

Present Situation of Marine Mammal Specimen Collections in Taiwan

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Abstract Marine mammal specimen collections were surveyed and the present situation of these collections were examined. Yang (1976) compiled then available data and concluded there are 25 species of cetaceans reported from the seas around Taiwan. We visited 14 institutions where marine mammal specimens are preserved either for scientific or for exhibition purpose. Nearly 400 specimens of 37 species of marine mammals were confirmed in these organizations. Listing of these specimens and references list of the works concerning marine mammals from Taiwan waters, or marine mammal researchers from Taiwan are given in the present article.

Key words: marine mammal, specimen, cetacea, sirenia, Taiwan

Introduction

Curiosity could be one of the prime motivations for collecting natural history specimens. In the very beginning, many of the major natural history collections were products of noble or rich people's curiosities to prove their prestigious positions. Curiosity alone, however, cannot be enough to build and to maintain good specimen collections. Naturalists in the earlier days like Linnaeus worked hard for those wealthy and/or noble people to compile catalogues of these collections. This could have been one of the very important conditions where natural history studies were developed. Anyway, a combination of human curiosity and efforts of listing was the primary driving force for the natural history studies. Natural history studies on marine mammal, however, require tremendous efforts in collecting specimens, because the subjects can be huge, and extremely difficult to handle.

In Taiwan, good marine mammal specimen collections are being built and maintained by researchers in various institutions. Specimens collected are: 1) skeletons, 2) tissue samples for DNA analyses, 3) tissue samples for pathology, 4) taxidermies, 5) stomach contents 6) parasites and, 7) miscellaneous specimens. International research projects with U.S.A., Canada, Hong Kong, Japan, etc. are in progress. Purposes of the researches are, needless to say, to obtain more profound understanding on the animals and their relationships among themselves and with their habitat, that could be useful for the conservation of the ecosystem. Preserved specimens are important backup of the data sources. Some of our joint projects prepared by researchers of Taiwan and Japan are a research on the geographical relationships among the extant *Dugong dugon* pop-

ulations in Okinawa, Palau and the Philippines, re-examination on the phylogeny of *Balaenopterid* whales or geographical comparison of *Stenella* spp. Most of these projects are possible because skeletal specimens are preserved in good condition.

Marine Mammal Specimen Collections

The first cetacean osteological specimen recorded in Taiwan was a fin whale collected in the mid-19th Century by a British naturalist Robert Swinhoe. It was first described as *Balaenoptera swinhoii* Gray 1865, which later was listed as one of the junior synonyms of *B. physalus* (Hershkovitz, 1966). The specimen is now preserved at the Natural History Museum in London. After this discovery, no significant documents are recorded until the early 20th century. Cetology studies in Taiwan before the end of the second World War were lead by Japanese scientists. During the 1950's, Yang conducted extensive works with Nishiwaki to brush up the species list of cetaceans from the Taiwan waters. Since the 1990's Chou, and her colleagues have worked actively in introducing current methods of cetacean studies sometimes as international joint projects.

The largest collection is in National Museum of Natural Science, where skeletal specimens are deposited as an outcome of research activities centered around Taiwan Cetacean Stranding Network. There are several more museums and aquaria where marine mammal specimens are preserved and made available for research. Some of the collections are digitally databased and computer accessible. We are aiming at building a nation wide database of marine mammal specimens accessible through the internet. We already started building a small database for specimens collected by Dr. Mizue in the 80's and preserved in National Taiwan Ocean University to find out comfortable way of building practical specimen database. Establishing an international network for the effective utilization of collected specimens is another goal of ours. Natural history studies in the present framework were initiated in Europe. Marine mammal research in Taiwan was initiated in collaboration with researchers from Japan. Further co-operations between the two countries as well as among adjacent countries will yield fruitful results in the future.

Various institutions where marine mammal specimen collection is kept in Taiwan are listed in Table 1. These institutions are briefly introduced below:

Table 1. List of institutions and organisations where marine mammal specimen collections are kept.

