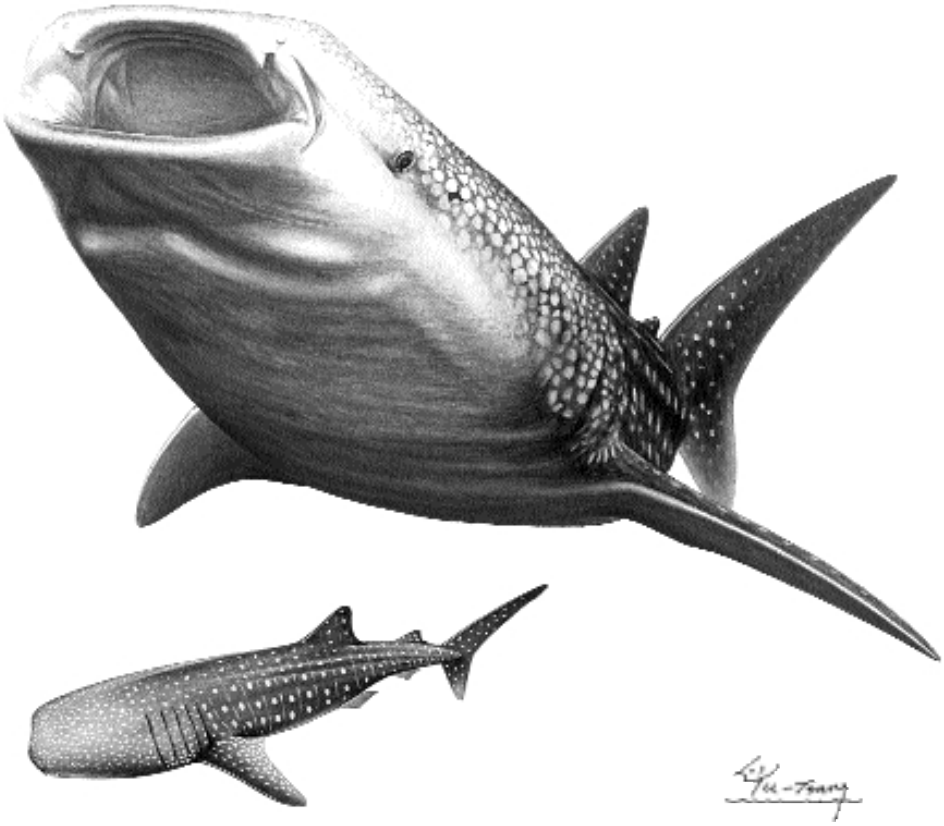
Management and Trade of Whale Sharks in Taiwan

Vincent Y. Chen & Marcus J. Phipps

A TRAFFIC East Asia REPORT
September 2002



台北野生物貿易研究委員會
TRAFFIC EAST ASIA-TAIPEI

The David and Lucile Packard Foundation

Published by TRAFFIC East Asia-Taipei.

First published in 2002

Suggested citation:
Chen, V.Y & Phipps, M.J. (2002). Management and Trade of Whale Sharks in Taiwan. TRAFFIC East Asia-Taipei.

ISBN 957986282-6

Front cover illustration: Whale Sharks (*Rhincodon typus*)

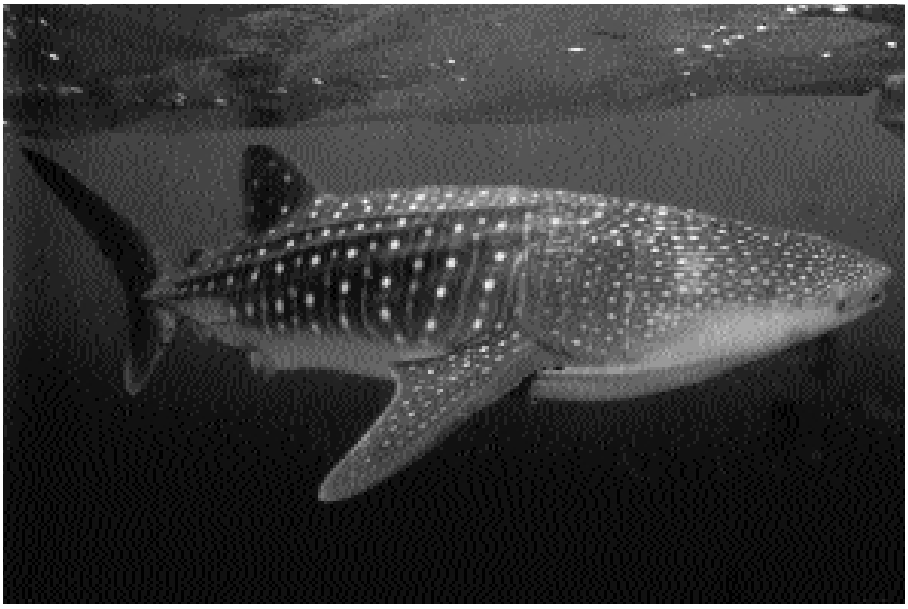
Illustration credit: Cheng, Yi-Lang

Layout and design: Lin, Yu-Cheng

Publisher:
TRAFFIC East Asia-Taipei
P.O. Box 7-476
Taipei, Taiwan 106
Tel: (886) 2-2362-9787
Fax: (886) 2-2362-9799
E-mail: treatai@ms1.hinet.net
Web site: http://www.wow.org.tw

Management and Trade of Whale Sharks in Taiwan

Vincent Y. Chen & Marcus J. Phipps



IUCN Shark Specialist Group

September 2002

CONTENTS

Acknowledgements i
Executive Summary ii
Introduction 1
Background 1
Biology of the Whale Shark 1
Taiwan 's shark fishery 1
Conservation status of the Whale Shark 2
International measures 2
National measures 3
Methods 6
Analysis of catch and trade data 6
Trade and market surveys 6
Literature review and interviews 6
Results 7
Catch data 7
International trade 9
Newspaper reports 9
Market surveys 10
Processing and distribution of Whale Shark products 10
Landing prices for whole sharks 10
Whale Shark fin 12
Whale Shark meat 12
The market for chilled and frozen Whale Shark meat 12
Taipei's wholesale market and prices 12
Smoked Whale Shark meat 14
Restaurants 15
Discussion 16
Catch data 16
Market data 16
Comparing catch and market data 17
Implications for Taiwan 's Management of Whale Shark 18
Strengthening the regulatory system 18
FAO-NPOA guidelines 19
International co-operation 19
Management options 20
Other uses of Whale Shark 20
Conclusions and Recommendations 21
References 22
Appendix I: Life history parameters of the Whale Shark 24
Appendix II: Whale Shark harvest data 25

ACKNOWLEDGEMENTS

This report was made possible by funding provided by the Fisheries Administration, Council of Agriculture, Taiwan and the David and Lucile Packard Foundation. The authors would like to thank Joyce Wu and Rita Chang (TRAFFIC East Asia), Bruce Lee (consultant to (TRAFFIC East Asia) for his field survey work, and Dr. Kwang-Ming Liu and Dr. Shoou-Jeng Joung for their research advice and provision of catch data. Mr. Denny Chen and Zhen-Rong Yang facilitated interviews with fishermen. Ms Hui-Shu Chiang from Fisheries Administration provided market data and Shelley Clarke provided Whale Shark fin data. Dan Chamberlain assisted with editing the English manuscript.

The authors also would like to thank Sarah Fowler (IUCN/SSC Shark Specialist Group), Dr. Fumihito Muto (TRAFFIC East Asia), and Dr. Craig Kirkpatrick (TRAFFIC East Asia) for their helpful comments on the original manuscript. The authors gratefully acknowledge the assistance of Dr. Kwang-Ming Liu, Dr. Shoou-Jeng Joung, Dr. Yi-Ya Liao, Mr. Zong-Shan Lin and Mr. Lin Chen (Chairman, Taiwan Set Net Association) in reviewing the draft report.

Finally, the authors would like to express their gratitude to Mary Lack (Shellack Pty. Ltd.) and Glenn Sant (TRAFFIC Oceania) for their time and valuable technical input to the report. Their expertise and insights were greatly appreciated.

