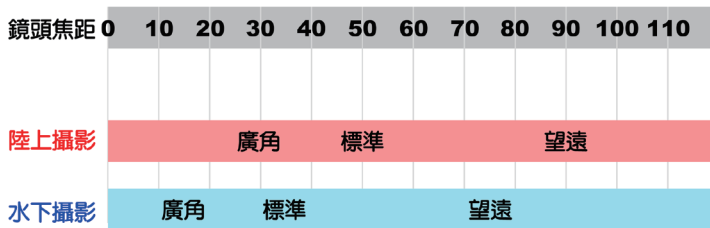


Figure 7-2 Focal length changes on the ground and underwater<sup>27</sup>

Source: “完全入門デジカメマリンフォト,” 水中造型センタ, Editing Department, 2004, page 46

### 3. Auxiliary Light Source

Visibility decreases due to less light underwater, it is thus necessary to purchase an additional continuous light source, regardless of whether sunlight directly reaches the ocean bottom or when filming at night, so as to gain clearer images.

## (II) Computer System

### 1. Hardware:

Desktop computers are currently divided into two categories – the PC and Macintosh, and can be selected based on the following principles:

#### (1) Computer

- a. PC: Editing audiovisual files consumes relatively more hardware resources. Therefore, when selecting the CPU and motherboard, performance is an important consideration in addition to compatibility; faster CPUs support more high-end motherboards, which allow the computer to operate smoother and reduce the chances of a crash. Furthermore, motherboards with a built-in FireWire (IEEE 1394) interface may be considered for the convenience of image capture because videos need to be transferred into the computer for processing.<sup>28</sup>

<sup>27</sup> Source: センタ—Editing Department, 2004, page 46.

<sup>28</sup> CPU formats currently include 64bit and multiple cores (dual core, quad core), both greatly enhance the computer’s performance at reasonable prices. If you are using a 64bit computer, it is recommended to use a 64bit system and software to fully utilize its hardware, otherwise using a 32bit computer would achieve the same results.

b. Macintosh: Macintosh computers have always been favored for graphics and audiovisual processing, mainly because of its closed architectural design, which reduces instability and incompatibility caused by hardware from different manufacturers. Moreover, Macintosh computers have superior computing ability and convenience compared the PC. At present, Macintosh computers are gradually allowing certain parts, such as the memory, graphics card, disc player and burner, to be replaced in hopes of expanding its customers. Even so, Macintosh computers are still stable and don't easily crash or become infected by viruses. However, relatively few applications support the Macintosh compared with Windows, so overall expenses (including software and hardware) are much higher than purchasing a PC. Still, Macintosh computers are a good option if the budget allows.

(2) Random Access Memory (RAM):

The RAM used by both PCs and Macintoshes all have the capacity to store required programs. Still, more RAM allows smoother execution of different applications, so the more RAM there is the better, but not exceeding the computer's limit.<sup>29</sup>

(3) LCD Monitor:

Considerations for selecting a LCD monitor include size, dead pixels, input interface, brightness, contrast, and response time. The current mainstream of LCD monitor size is 19~22 inches. If you are processing Full HD images, then consider 24 inch or above LCD monitors because they can achieve 1920x1080dpi of full HD. In principle, higher brightness, larger contrast and shorter response time is better. In addition, make sure the digital signal interface is HDMI and not only DVI because only HDMI supports Full HD.

(4) Hard Disk:

Generally speaking, video files are much larger than image files and require a lot more storage space, but not without proper file storage

---

<sup>29</sup>Current motherboards have what we call a dual channel memory mode, which achieves better performance when a memory stick is inserted in two channels with different colors.

plans. With current computers transferring larger and larger quantities of data, the bandwidth of the old IDE interface is gradually becoming too small, so the current mainstream in the market has shifted to SATA or SATA II. Also consider the RPM when purchasing hard disks,<sup>30</sup> faster hard disks search and access data faster, enhancing system performance. The downside is that faster hard disks are more expensive, and noise and heat are also issues that need to be considered.

In order to enhance system performance, it is recommended to store digital files and the operating system and applications on separate hard disks; 1TB hard disks are a good option since they are currently lower than NT\$3,000. Furthermore, external hard disks can be purchased as an alternative for remote backup.

(5) DVD Recorder:

DVD recorders are already very popular, and a blank DVD can store 4.7GB or even 8.5GB of data, making it a good alternative for data backup.