Organization	Abbreviation	Locality
National Taiwan Museum	NTM	Taipei
National Museum of Natural Science	NMNS	Taichun
National Taiwan University	NTU	Taipei
National Taiwan Ocean University	NTOU	Keelung
National Cheng Kung University	NCKU	Tainan
National Pingtung University of Science and Technology	NPTU	Pingtung
Tainan County Museum of Natural History	TCMNH	Tso-Chen
Taiwan Fishery Research institute in Keelung	TFRJK	Keelung
Taiwan Fishery Research institute in Keelung	TFRIT	Tungkang
Kinmen National Park	KMNP	Kinmen
Ocean World	OWAQ	Yeh-Liu
Peng-Hu aquarium	PHAQ	Pai-Sha
National Museum of Marine Biology and Aquarium	NMNBAQ	Kentin
Bureau of Culture/ Peng-Hu Local government	BCPLG	Makung
Temple specimen	SWT	Tainan

Table 2. List of marine mammal specimens preserved in Taiwan (abbreviations are as seen in Table 1).

Order	Suborder	Family	Scientific name	1 NTM	2 NMNS	3 NTU	4 NTOU	5 NCKU	6 NPTU	7 TCMNH	8 TFRIK	9 KMNP	10 OWAQ	11 PHAQ	12 NMNBAQ	13 BCPLG	14 SWT		
Cetacea	Mysticeti	Balaenopteridae	<i>Balaenoptera edeni</i> *							1							2		
			<i>Balaenoptera brydei</i> *														2		
			<i>Balaenoptera sp.</i> *	4	4										1			10	
			<i>Balaenoptera acutorostrata</i>		1	2							1					6	
	Odontoceti	Physeteridae	<i>Megaptera novaengliae</i>	1														1	
			<i>Physeter macrocephalus</i>		1													3	
			<i>Kogia breviceps</i>		3	1							1					6	
			<i>Kogia sima</i>		8													12	
		Ziphiidae	<i>Ziphius cavirostris</i>		5													8	
			<i>Mesoplodon densirostris</i>		1	1												3	
			<i>Mesoplodon ginkgodens</i>															1	
		Delphinidae	<i>Globicephala macrorhynchus</i>		1	1												2	
			<i>Peponocephala electra</i>		5													5	
			<i>Feresa attenuata</i>		4				2				1					7	
			<i>Pseudorca crassidens</i>									1						1	
			<i>Steno bredanensis</i>		9	2		1										13	
			<i>Lagenodelphis hosei</i>		18			3					2			1		24	
			<i>Lagenorhynchus obliquidens</i>									1						1	
			<i>Tursiops truncatus</i>		72			3	1					1			1	78	
			<i>Tursiops aduncus</i>		15	1								2		1		19	
<i>Grampus griseus</i>		27			1										28				
<i>Stenella attenuata</i>		77			9	1									87				
<i>Stenella coeruleoalba</i>		7			1										8				
<i>Stenella longirostris</i>		19			2						1				22				
<i>Sousa chinensis</i>		1													1				
<i>Lissodelphis borealis</i>		1													1				
<i>Delphinus delphis</i>		7								1					8				
<i>Delphinus capensis</i>		7										1			8				
<i>Delphinus sp.</i>															1				
Phocoenidae	<i>Neophocaena phocaenoides</i>		9	1	1	1					1			1		15			
	<i>Phocoena phocoena</i>		1													1			
	<i>Phocoenoides dalli</i>															1			
	<i>Dugong dugon</i>															3			
Sirenia	Dugongidae		1		2											1			
Carnivora (Pinnipedia)	Otariidae	<i>Callorhinus ursinus</i>									1					1			
		<i>Zalophus californianus</i>												1			1		
Total number of specimens				6	303	11	23	13	2	1	5	6	1	9	2	5	1	2	390

* For *B. edeni*, *B. brydei* and *B. omurai* (*B. sp.*) further investigations are necessary.