EXECUTIVE SUMMARY

The Whale Shark *Rhincodon typus* is the largest fish on earth. It is a large, plankton-feeding, highly migratory shark distributed widely in tropical and warm temperate seas. The species is currently listed in the 'vulnerable' category of IUCN-the World Conservation Union's *2000 Red List of Threatened Animals.* A proposal to list the species in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora was defeated in 2000 despite achieving a simple majority in favor largely because of a lack of biological and trade information.

Earlier work by TRAFFIC in co-operation with researchers at National Taiwan Ocean University (Chen et al., 1997) identified Taiwan as a major, and possibly the largest, market for Whale Shark meat. Trade is supplied both by Taiwan's harvest and imports from other countries. The current study reports the results of a comprehensive survey of Taiwan's Whale Shark trade and markets and recommends initiatives to improve management of Taiwan's Whale Shark fishery and monitoring of both catch and trade.

In 2001, TRAFFIC East Asia-Taipei carried out market and trade surveys of Whale Shark meat in 14 counties and cities around Taiwan. The survey found that:

- most Whale Shark landings take place on the island's Pacific Ocean seaboard;
- the annual volume of Whale Shark meat sold through the Taipei fishery product wholesale market more than doubled between 1998 and 2000, reaching 60 t in 2000;
- the average wholesale price decreased dramatically from TWD 231.8/kg (USD 6.93/kg) in 1998 to TWD 71.4/kg (USD 2.03/kg) in 2001;
- Taipei's Central Market is the only market in Taiwan with a specific statistical code to record data on Whale Shark meat trade;
- nearly 5% of stalls selling fish, mostly concentrated around recreational fishing harbours, were found to carry Whale Shark meat; and
- Whale Shark dishes were more likely to be available in Taiwanese and Japanese seafood restaurants and in the northern part of the island.

In July 2001 the Taiwan government introduced a Whale Shark Harvest Reporting System and in March 2001 established commodity codes specific to Whale Shark to monitor Taiwan's trade in this species. Taiwan intends that this information will provide the basis for the development of a Whale Shark management system that takes into account both the conservation needs of the species and the economic needs of fishers.

These monitoring systems have not been in place long enough to give an accurate picture of trends in catch, trade and consumption. However, this study suggests that:

- there has been a decline in catch compared to previous estimates;
- Whale Shark taken by Taiwanese fishers are relatively small in size;
- there is a significant gap between the data collected by the official catch monitoring system and the quantity of product on the market that cannot be explained by reported import statistics;
- there is reason to believe that catch is under-reported; and
- significant quantities of Whale Shark meat may be imported through unofficial channels.

While catch data suggests a possible decline in catch the results of the survey of Taiwan's markets for Whale Shark meat indicate that there is significantly more Whale Shark meat on the market than can be accounted for by reported domestic catch and imports. This creates uncertainty as to whether domestic catch has in fact declined and lends weight to the possibility that catch is being under-reported. Alternatively, or perhaps in addition to under-reporting of catch, it is possible that the official import data under-reports the total quantity of imports flowing onto the domestic market in Taiwan.

It is important that the apparent reduction in catch of Whale Shark is explained and that the quantity of Whale Shark meat on Taiwan's market can be accounted for through the official catch and trade monitoring systems. The appropriate management for Whale Shark in Taiwan will depend in large part on the reasons for the apparent decline in catch and the explanation for the gap between market availability and official catch and import data.

The following recommendations are directed primarily to the Fisheries Administration, Council of Agriculture (unless otherwise specified) for the management and conservation of Whale Sharks in Taiwan:

1. Develop constructive dialogue between relevant government authorities, proponents of Whale Shark conservation (including domestic and international conservation NGOs) and the fishing community to

encourage development of a more sustainable Whale Shark fishery. Stakeholders in the fishing community include the Taiwan Set-Net Association and local fishermen's associations, particularly in the counties of Ilan, Taitung, Taichung, Hualien, and Penghu where Whale Shark harvest commonly occurs.

2. Improve the Whale Shark harvest and trade monitoring systems:

a. Undertake further promotional and educational seminars for fishermen to ensure they understand the purpose of the Whale Shark Harvest Reporting System and to overcome the perception that the System is designed to detect illegal fishing of Whale Shark.

b. Develop and provide clear guidelines for fishermen to assist them to provide accurate and comprehensive information to the Whale Shark Harvest Reporting System.

c. Conduct further research on techniques to identify Whale Shark products, such as meat and fin, so as to increase the capacity of enforcement staff of Customs and the Coast Guard to detect these products.

3. Improve the data on Whale Shark collected at wholesale fish markets by encouraging these markets to add a specific category item for recording sales data (volume and price) for Whale Shark and incorporate this data into the established monitoring system.

4. Investigate the claims that imported Whale Shark meat is entering Taiwan through unofficial channels and, if necessary, introduce measures to address this.

5. Initiate the development of a Shark Assessment Report and a National Plan of Action for Sharks (NPOA-Sharks) as recommended in the Food and Agriculture Organization's International Plan of Action for Sharks. The development of measures to identify and protect vulnerable species, such as the Whale Shark, would form part of the NPOA-Sharks.

6. Undertake a full evaluation of management options for Whale Shark in Taiwan. This evaluation should consider both the ecological and economic impacts of the options.

7. Review the merits of alternative uses of Whale Shark, such as ecotourism, by conducting a feasibility study.

8. Promote international co-operation for the conservation of the Whale Shark. This co-operation may involve research, for example, tagging studies at National Taiwan Ocean University to identify migration routes, and the collation and analysis of catch and trade data among range and consumer states.

INTRODUCTION

Previous work by TRAFFIC (Chen et al., 1997) identified Taiwan as a major consumer of Whale Shark meat. This, together with increasing international concern for the sustainability of harvests of this species, prompted TRAFFIC East Asia - Taipei to undertake a comprehensive survey of Taiwan's Whale Shark fishery, trade and markets. In this report the survey results are presented and analysed, the current Taiwanese systems for monitoring catch and trade are evaluated and recommendations are made for improvement of the monitoring and management of Whale Shark.

BACKGROUND

Biology of the Whale Shark

The Whale Shark *Rhincodon typus* is the largest fish on earth. A Whale Shark specimen 20 m long and weighing 34 t has been recorded in Taiwan (Chen et al., 1997). In February 1999, a Whale Shark 17.5 m long and weighing 15 t was caught in the Arabian Sea off the coast of Veraval, India (Hanfee, 2001).

It is one of three known filter-feeding sharks feeding on plankton, small fishes and squid. It has a 'checkerboard' pattern on its body and a wide, flat head that is easily distinguished from other sharks. The Whale Shark is pelagic and inhabits tropical and subtropical oceans, ranging from 30° north latitude to 35° south latitude (Colman, 1997). The Whale Shark is highly migratory and is known to follow schools of Golden Trevally *Gnathanodon speciosus* (Waller, 1996) or Skipjack Tuna *Katsuwonus pelamis* (F. Muto pers. comm. to V. Chen, October 2001).

Unlike other predatory sharks, the Whale Shark is known to be a slow swimmer. Its huge adult body size suggests that, apart from humans, its natural enemies in the wild probably consist mainly of hunting whales. In July 1992, an eight metre Whale Shark was observed being hunted and preyed upon by two Killer Whales *Orcinus orca* in the Gulf of California, Mexico (O'Sullivan and Mitchell, 2000).

The latest research conducted by the USA and Malaysia using Whale Shark satellite tracking indicates that the Whale Shark: begins to migrate at a length of 5-15 m; the adult can swim 24 km/day in the top layer of the ocean; can migrate 2152 km in 97 days; and has a vast home range. This mobility suggests that conservation of the Whale Shark will require the co-operation of many countries (Eckert et al., 2000).

The Whale Shark is ovoviviparous, and can carry more than 300 embryos in a litter, more than any other elasmobranch (Joung et al., 1996). It grows rapidly after it is born but growth slows after the shark reaches sexual maturity. A newborn is about 58 cm long and can reach 143 cm after 143 days (Chang et al., 1997). An aquarium in Okinawa, Japan reported an annual growth rate of 20-30 cm in a four metre Whale Shark (Uchida et al., 2000) while an aquarium in Penghu, Taiwan reported that a three metre, 350 kg male Whale Shark grew to 3.3 m and 505 kg (a 144% increase in weight) over 102 days (Hsu et al., 2000).