Although disc recorders using Blu-ray technology can already be found in the market, they are still very expensive. Considering that the storage capacity of a single layer Blu-ray disc can reach 25GB or 27GB, which can record up to 4 hours of high definition video, and that two layer, four layer and eight layer Blu-ray discs have storage capacities up to 46GB, 100GB and 200GB, they will serve as very good tools for backup once the technology matures and prices drop.

(6) Video Capture Card:

Video capture cards in the market are divided into analog capture cards and digital capture cards for different types of video cameras. The former captures images of an analog video camera via an AV terminal or S terminal to the computer; the later transfer images via FireWire (IEEE 1394). If you are using a DV camera with a hard disk, then you do not need to purchase a video capture card.

## 2. Software:

Besides the functions of software, the most important consideration is the minimum system requirements, which normally lists CPU speed,

---

<sup>30</sup>RPM refers to the speed that the hard disk's motor rotates.

memory, hard disk space, monitor resolution, disc player, operating system and other input/output devices for consumers to consider before purchase (Figure 7-3).

### Adobe Premiere Pro CS4



▶ 購買

**透過線上、光碟或裝置擷取、編輯和提供內容**

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- 日文
- 西班牙文
- 德文

系統需求

**Windows**

- 針對 DV 需 2GHz 或速度更快的處理器。針對 HDV 需 3.4GHz; 針對 HD 需 雙 2.8GHz\*\*
- Microsoft® Windows® XP with Service Pack 2 (建議 Service Pack 3) 或 Windows Vista® Home Premium、Business、Ultimate 或 Enterprise with Service Pack 1 (取得 Windows XP 的 32 位元版本以及 Windows Vista 32 位元與 64 位元的認證)
- 2GB 的記憶體
- 10GB 的可用硬碟空間以進行安裝。安裝期間需要額外可用空間 (無法安裝在快閃儲存裝置上)
- 1,280x900 顯示器以及 OpenGL 2.0 相容的顯示卡
- 針對 DV 和 HDV 編輯需使用專用的 7200 RPM 硬碟機。針對 HD 需使用垂直磁碟陣列儲存 (RAID 0)。建議使用 SCSI 磁碟子系統
- 針對 SD/HD 工作階段, 需 Adobe 認證的介面卡以擷取並匯出至硬碟
- 針對 DV 和 HDV 錄取、匯出至磁碟和傳送至 DV 裝置需使用 OHCI 相容的 IEEE 1394 連接埠
- DVD-ROM 光碟機 (建立 DVD 需使用 DVD+-R 燒錄器)
- 建立 Blu-ray 光碟需使用 Blu-ray 燒錄器
- Microsoft Windows Driver Model 或 ASIO 相容音效卡
- 需要有 QuickTime 7.4.5 軟體, 才能使用 QuickTime 功能
- 需要有寬頻網路連線才能使用線上服務†

**Mac OS**

- 多核心 Intel® 處理器
- Mac OS X v10.4.11–10.5.4
- 2GB 的記憶體
- 10GB 的可用硬碟空間以進行安裝。安裝期間需要額外硬碟空間 (無法安裝在使用區分大小高的檔案系統的磁碟區或快閃儲存裝置上)
- 1,280x900 顯示器以及 OpenGL 2.0 相容的顯示卡
- 針對 DV 和 HDV 編輯需使用專用的 7200 RPM 硬碟機。針對 HD 需使用垂直磁碟陣列儲存 (RAID 0)。建議使用 SCSI 磁碟子系統
- DVD-ROM 光碟機 (需使用 SuperDrive 才能燒錄 DVD)
- 建立 Blu-ray 光碟需使用 Blu-ray 燒錄器
- Core Audio 相容的音效卡
- 需要有 QuickTime 7.4.5 軟體, 才能使用 QuickTime 功能
- 需要有寬頻網路連線才能使用線上服務†

Figure 7-3 Adobe Premiere Pro CS4 System Requirements<sup>31</sup>

Like the saying that one should “compare before making a purchase,” the most important thing to do before purchasing any equipment is to listen to the opinions of users. Purchasers can read test reports in magazines or on the internet to understand products currently in the market, find information regarding a new product or if a product will no longer be manufactured, project units can also ask the manufacturer to introduce and test their products. This information can serve as excellent reference that will allow institutions to avoid purchasing unsuitable products.

<sup>31</sup> “Adobe Premiere Pro CS4: Summary,” Adobe, Search: January 20<sup>th</sup>, 2009, <http://www.adobe.com/tw/products/premiere/>.