1. National Taiwan Museum (NTM), Taipei

The museum now houses several marine mammal specimens inherited from its antecedent museum originally built in 1908. The marine mammal specimen collection was moved to a nearby building for storage. Re-organization of old specimens are under way. Marine mammal specimens are maintained jointly by Zoology and Palaeontology departments. We had opportunities to take a look at a *Dugong* specimens (a taxidermy and a mounted skeleton probably prepared from one individual), and several large whale skeletons. The *Dugong* skeleton and skin specimen was taken from an individual captured off Camiguin Island (Babuyan Islands) on 25. Mar. 1937, transported to Taiwan and dissected by Aoki *et al.* (1938). It is a female *Dugong dugon* with 238cm body length. It is also mentioned that some visceral organs were kept in formalin at the department of zoology, Taipei Imperial University (present National Taiwan University). Baleen whale skeletons are consisted of three mandibles possibly from two balenopterid individuals, one broken skull and a scapula. The scapula is that of *Megaptera novaeangliae*.

2. National Museum of Natural Sciences (NMNS), Taichun

The museum houses probably the largest marine mammal specimen collection in Taiwan, *i.e.* about 300 marine mammal specimens. Major portion of the specimens consisted of skeletons are preserved in an excellent condition. Specimens preserved were mostly collected by the efforts of National Taiwan University and Taiwan Cetacean Society. Some of the important specimens were carefully prepared by Mr. Yu-Chen Yeh. Data on the specimens are basically maintained by PC based database management system Microsoft Access (Fig. 1).

Among the specimens are a few balenopterid whale skeletons of stranded individuals. These were not identified and should be investigated to determine their systematic status (Fig. 2).

3. College of Life Science, National Taiwan University/Taiwan Cetacean Society, Taipei

Several marine mammal specimens are on exhibit at the ground floor of the building, which is called the 'specimen room', Department of Zoology, National Taiwan University. These are mainly educational specimens for students and also bear some historical significances. Most of

The screenshot shows a Microsoft Access database form titled "標本資料庫" (Specimen Database). The form is divided into several sections with tabs at the top: "新增" (New), "修改" (Modify), "刪除" (Delete), "查詢" (Query), "匯出" (Export), "匯入" (Import), "備註" (Remarks), and "825/6968". The form contains the following fields and data:

- 編號** (Number): 000999
- 登錄號** (Registration Number): 001996
- 暫時號** (Temporary Number): T0000795
- 野地號** (Field Number): BK-9401
- 蒐集日期** (Collection Date): 1994/12/22
- 入館日期** (Museum Date): 1994/12/22
- 入館狀態** (Museum Status): 屍體
- 標本採集來源** (Specimen Source): 雲月灣宜蘭縣
- 日期地點** (Date/Location): 1994/12/22
- 提供者** (Provider): 周運香 國立台灣大學動物系
- 鑑定** (Identification): 學名: Balaenoptera acutorostrata 小鬚鯨
- 鑑定日期** (Identification Date): 11
- 標本製成** (Specimen Preparation): 年齡: 不詳, 成體, 幼體, 胎兒; 性別: 不詳, 雌, 雄
- 保存法** (Preservation Method): 無, 酒精, 其他
- 標本內容** (Specimen Content): 頭骨, 軀幹, 尾
- 模式標本** (Type Specimen): 無, 全標, 副標, 新標
- 標本等級** (Specimen Grade): A, B, C
- 標本狀況** (Specimen Status): 正常, 受損, 註銷
- 製成者** (Prepared By):
- 製成日期** (Prepared Date): 1994/09/24
- 測量箱類別** (Measurement Box Category): 鯨, 非鯨
- 備註** (Remarks): 幼鯨, 蘭溪, 台大, BK-9401, 淡水號62

At the bottom of the form, there is a note: "請先儲存本筆資料後,再填寫測量箱" (Please save this data first, then fill in the measurement box) and "若未先儲存本筆資料,測量箱按鈕不會出現" (If you haven't saved this data first, the measurement box button will not appear).