Significant uncertainty remains about the life history of the Whale Sharks. Fowler (2000) has recalculated the life history parameters of the Whale Shark recorded by FishBase (2002) based on the 20 m body length recorded in Taiwan. A comparison of the two calculations is provided in Appendix I. Fowler's re-calculations suggested a much longer life span, a higher age at first maturity and a greater length at maturity.

Taiwan's shark fishery

During the 1990s, Taiwan's fisheries statistics indicate that Taiwan's annual combined coastal and distant-water shark catch ranged from 39 000 t to 74 000 t (Liu, 2001). The Capture Production database for sharks, rays, and chimaeras of the United Nations Food and Agriculture Organization (FAO, 2002) indicates that Taiwan's national shark catch in 2000 was 45 923 t, the fifth highest in that year after Indonesia, Spain, India and Pakistan. However Taiwan's contribution to world shark catch has halved over the decade to 2000 falling from 11% in 1990 to 5.5% in 2000 (FAO, 2002).

Sharks comprised the eighth highest fisheries catch by volume in Taiwan in 2000 (Council of Agriculture (COA) Fisheries Administration, 2001). Despite the significant contribution to total catch and the variety of shark products used (meat, fins, intestines, cartilage, teeth) shark catch data are only broadly categorised as shark (large sharks), young shark (small sharks), smoked shark meat and shark fins.

Species-specific shark catch and trade data are generally not available.

Most Whale Sharks caught in Taiwan are found close to the coast. The slow, surface swimming Whale Shark is a relatively easy catch for fisherman regardless of the fishing gear used. Even a small harpoon can be used to catch a Whale Shark. The harpoon is thrown to penetrate the Whale Shark's mouth as it feeds. If the fish is too large for the fishing boat to land, a radio call is made to request assistance.

Chen et al. (1997) reported on a survey of Taiwan's Whale Shark harvest in 1996 estimating an annual catch of 272 Whale Sharks (158 from set nets and 114 from harpooning). That report also recorded a decline in Whale Shark catch in some areas, such as the Penghu Archipelago, where annual catch had decreased from about 50 to ten over a ten-year period.

Conservation status of the Whale Shark

Compared to other fishes, shark species grow more slowly, mature later, produce fewer offspring and live for a longer time. These characteristics make sharks vulnerable to over-fishing and, once depleted, they recover more slowly than do other fishes. Given it's biological characteristics the Whale Shark is particularly vulnerable to overexploitation and has been the focus of much recent conservation concern.

International measures

IUCN's Red List of Threatened Species

IUCN- The World Conservation Union is a major international conservation organisation, members of which include States, governmental agencies, non-governmental organisations, and individual experts. IUCN regularly publishes the Red List of Threatened Species that evaluates the conservation status of wild species. The IUCN's Species Survival Commission defines three levels of 'threatened' - Vulnerable (least threatened), Endangered and Critically Endangered (most threatened). The IUCN conservation status of the Whale Shark was changed from 'Data Deficient' to 'Vulnerable' in 2000 (Hilton-Taylor, 2000).

CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established to protect wildlife species from overexploitation due to international trade. There are currently 159 Parties to the Convention, among which over 90 are Whale Shark range states (Fowler, 2000). CITES operates by requiring these Parties to regulate international trade in species listed in its three Appendices. Species threatened with extinction by international trade are listed in Appendix I of CITES. Appendix I species are strictly regulated and are not allowed to be commercially traded internationally. Appendix II includes all species, which, although not currently threatened with extinction, may become so unless their trade is subject to regulation. Before trade in Appendix II species is allowed to proceed, a CITES permit is required. Species in these two Appendices may only be added or deleted by a two-thirds majority vote at the Conference of Parties (CoP) of CITES. Only a few marine fishes are currently listed in the CITES Appendices.

CITES Resolution Conf. 9.17 The Status of International Trade in Shark Species expressed concern that some shark species are heavily utilised for their fins, skins and meat. It noted that levels of exploitation in some cases are unsustainable and may be detrimental to the survival of certain species, that sharks were not specifically managed or conserved by any multilateral or regional agreement for the management of marine fisheries. It expressed concern that the international trade in parts and products of sharks lacked adequate monitoring and control. The Resolution directed the CITES Animals Committee to compile and review existing data on the biological and trade status of shark species subject to international trade, and to prepare a discussion paper on these data prior to the 10th CoP in 1997. In addition, Parties to CITES, FAO and other international fisheries management organisations were asked to establish programmes to provide biological and trade data in time for the 11th CoP in 2000 (IUCN Shark Specialist Group and TRAFFIC, 2002).

At the eleventh CoP held in Kenya in 2000 the USA proposed listing of the Whale Shark in Appendix II. Although around half of the Parties present agreed with the proposal (51 in favour, 40 against, and 13 abstentions) the two-thirds majority required was not reached (Anon., 2000).

The Bonn Convention

The Convention for the Conservation of Migratory Species of Wild Animals (known as the Bonn Convention) came into force in 1983. The Convention seeks international co-operation through agreements to study and protect species listed in its two appendices. A species qualifying for Appendix I listing must be at risk of extinction throughout all, or a portion, of its range. Parties to the Convention that are also range states to such species are then subject to strict conservation obligations. Migratory species qualify for Appendix II listing if they have an unfavourable conservation status and if their successful conservation will depend on international agreements or if their conservation status would benefit significantly from international co-operation. An Appendix II listing does not impose any direct obligations on Parties to the Convention but the Convention specifies that Parties "shall endeavour to conclude Agreements covering the conservation and management of migratory species included in Appendix II".

In 1999, the Whale Shark was listed on Appendix II of the Bonn Convention however to date no agreements have been developed in relation to this species.

United Nations Fish Stocks Agreement

The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea (UNCLOS) of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (the Fish Stocks Agreement) came into force on 11 December 2001. The Fish Stocks Agreement sets out principles for the conservation and management of straddling and highly migratory fish stocks, based on the precautionary approach and the best available scientific information. The Agreement gives expanded powers to port States to enforce proper management of fisheries resources.

The Whale Shark is included as a highly migratory species in Annex I of UNCLOS. The Fish Stocks Agreement requires that range States and other States whose nationals fish for highly migratory species should co-operate to ensure conservation and promote the objective of the optimum utilization of fisheries resources both within and beyond their exclusive economic zones.

FAO 's International Plan of Action for Sharks

In 1999, as a result of concerns over the possible over-exploitation of shark resources, members of the FAO agreed on an International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) (FAO, 1999). The IPOA-Sharks calls on FAO member states to develop, voluntarily, a national plan of action (NPOA) by 2001. The IPOA-sharks specifies that an NPOA should aim to:

1. Ensure that shark catches from directed and non-directed fisheries are sustainable;
2. Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long term economic use;
3. Identify and provide special attention in particular to vulnerable or threatened shark stocks;
4. Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between member States;
5. Minimize unutilized incidental catches of sharks;
6. Contribute to the protection of biodiversity and ecosystem structure and function;
7. Minimize waste and discards from shark catches in accordance with article 7.2.2.(g) of the Code of Conduct for Responsible Fisheries (for example, requiring the retention of sharks from which fins are removed);
8. Encourage the full use of dead sharks;
9. Facilitate improved species-specific catch and landings data and monitoring of shark catches;
10. Facilitate the identification and reporting of species-specific biological and trade data.

However by May 2002 only 29 States have reported any progress with IPOA implementation. Of these, just five States have Shark Assessment Reports or NPOAs available for public consultation and review. Only one of the 18 major shark fishing nations has an Assessment Report (draft) and only two have completed NPOAs (IUCN Shark Specialist Group and TRAFFIC, 2002).

National measures

Although the size of the Whale Shark population globally is not known, the species has been reported as sighted in the waters of about 124 countries (Fowler, 2000). A number of countries, including the Maldives, the Philippines, Thailand, India, the USA and Australia have announced prohibitions on Whale Shark harvesting or have introduced some form of regulation (see Table 1).