54 Underwater Video Digitization Procedures Guideline

## II. Budget Planning

Due to the special filming environment underwater, additional waterproof equipment must be purchased because filming equipment used on the ground cannot be used underwater without waterproofing. Video post-processing also requires relatively high-end computer systems, so overall cost will be higher than typical digitization work. Basic planning and advanced planning of digitization work is briefly described below.

### (I) Manpower Arrangements:

#### 1. Basic Planning:

- (1) 1 Researcher: Salary is based on regulations of the repository.
- (2) 1~2 Assistants: Must have a diving license, knowledge on marine species, underwater filming skills, digital file conversion and processing skills. Salary is based on regulation of the repository.
- (3) 1 Information Technician: To assist with audiovisual database establishment and take part in metadata planning.

#### 2. Advanced Planning:

Similar to basic planning, several researchers, assistants and information technicians are required for digitization work. In addition, a professional photographer familiar with underwater filming can be hired to assist with filming ecological videos.

### (II) Software/Hardware Purchasing

DV cameras with hard disks (or memory cards) are the current mainstream, and are therefore the basis for equipment planning shown in Table 7-2.

Table 7-2 Basic software/hardware planning

Item	Specifications	Price	Description
Video camera	Full HD Hard Disk (80G~120G) Video Camera	NT\$30,000 ~ NT\$50,000	
Pressure resistant waterproof shell		NT\$100,000	Requires compatible video camera
Lights (including lamp arm and continuous light source)		NT\$25,000	Requires compatible waterproof shell

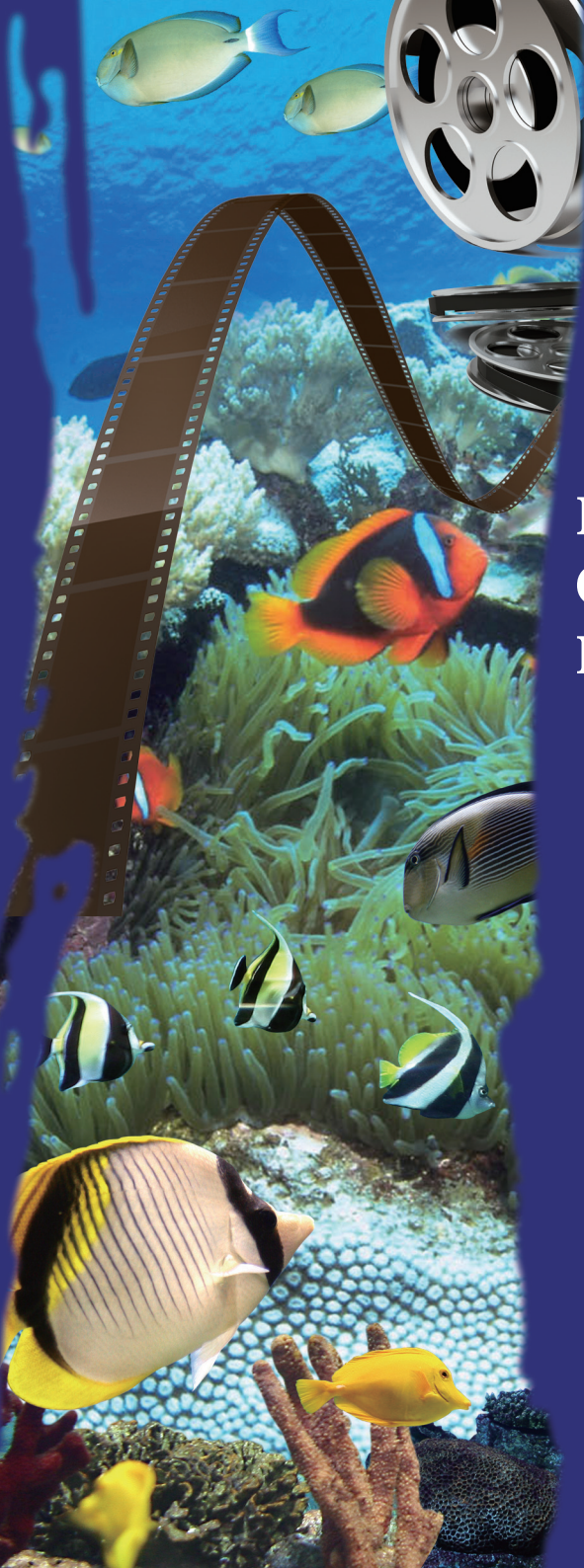
Item	Specifications	Price	Description
Computer	Dual core CPU, 4G RAM, 1TB Hard disk	NT\$30,000 ~ NT\$35,000	Motherboard has built-in IEEE 1394
Monitor	24 inch monitor (FullHD_1080P)	NT\$7,000	
External hard disk	1TB 3.5 inch external hard disk	NT\$3,000	
External disc recorder	Single side two layer, dual mode DVD recorder	NT\$2,000	Able to burn 8.5G DVD
Audiovisual editing software	Allows conversion to different file formats, such as MPEG, WMV and FLV	NT\$3,000	Must support files created by AVCHD and HDV video cameras
Watermarking software		Free	
Anti-virus software		NT\$1,500	