Fig. 1. Database system built by Access (Microsoft Access) in National Museum of Natural Sciences. Virtually all specimens preserved can be searched by computer terminals.



Fig. 2. A skull of *Balaenoptera acutorostrata* (NMNS 999) kept in National Museum of Natural Sciences.

the specimens were collected before the World War II. Among the specimens collected by Japanese researchers were two of the *Dugong dugon*, and one *Kogia breviceps* on all of which Hirasaka (1932, 1933a, b, 1937) gave relevant descriptions. Two of the mounted skeleton of cetaceans are *Balaenoptera acutorostrata* and *Globicephala macrorhynchus*. These two were prepared in Shimazu specimen company, Japan probably from hunted carcasses.

Other group of specimens are collected by the university staffs in joint operation with members of Taiwan Cetacean Society. Specimens include skeletons, skin samples for DNA analyses, stomach contents, and so on. Cetacean studies of various aspects have been carried out on these specimens. Some of the specimens here are utilized for the educational activities of Taiwan Cetacean Society.

4. National Taiwan Ocean University (NTOU), Keelung

23 skeletal specimens, most of which consisted of the skull and mandibles, are kept in this University. These were collected by Prof. Kazuhiro Mizue, during the period between May 1987 and May 1988, mainly at Nan Fang Ao fishing port. Most of the skull specimens accompany color photo prints of the animal when they were collected. This small collection was chosen as a test case in building a database on personal computer including graphic files of both external morphology and osteology (Fig. 3).

5. National Cheng Kung University (NCKU), Tainan

A small but important Cetacean specimen collection is at the Department of Biology, with

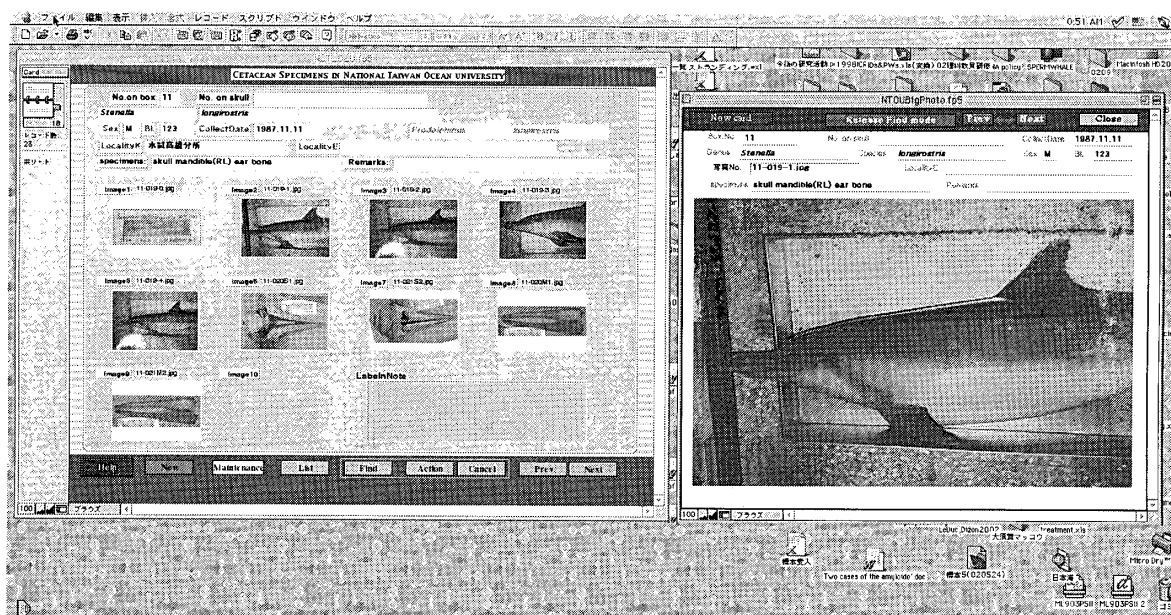


Fig. 3. A database made by File Maker Pro on cetacean specimens collected by Dr. K. Mizue preserved in National Taiwan Ocean University. The database include images both of external morphology and skull morphology.