Taiwan's regulatory framework

The Whale Shark fishery and trade in Taiwan are regulated in a general sense by the Fisheries Law, the Wildlife Conservation Law and the Foreign Trade Act. Measures specific to Whale Shark are the Whale Shark Harvest Reporting System and the Monitoring System for International Trade Quantities.

The Fisheries Law

Taiwan 's Fisheries Law (enacted 1929, amended 1991) includes eight chapters: General Principles; Fishing Rights; Directed Fisheries; Recreational Fisheries; Conservation and Management; Fishery Development; Penalties; and Miscellaneous. The Law appoints the COA as the fishery management authority and provides for it to implement measures to:

- Limit or prohibit the harvest of marine plants and animals;
- Limit or prohibit sale or possession of aquatic plants and animals and their products;
- Limit or prohibit fishing gear and methods; and
- Limit or prohibit fishing in certain grounds or periods.

The Fisheries Law also provides for fishermen to be required to submit catch data and provides for penalties to be imposed for violation of the provisions of the Law. The Fisheries Administration announced in July 2002 that it will use the provisions of the Fisheries Law to implement a catch limit of 80 Whale Shark in 2002/03

The Wildlife Conservation Law

The Wildlife Conservation Law (WCL) (enacted 1989, amended 1994) offers much broader coverage than the Fisheries Law as it also regulates international trade and allows for habitat protection. It might be applied to conserve or manage the Whale Shark 's habitat, harvest, domestic and international trade, possession or display. A Schedule of Protected Species of fauna is appended to the WCL. The Law classifies wild animals as either Protected Species (Endangered Species, Rare and Valuable Species and Other Conservation-Deserving Wildlife) or General Wildlife. In practice the level of protection extended to the three categories of Protected Species is almost equal regardless of their conservation status.

Penalties for violations of the WCL are higher than those imposed under the Fisheries Law.

Table 1. National regulations on Whale Shark harvesting

State	Action, effective date	Document no.
Belize	habitat protection, 18 May 2000	Decree No. 68 of 2000
Honduras	ban, 28 October 1999	N/A
Maldives	ban, 24 June 1995	FA-A1/29/95/39
Philippines	ban, 25 March 1998	Fisheries Administrative Order no. 193
Thailand	ban, 28 March 2000	Section 32 (7) of the Fishing Act B.E. 2490
India	ban, 28 May 2001	Listed under Schedule I of the Wildlife Act
USA	ban, Eastern seaboard	N/A
Australia	Protected in Commonwealth waters (from 3-200nm) and waters of Western Australia and Tasmania	N/A

The Foreign Trade Act

The Foreign Trade Act (enacted 1993, amended 2002), administered by the Board of Foreign Trade, Ministry of Economic Affairs (BOFT, MOEA) provides for restriction of exports and imports for reasons including implementation of international treaties and environmental or ecological protection. Taiwan implements actions consistent with CITES decisions under this Act. The list of goods subject to restriction as a result of CITES listings is usually updated after each CITES CoP. The Act specifies penalties for violation of its provisions.

Monitoring systems

The concerns of Taiwan's official fishery authority, the Fisheries Administration of COA, about the utilization of shark resources led to the initiation of a series of studies on shark ecology and resources in 1995 (Shieh, 2002). In October 2000, in response to calls for Whale Shark conservation action from a number of sources including TRAFFIC, National Taiwan Ocean University (NTOU) and other members of the international conservation community, the Fisheries Administration held a meeting of stakeholders to discuss the management of the Whale Shark fishery. The meeting agreed on the need to set up systems to monitor Whale Shark catch and international trade. As a result the Whale Shark Harvest Reporting System was implemented by the Fisheries Administration, under the Fisheries Law, on 1 July 2001. The system requires that any catch of Whale Shark be reported to the Fisheries Administration and the Laboratory of Fishery Resources, NTOU. The system collects data including: date of harvest; catch and landing position; position of set net; fishing method; gender, length and weight of Whale Shark taken; other target fishes; sea conditions; name of fishing boat; name of owner; and name and telephone number of the person providing the details.

Prior to the introduction of the Harvest Reporting System the Fisheries Administration organised a series of four seminars to introduce the new system to fishermen at four major Whale Shark landing harbours in June 2001. These seminars were led by the Fisheries Administration with support from shark researchers from NTOU. Participants included fishermen, fisheries officers from relevant local governments, staff from local fishermen's associations and TRAFFIC East Asia-Taipei.

The principal objectives of the seminars were to promote support for the Harvest Reporting System and convey the message that the System was not an attempt to restrict or limit harvest of the Whale Shark. Researchers from NTOU provided general shark fisheries information, addressed the possibility of over-fishing as well as global shark conservation trends and advised of the type of data that would be collected through the Harvest Reporting System.

To improve monitoring of international trade in Whale Shark, the Board of Foreign Trade (BOFT) created seven categories of Whale Shark products under the Common Commodity Code (CCC). The Codes took effect on 22 March 2001. These are the first shark species-specific codes to appear in Taiwan's Customs records (see Table 2).

Landed Whale Shark being transported to fish market.

Zhen-Rong Yang

Table 2. Common Commodity Codes for Whale Shark products

CCC	Description
0302.65.00.10-5	Whale Shark (Rhincodon typus), fresh or chilled
0302.75.00.10-2	Whale Shark (Rhincodon typus), frozen
0304.10.90.80-5	Whale Shark (Rhincodon typus), fillets and meat (whether minced or not), fresh or chilled
0304.20.90.61-6	Whale Shark (Rhincodon typus), fillets or steaks, frozen
1604.19.90.71-2	Whale Shark (Rhincodon typus), whole or in pieces, but not minced, prepared or preserved, frozen
1604.19.90.72-1	Whale Shark (Rhincodon typus), whole or in pieces, but not minced, prepared or preserved, canned
1604.19.90.79-4	Whale Shark (Rhincodon typus), whole or in pieces, but not minced, prepared or preserved

Source: Directorate General of Customs (2001)

METHODS

The current project was carried out between April 2001 and June 2002 and consisted of three components: analysis of catch and trade data; conduct of trade and market surveys; and review of the literature and interviews with participants in the catch and trade of Whale Shark.

Analysis of catch and trade data

The catch data gathered by the Whale Shark Harvest Reporting System were analysed and compared with harvest data collected by TRAFFIC-India (Hanfee, 2001). International trade data collected since the introduction of new trade codes for Whale Shark were also examined.

Trade and market surveys

The availability of Whale Shark at publicly owned marketplaces in large cities and recreational fishing harbours was investigated. A total of 85 marketplaces and harbours including more than 1600 retail seafood stalls were visited. The percentage of stalls with Whale Shark meat and its price were recorded. Telephone surveys were conducted of restaurants to determine the availability and price of Whale Shark meat. A sample of restaurants listed in the yellow pages of Taipei, Ilan and Penghu counties and Taipei, Taichung and Kaohsiung cities was surveyed together with restaurants in 22 recreational fishing harbours identified from the Field Guide of Seafood Restaurants (Chang, 1998). During the course of the study, a number of meat samples was purchased and provided to the Taiwan Fisheries Research Institute for DNA analysis. The results of that analysis are not included in this report.

Literature review and interviews

Relevant documents were collected. Whale Shark fishermen and owners of seafood stalls and restaurants were interviewed, and international Whale Shark researchers were contacted via email to gather up-to-date information. A databank of newspaper headlines relating to Whale Shark in the period 1 January 1996 to November 2001 was assembled from the National Library. The databank includes national and local editions of Taiwan 's five major newspapers: China Times, United Daily News, Economic Daily News, Commercial Times, and Central Daily News.