Source: Compiled by Taiwan Digital Archives Expansion Project

### (III) Other Expenses

1. Ship expenses: In the case of the “Inventory Studies of Taiwan Fauna: Digital Archives of Fish from Taiwan” of the Biodiversity Research Center, Academia Sinica, the project is working with the National Science Council and may apply for research ships or ship rental for filming videos out at sea, so the project does not need to pay for this expense. If other projects do not have such resources, they may need to hire local fishing boats for operations at sea.
2. Transportation and accommodations: Using the business trip budget of a NSC project as an example, assistants can apply for reimbursement for NT\$1,400 spent on accommodations a day and NT\$500 in meals and miscellaneous expenses. Transportation expense is reimbursed according to the expense.
3. Diving equipment rental or purchase.





## **Eight. Conclusion and Recommendations**

Taiwan's aquatic ecosystem is gradually being polluted by waste water from families, farmland and factories, and many aquatic organisms are either migrating or disappearing as a result. This is an effect of population growth, global climate change, introduction of foreign species, over-development and over-fishing. Therefore, many people who love the ecology and environment are actively filming ecological videos and digitizing them for permanent preservation. These videos are not merely records, but aim to let more people know of the precious underwater world, so that fish can continue to happily swim in the water.

Uploading these cherished ecological videos and photos not only allows the general public to view images of endangered species, but also gives them the opportunity to learn. The internet makes extensive communication and sharing of resources and information between different areas convenient, and has thus developed in to a trend of academic data exchange in recent years.

Although it is important to gather together the resources and digitization experiences of professional repositories in Taiwan, their quantity is limited, and even more, the ecological videos and photos that are scattered in the society. Without proper management and protection, such resources will easily disappear. There are two websites in Japan established to resolve this issue – “Web Fish Guide”<sup>32</sup> and “Database for Aquatic-vertebrate Science.”<sup>33</sup> The websites allow the public to submit photos of specimen and increase the database's content, making the websites even more practical and worth viewing.

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<sup>32</sup> “Web Fish Guide” is managed by the Fishing Forum, <http://fishing-forum.org/zukan>.

<sup>33</sup> The “Database for Aquatic-vertebrate Science” was established on the basis of the fish database of the Kanagawa Prefectural Museum of Natural History, and its data search functions were jointly developed with Japan's National Museum of Nature and Science, Search: December 28th, 2009, <http://research.kahaku.go.jp/zoology/photoDB/>.

**WEB魚図鑑**

みなんで作ってみんなで楽しむ魚図鑑です。専門知識をもつ同好チームが、写真周辺こまかくていえますので、名前がわからなくてもBBSに写真を投稿してみてください。

**投稿**  
投稿方法について

現在の登録  
42目 246科 1864種 20397データ

検索欄 指定なし フルワード 検索開始

**似たもの検索**  
世界初々の形態で検索する魚図鑑です。

**和名一覧**  
あかさたな はま やらわ

**科名一覧**  
科名一覧から検索。サムネイルが綺麗！

**目名一覧**  
目名一覧から検索。大きな分類です。

**Headline News!**

- 謝絶宏博士が、ツルギエイズハナダイの標本を募集しています。詳しくは、こちら。
- 各種画像の表示を Adobe Flash Player での表示に変更しました。
- 図鑑への投稿、【さかなBBS】への質問の際には、【はじめに】をご確認ください。
- リンクを修正いたします。個々の写真、データの無断使用はお断じいたします。

**Contents**

魚名の質問などはこちらへ ● 携帯電話でアクセスしよう ● 貴方だけの図鑑が作れます

**What's New!**

和名	科名	採集地	お名前
テンジクアスツギイ(幼魚)	スズキ目科	宮崎県	ふいふいユッケ
ヒメジ鰯の1種(第1種群)	ヒメジ科	宮崎県	ふいふいユッケ
ヒメジ鰯の1種(群部・音画)	ヒメジ科	宮崎県	ふいふいユッケ
ヒメジ鰯の1種(頭部)	ヒメジ科	宮崎県	ふいふいユッケ
ヒメジ鰯の1種	ヒメジ科	宮崎県	ふいふいユッケ
ヒラズキ	スズキ目科	鹿児島県	ふいふいユッケ
トガカナガシラ	ネボウ目科	高知県	MS
ウナギ	ウナギ目科	高知県	MS
マルンワダ(専養・下)	サバ目科	三重県	小三郎J
マダラトビエイ	トビエイ目科	三重県	小三郎J