close co-operation with National Taiwan University and Taiwan Cetacean Society. Specimens collected are kept in the Department of Zoology, and some of them are on exhibit as mounted whole skeletons. Among the specimens are a partial skeleton of a baleen whale *Balaenoptera* sp. with fragmented skull, mounted skeleton of *Mesoplodon densirostris* and so on. Another mounted whole skeleton of Bryde's whale is on exhibit in a separate campus of this university.

6. National Pingtung University of Science & Technology (NPTU), Pingtung

Department of Anatomy of this university has a specimen hall where mounted skeletons including a rough-toothed dolphin (*Steno bredanensis*) and a Risso's dolphin (*Grampus griseus*) are exhibited for the educational purpose. Most of the pathological investigations on the stranded cetaceans are made by staffs from this university.

7. Tainan County Museum of Natural History (TCNMH), Tso-Chen

This private museum mainly exhibit fossil specimens has a skull of the Bryde's whale and several cetacean skeletons.

8. Taiwan Fishery Research Institute (TFRI), Keelung (TFRIK) and Tungkang (TFRIT)

The Institute has cetacean taxidermy specimens of all together 10 specimens in Keelung and Tungkang branches.

9. Kinmen National Park (KMNP)

This National Park recently started to exhibit a mounted whole skeleton of *Balaenoptera edeni*. The skeleton was prepared from a carcass found stranded in Little Kinmen Island in 2001.

10. Ocean World (OWAQ), Yeh-Liu

Ocean World was the only aquarium where cetaceans were kept until very recently. Several

cetacean skeletons including one minke whale (*Balanoptera acutorostrata*) are preserved here mainly for exhibit. The aquarium is one of the oldest organizations where stranding responses, including rescuing live strandings and collecting dead carcasses, were carried out.

11. Peng-Hu aquarium (PHAQ), Pai-Sha

This aquarium has several cetacean skeletons mounted and on exhibit. A whole skeleton with broken skull of a baleen whale (*Balaenoptera* sp.) is also kept. This aquarium also has been actively involving stranding responses.

12. National Museum of Marine Biology and Aquarium (NMMBAQ), Kentin

Major portion of this organization is an aquarium. It has some cetacean skeletons and a small exhibit on cetology. This aquarium is taking stranding responses seriously as well and is prepared for action.

13. Bureau of Culture/Peng-Hu Local government (BCPLG), Makung

A mounted whole skeleton of *Balaenoptera brydei* is exhibited here. The skeleton is on exhibit in a hall specially build for this specimen.

14. Temple specimens (SWT), Tainan

Asian temples sometimes keep important natural history specimens, such as Buddhist temples in Vietnam and Thailand (Andersen & Kinze, 1999). In Taiwan, it is not an ordinary case, but there is a temple where two sperm whale skeletons, supposedly a mother and a calf, are exhibited. The animals were found stranded in 1992. They were secured and prepared for religious purposes, but the specimens are very carefully prepared and in excellent condition.

Conclusion

Cetology studies in Taiwan was initiated by researchers from abroad. Specimens for natural history studies were collected in several institutions. Cetacean carcasses, especially larger ones are often attract public interests and are kept not for scientific purposes. These skeletons or taxidermies are also often utilized as scientific specimens. It is very important for a society to keep such subjects that are demanding financial, logistic and human resources. These efforts will extend people's understanding on the environment surrounding human activities.

Infrastructures such as excellent specimen preparators or whale/dolphin watching industry with good interpreters are also important elements to promote marine mammal studies in Taiwan.

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Appendix

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