RESULTS

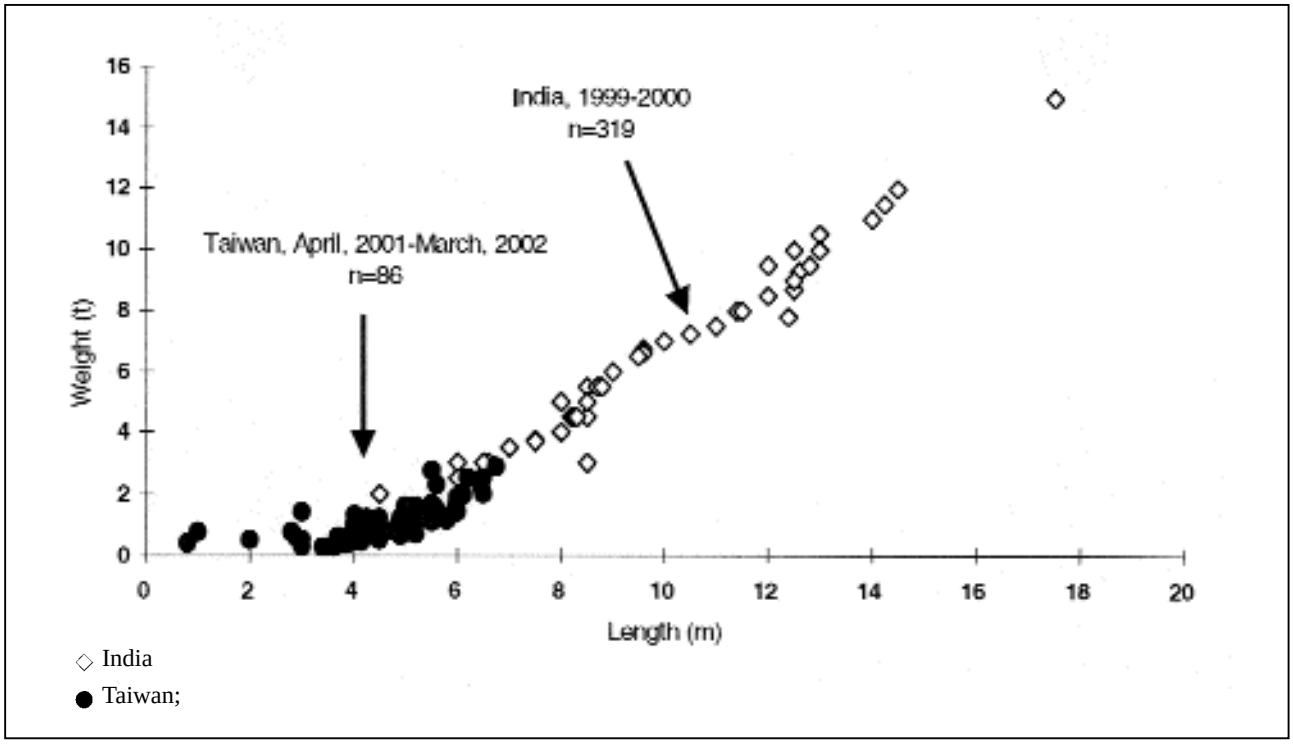
Catch data

Records of the Whale Shark Harvest Reporting System (from July 2001) and harvest data from the Laboratory of Fishery Resources, NTOU indicate a total of 113 catch reports of Whale Shark between January 2001 and March 2002 (see Appendix II). Of these records 94 included weight, 87 included length and 86 both weight and length. The weight records indicated a total catch of 104 876 kg.

All Whale Sharks for which records were provided had a total length of less than seven metres and weighed less than three tonnes. The records indicated an average total length of 4.65 m and an average weight of 1 116 kg. The average size of Whale Sharks harvested around Taiwan was far less than those reportedly harvested in the Arabian Sea off the western coast of India in 1999 and 2000 (Hanfee, 2001) (see Figure 1).

Of the 113 Whale Sharks caught around Taiwan, most (93 fish, 82%) were caught off Taiwan's eastern coast in the Pacific Ocean. The remainder were harvested in the Taiwan Strait (13 fish, 12%) and Penghu Archipelago (seven fish, 6%) (see Figure 2). Forty-four per cent of the Whale Sharks were caught by set net, 36% by harpoon and 20% by other methods such as trawl. The data identify May (22%) and November (18%) as the peak catch months.

Figure 1. Size of Whale Sharks harvested around Taiwan (Jan. 2000-March 2002) and in offshore fisheries at Veraval, India (1999 and 2000)



Source: Hanfee, F. and Fishery Administration, COA

Figure 2. Whale Shark landings in Taiwan by county, January 2001-March 2002 (%).

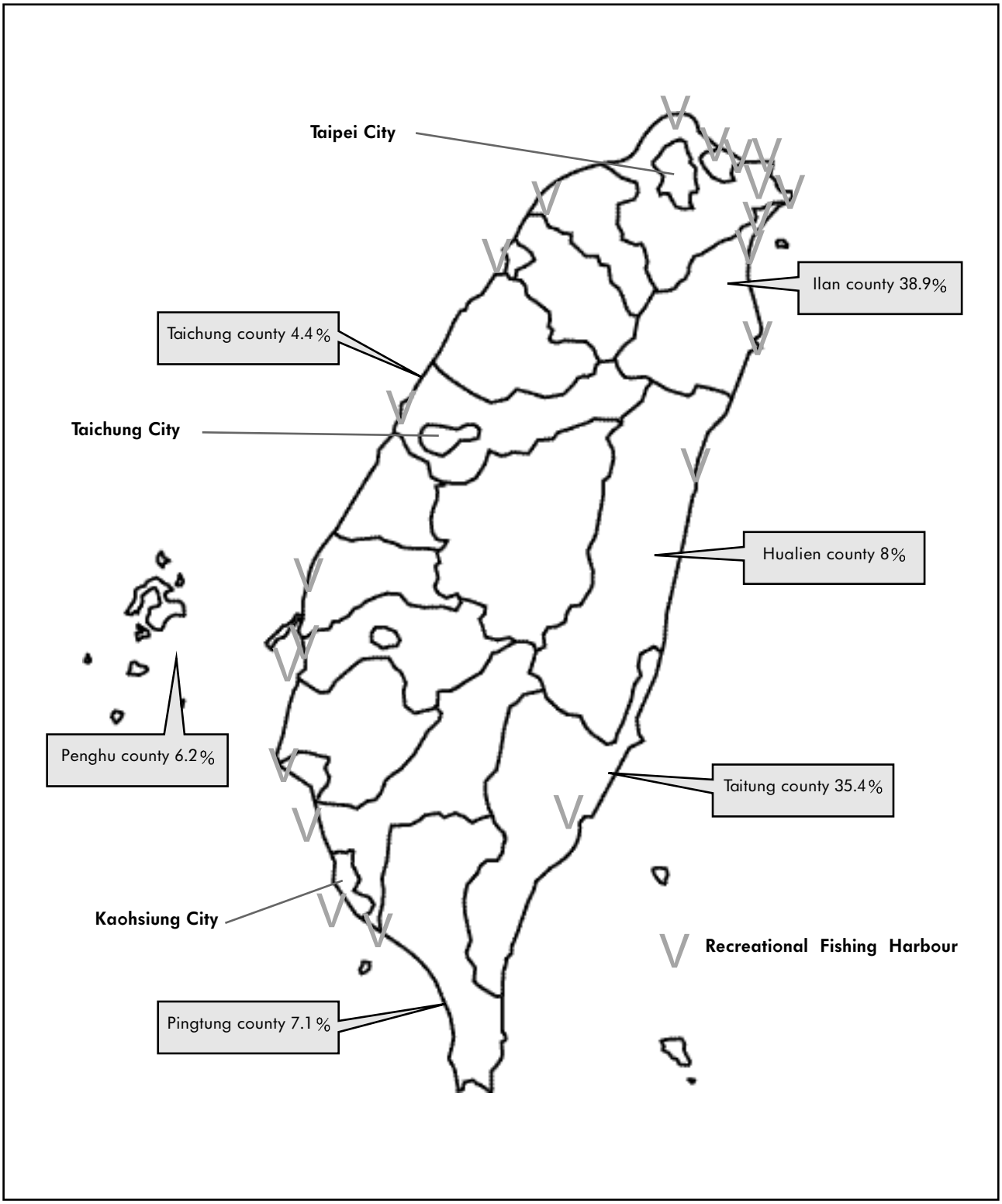
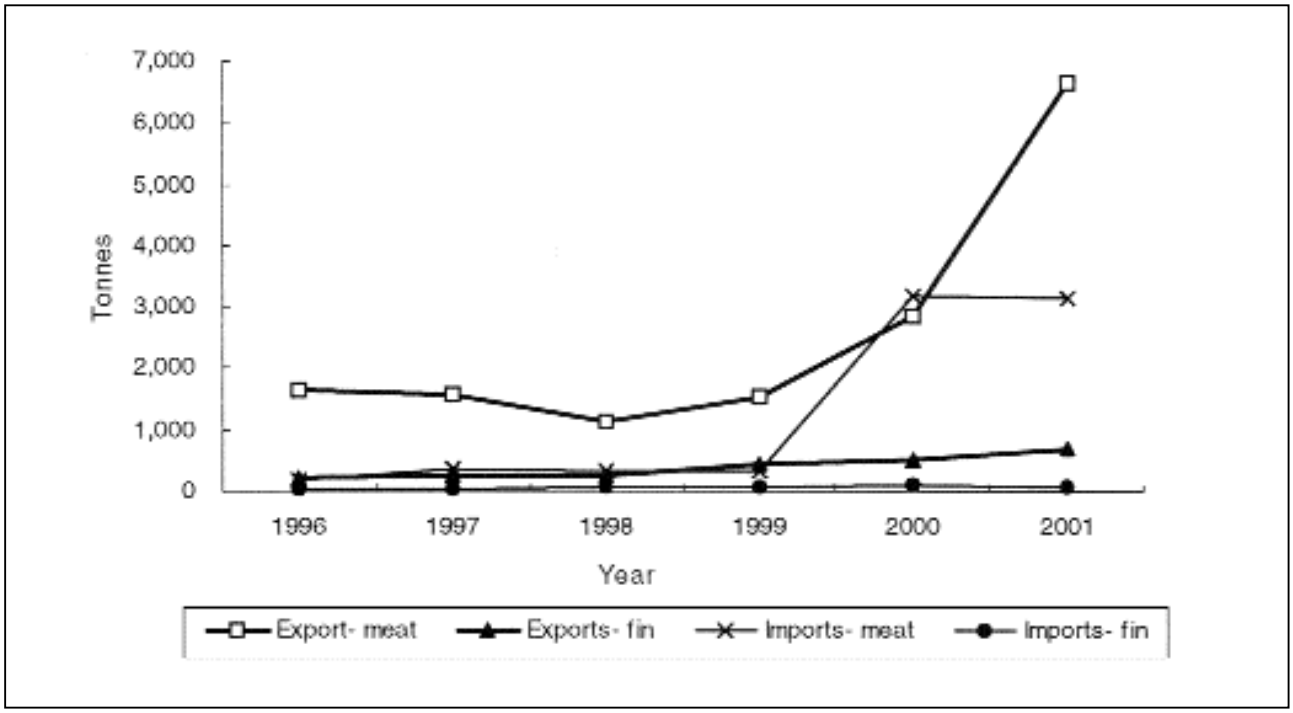