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釣カーム.jp WEB魚図鑑 Gear-Lab

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Figure 8-1 Web Fish Guide

In a digital era, the production of digital content is not a task that can be completed solely or by a single institution. It is selfless sharing and experience accumulated throughout the years that is essential to the effective presentation and application of biological heritage. “The Fish Database of Taiwan”<sup>34</sup>, established by the “Inventory Studies of Taiwan Fauna: Digital Archives of Fish from Taiwan” of the Biodiversity Research Center, Academia Sinica is

<sup>34</sup> The Fish Database of Taiwan, Search: December 28<sup>th</sup>, 2009, <http://fishdb.sinica.edu.tw/>.

actively gathering ecological videos and still images of fish, hoping to preserve ecological images of Taiwan through the joint efforts of all sectors, and thus create a complete underwater world resource. Furthermore, fish data that it collects is simultaneously imported into the famous “FishBase<sup>35</sup>,” sharing and exchanging underwater ecological resources with fish databases around the world. This benefits the acquisition of research data in Taiwan which drives academic research development, also providing important material for ecological preservation and education. International cooperation and exchanges through websites like TaiBIF<sup>36</sup> and Digital Taiwan - Culture & Nature<sup>37</sup> help the world become better acquainted with Taiwan, and allow Taiwan to join in the globalized accumulation of knowledge.



Figure 8-2 The Fish Database of Taiwan


<sup>35</sup> FishBase, Search: September 29<sup>th</sup>, 2009, <http://www.fishbase.org/search.html>.

<sup>36</sup> TaiBIF, Search: January 7<sup>th</sup>, 2010, <http://taibif.org.tw>.

<sup>37</sup> Digital Taiwan - Culture & Nature, Search: January 7<sup>th</sup>, 2010, <http://culture.teldap.tw>.

Mirrors: [fishbase.org](http://fishbase.org) | [fishbase.us](http://fishbase.us) | [fishbase.de](http://fishbase.de) | [fishbase.fr](http://fishbase.fr) | [fishbase.se](http://fishbase.se) | [fishbase.tw](http://fishbase.tw) | [fishbase.cn](http://fishbase.cn) | [fishbase.br](http://fishbase.br)

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 **FishBase** (31400 Species, 279600 Common names, 49000 Pictures, 43500 References, 1740 Collaborators, 33 million Hits/month) (10/2009)

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**Common Name**  
 Search (e.g. rainbow trout)  
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z  
 中文 العربية Русский 日本語 ភាសាខ្មែរ [More scripts...](#)

**Scientific Name**  
**Genus** is  Search (e.g. Rhinodon)  
**Species** is  Search (e.g. typos)  
**Genus + Species**  Search (e.g. Tor soro)  
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z  
 You can search names also in the independent [Catalog of Fishes](#).

**Glossary**  
 Search (e.g. oophagy)  
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Information by Family**  
  
 Family info.  Pictures  References (FishBase)  Graphs  
 All fishes  Identification  Missing photos  Species Ecology Matrix  
 Nominal species  Identification keys  Stamps

Note: Lists may be incomplete. Some lists may be very long and will take time to load.

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Figure 8-3 FishBase

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 Taiwan Biodiversity Information Facility  
 Node of GBIF (Global Biodiversity Information Facility)

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搜尋

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- About GBIF
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 出現紀錄  
 生態管性  
 文獻資料庫  
 生態照

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 GBits 第13期中文版  
 第三屆國際生命條碼學術會議  
 TDWG已經Darwin Core標準  
 TDWG邀請大港檢閱TAPIR

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 水中較龐—水棲爬行動物化石特展  
 亞洲生物國際研討會  
 西太平洋區之標本物種(紅皮書)評估國際研討會  
 第三屆海峽兩岸珊瑚礁生物學與南海洋保護區研討會

more ...

Figure 8-4 TaiBIF

# Digital Taiwan - Culture & Nature




Taiwan e-Learning and Digital Archives Program

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The vast collections connect visitors to Taiwanese arts, nature, heritage, and society. [Visit...](#)

## A Short Tour of the Portal



Figure 8-5 Digital Taiwan - Culture & Nature



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