Figure 3. Volume of exports and imports of shark products, Taiwan 1996-2001



Source: Directorate General of Customs, 2001

International trade

Taiwan reports international trade in shark against 13 non-species-specific trade codes for meat, skin and fin products and a further seven codes for Whale Shark products (see Table 2). In general, Taiwan exports more shark meat than it imports. During the 1990s, the amount of shark meat exported varied between 1000 and 2000 t/year. South Korea replaced the USA as the largest importer in 1999 and 2000, accounting for approximately 40% and 27% of Taiwan's exports of shark products in these two years. Both imports and exports of shark meat and exports of shark fin have increased significantly since 1998. Exports of shark meat quadrupled between 1999 and 2001 (see Figure 3).

Despite the introduction of new Whale Shark codes in March 2001 Taiwan Customs statistics for the period March 2001 to February 2002 (Directorate General of Customs, 2001) record only two tonnes of exports, and no imports, of Whale Shark. The two tonnes of frozen Whale Shark meat exported to Spain was valued at TWD79 000 (USD 2 302) or TWD39.36/kg (USD1.15/kg).

A small market also exists for live Whale Shark. Large Japanese aquariums, including those in Osaka and Okinawa, which display Whale Sharks, have tried to buy live Whale Sharks from Taiwan. In 1995, a Japanese aquarium bought a newborn Whale Shark which was removed from a harvested female in Taitung, but the price paid for this newborn is not known (Wu, 1995).

Newspaper reports

TRAFFIC's analysis of newspaper articles on Whale Shark may indicate a shift in the focus of media attention on the species in Taiwan over the last decade. Chen et al. (1997) reported that in the early 1990s Taiwan's media were more interested in Whale Shark landings, specifically with the shark's large size, high price, and responses of the fishermen, but were less concerned with its conservation. However the review of relevant news items conducted in this study identified a change in focus. The review found 50 news items related to the "Tofu shark" (a nickname for Whale Shark) and 115 news items with the term Whale Shark between 1996 and 2001. The nature of these news items is summarised in Table 3. The analysis reveals that in

Table 3. Number of Whale Shark items in Taiwan's major newspapers, by topic, January 1996-November 2001

Years	Topic						Total
	Catch, Size, Price	Conflicts	Harvest	Report System	Conservation	Others	
1996	4	0	0		1	1	6
1997	2	1	0		0	0	3
1998	0	0	0		0	3	3
1999	5	0	0		3	1	9
2000	11	11	0		67	15	104
2001	8	1	6		14	7	36

the last six years, the Whale Shark has become a popular news item. Before 1999, most of the news stories focused on the size of the Whale Shark. Since 1999 an increasing number of news items on the species have related to conservation concerns. This appears to have been due in large part to the interest generated in June and August 2000 by the efforts of Penghu Aquarium and the National Museum of Marine Biology and Aquarium to nurse and release a baby Whale Shark originally caught in a set net. This helped to focus the attention of the general public on Whale Shark conservation. Many of these articles also included coverage of the conflict between Whale Shark conservation and fishermen's livelihoods. However, even after this event, in 2001, coverage of Whale Shark issues has remained higher with most articles dealing with conservation and monitoring.

Market surveys

Processing and distribution of Whale Shark products

When a Whale Shark is caught and killed at sea, the belly is opened first to remove the internal organs, which spoil quickly. Usually the fish are landed and auctioned at the fish markets operated by fishermen's associations in Taiwan. The fish are then processed. First the fins are removed, then the meat is cut into chunks, and the cartilage and liver are removed. Almost all the parts of the Whale Shark are used. Local fishermen consider even the gills a delicacy. Distribution methods vary according to the type of product and how it is to be used. The valuable meat is quickly stored into boxes with ice and sent to local or wholesale markets for sale to retail outlets or restaurants (see Figure 4). As is the case with other shark species the fins, livers and cartilage of the Whale Shark are sold to fish factories for further processing.

Landing prices for whole sharks

Auction prices for Whale Sharks at landing markets are not available since there is no category for Whale Sharks at these markets and the auction records are included in the 'large shark' category. Some records of Whale Shark landings were available from news stories, but few contained reliable information. Six reliable records of catch were found between August 1999 and November 2001, with an average catch weight of 1 900 kg. The average price for the whole shark at the point of landing was TWD 123.13/kg (USD 3.75/kg) (see Table 4).

Figure 4. The distribution of Whale Shark meat

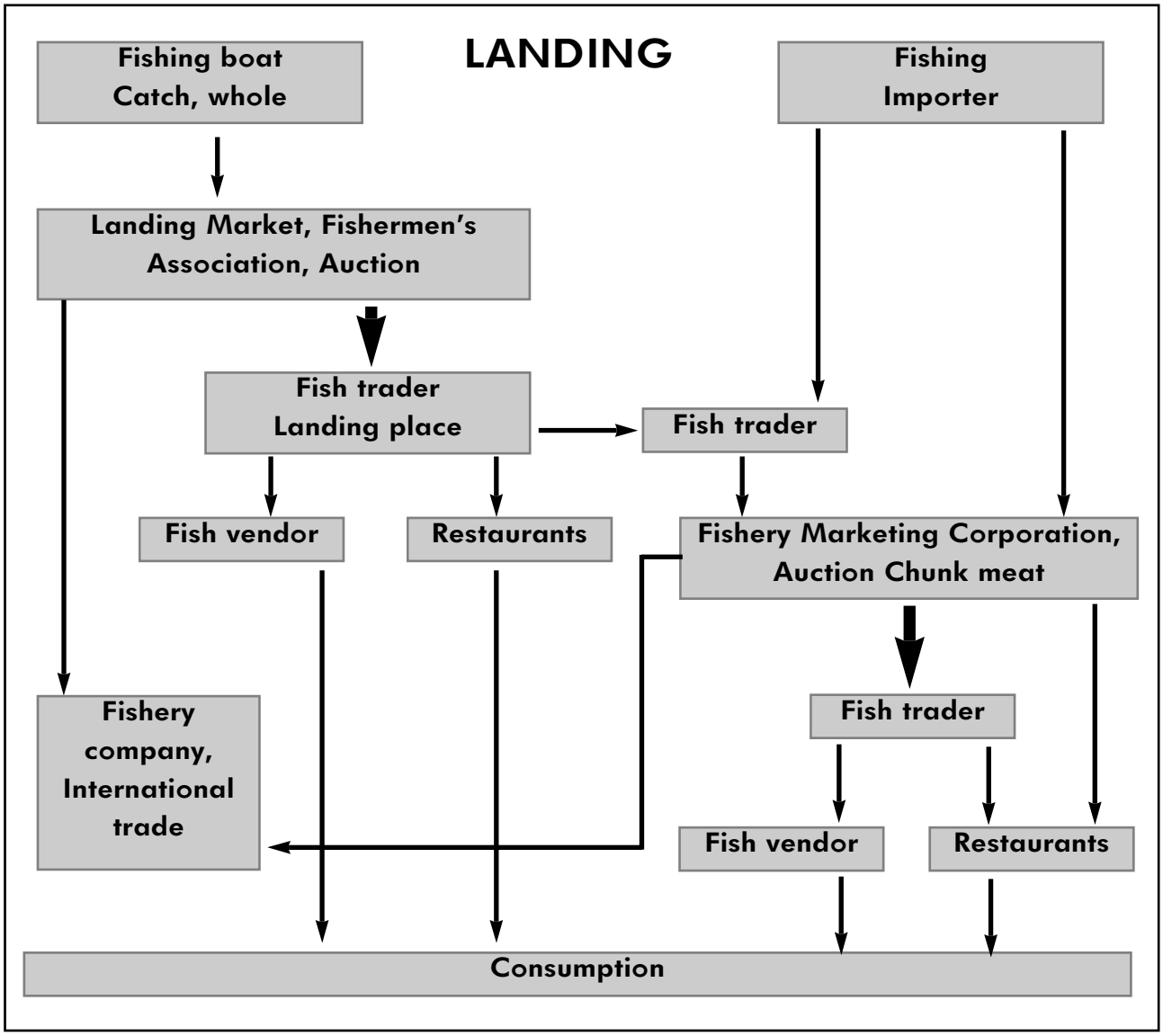


Table 4. Landing and price records of whole Whale Shark found in the Taiwanese press

Date	Harvest location	Weight (kg)	Wholesale price		Average price	
			TWD	USD	TWD/kg	USD/kg
8/1999	Penghu	2000	230 000	7116	115.00	3.56
5/7/2000	Taitung	1500	135 000	4 318	90.00	2.88
10/18/2001	Taichung	2500	700 000-800 000	20 600-23 543	> 130	> 3.83
10/18/2001	Taitung	1300	170 000	5 002	130.77	3.85
10/19/2001	Tainan	2800	440 000	12 948	157.14	4.62
04/15/2002	Taitung	10000	~750 000	21400	~75	2.14

Sources: Web news; National Central Library Headline Database; Taiwan Today News Network http://ttnn.com; United Daily News

Whale Shark fin

The huge size of the Whale Shark fin means that, when skinned, it can be confused with the large, high quality fin of the Basking Shark *Cetorhinus maximus*. In Hong Kong, the fin of the Whale Shark has been called 'Niou-Pyi Tian-Jeou Fin' meaning 'bogus giant fin'. However, the Whale Shark fin is of poorer quality and taste, and harder to prepare, than the expensive Basking Shark fin (Yang et al., 1995). Shark traders confirmed during interviews that Whale Shark fins are not good quality and that some are discarded during the landing process. At an auction held in Hong Kong in December 2000, three kilogrammes of Whale Shark fin sold for the relatively low price of HKD 300 (USD 38.5), equivalent to HKD 100/kg (USD 12.83/kg) (S. Clarke pers. comm. to V. Chen, November 2001). In comparison this study found that the highest quality fin from other shark species can fetch TWD 16667/kg (USD 490/kg), while second-grade shark fin sells for TWD 3 333/kg (USD 98/kg). Hence, while morphologically similar to Basking Shark, Whale Shark fin is readily identified by price.

This study found no Whale Shark fin products in the marketplace in Taiwan. One large fin suspected to be that of a Whale Shark was found at Taipei's largest shark fin market on Di-Hua Street. The sales clerk could not confirm the species but admitted that its quality was poor and that the big fin was mainly for display purposes.

Whale Shark meat

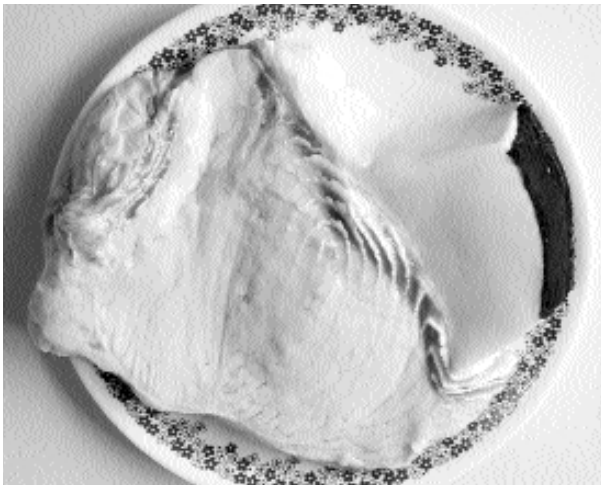
All shark meat requires careful handling owing to the fact that it contains high concentrations of urea. Ammonia is rapidly produced if the dead fish is not quickly chilled or frozen, producing an odious smell that makes the product unacceptable to consumers (Rose, 1996).

The texture of Whale Shark meat is soft and white, which has resulted in the nickname of 'Tofu (soybean curd) shark' in Taiwan. Prior to 1985 Whale Shark meat was considered to be a low-grade product, not readily accepted by consumers in Taiwan. However by the end of the 1980s Whale Shark meat had gained acceptance by consumers as an 'exotic' food, and the price began to increase, reaching TWD 400/kg (USD 13.93/kg) by 1997 (Chen et al., 1997). Marketing promotions by seafood restaurants and recognition of the product's relative scarcity may explain the change in consumer perceptions of Whale Shark meat.

The market for chilled and frozen Whale Shark meat

During the survey period (May to December 2001), 14 cities and counties were visited, including 1659 stalls in 85 public markets and recreational fishing harbours. Only 76 retail stalls (4.6%) in 10 of the 14 districts surveyed had Whale Shark meat for sale (see Table 5). Some stalls did not offer Whale Shark meat regularly, as it was very dependent on supplies in the wholesale market. Whale Shark was being sold in public markets of only three districts. In the remaining seven districts, Whale Shark was sold only at recreational fishing harbours. In most metropolitan areas, Whale Shark was not for sale in the marketplace. Only 15 stalls in seven markets in Taipei city had Whale Shark meat for sale, and these only had it irregularly. In Taichung city Whale Shark meat was being sold at three stalls in the wholesale market. No chilled or frozen Whale Shark meat was found in Kaohsiung city during the survey period.

Fresh Whale Shark meat at a retail market.



Vincent Y. Chen,
TRAFFIC East Asia-Taipei

Table 5. The number of retail stalls with Whale Shark meat

City/County	Public Markets	Recreational Fishing harbours
Keelung City		8
Taipei City	15	
Taipei County		18
Hsinchu City		5
Taichung City	3	
Taichung County		17
Tainan County		1
Kaohsiung County		5
Pingtung County		2
Ilan County	2	
Total	20	56

The retail price of Whale Shark meat depends on the freshness, the section of the shark from which it comes and the location of the market. In general, fresh meat with the skin still on brings the highest price, meat located close to organs is less expensive and frozen meat without elasticity or fresh color is the cheapest. The retail price (see Table 6) ranged from TWD 167/kg (USD 4.91/kg) to TWD 583/kg (USD 17.16/kg) for fresh meat. The most common price was TWD 400/kg (USD 11.77/kg), followed by TWD 333.3/kg (USD 9.80/kg). Extremely high and low prices were found on very few occasions. In the central and southern parts of Taiwan, some seafood stall owners provided defrosted meat for sale at the lower price of TWD 166.7-200/kg (USD 4.9-5.9/kg).

Taipei's wholesale market and prices

Generally, information on wholesale prices of Whale Shark meat was difficult to obtain because neither the fishery market nor fishery associations specify shark prices for different species. The Taipei Fishery Marketing Corporation, which operates the Taipei Central Market, is the only organization which records the daily wholesale price of Whale Shark (Tofu Shark, Item #164). Records have been collected since February 1998 (see Table 7).

Table 6. Frequency of the retail prices for fresh Whale Shark meat found in the marketplace

TWD/kg	166.7	200	300	333.3	366.7	400	416.7	583.3
USD/kg	4.9	5.9	8.8	9.8	10.8	11.8	12.3	17.2
Frequency	5%	9%	5%	27%	5%	32%	14%	5%

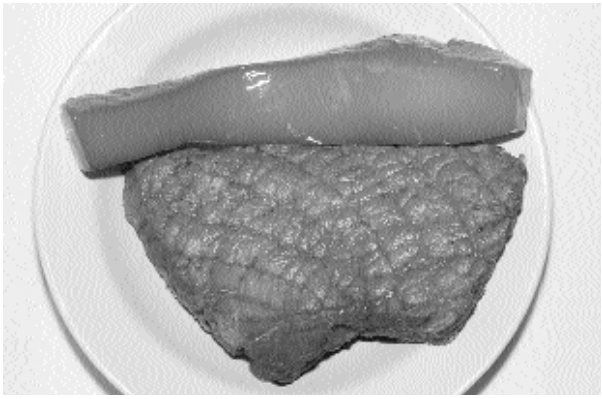
Table 7. Wholesale records for Whale Shark, February 1998 to August 2001

Year	Days with Whale Shark auction	Total volume (kg)	Total value (TWD)	Average price/kg TWD	Average price/kg USD
1998 (Feb-Dec)	94	24 367	5 649 089	231.80	6.92
1999	180	32 589	5 116 898	157.00	4.86
2000	254	59 434	6 570 496	110.60	3.54
2001 (Jan-Aug)	183	42 322	3 023 367	71.40	2.10

Source: Data provided to the Fisheries Administration by the Taipei Fishery Marketing Corporation.

According to the most recent four years of auction records (1998-2001) provided by the Taipei Fishery Marketing Corporation the daily auction volume fluctuated widely, ranging from 10 to 2000 kg. The number of days in a year for which Whale Shark was available at auction increased over the period, as did the available volume, but the average price decreased every year. The average daily auction unit price also fluctuated from TWD 10/kg (USD 0.30/kg) to around TWD 400/kg (USD 11.94/kg.). Since October 2000 the average price achieved at most auctions was, with few exceptions, lower than TWD 150/kg (USD 4.41/kg.) (see Figure 5). A significant and consistent downward trend in price is evident since 1998.

Smoked Whale Shark meat occasionally found on sale in supermarkets in Taipei.

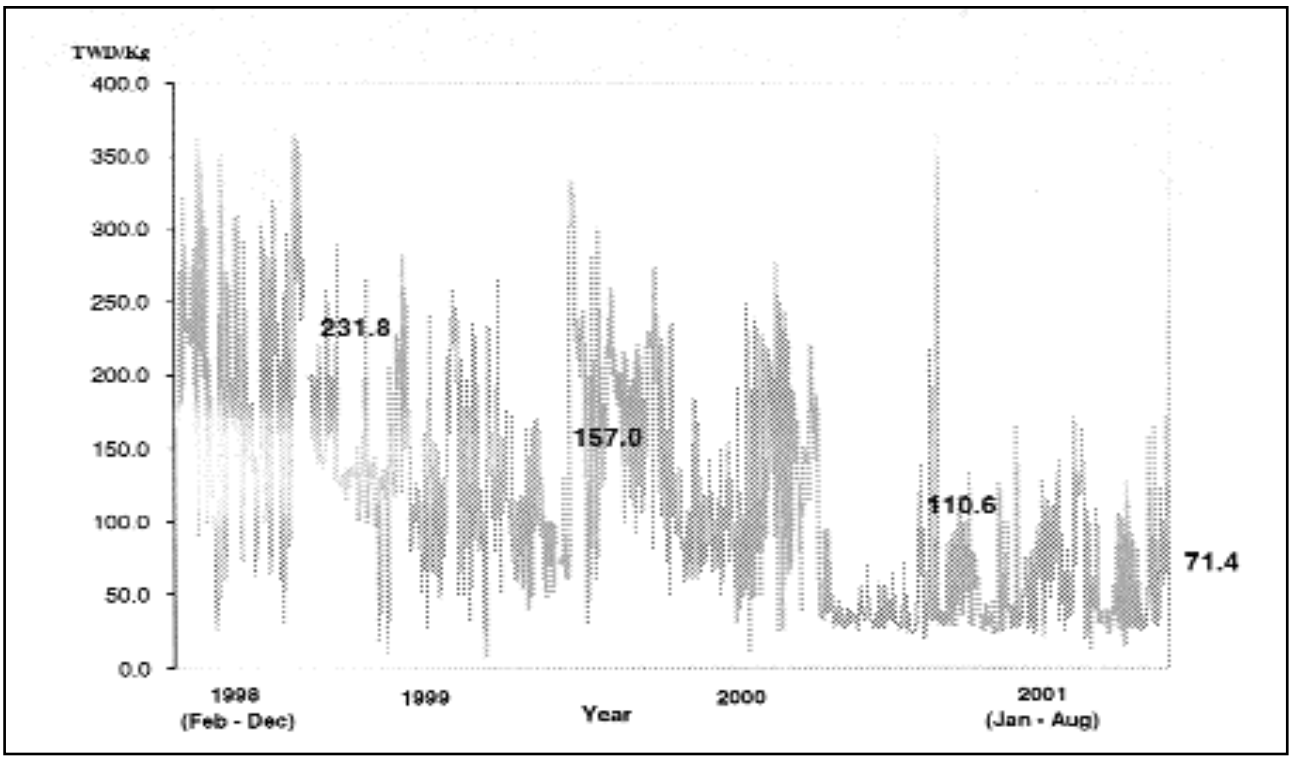


Vincent Y. Chen,
TRAFFIC East Asia-Taipei

Smoked Whale Shark meat

Smoked Whale Shark meat could only be found at a few public markets and one chain supermarket and was higher priced than fresh raw meat. In the supermarket this product was sliced and packaged into 200g, ready-to-eat serving. The price per serving was equivalent to TWD 327/kg (USD 9.62/kg).

Figure 5 . Daily and average annual wholesale prices for Whale Shark meat, 1998 - 2001



Source: Taipei Fishery Marketing Corporation

Restaurants

Investigators surveyed 353 seafood, Taiwanese and Japanese restaurants by telephone in the three metropolitan areas of Taipei, Taichung and Kaohsiung and in 22 recreational fishing harbours. Two hundred and ninety valid responses were recorded. Three different response types were recorded to questions about the availability of Whale Shark meat. The responses were "No", "Yes", and "Do not have the products now, but can obtain it if the customer insists".

Of the locations surveyed (see Table 8) Whale Shark meat was found most often at recreational fishing harbours where 67% of restaurants served Whale Shark dishes and a further 26% reported that they did not have the meat at the time but could get it. Only 6.8% of restaurants in recreational fishing harbours indicated that Whale Shark meat was not available. In Taipei 30% of restaurants had Whale Shark dishes available, while 59.8% did not. Of the restaurants surveyed in Taipei, 47.8% of seafood restaurants and 29.2% of Japanese restaurants responded that they provided Whale Shark dishes. While the survey results did not suggest a high level of availability of Whale Shark meat in restaurants in Ilan County anecdotal evidence suggests that the availability there is seasonal and that fresh Whale Shark meat is readily available in Ilan County during the main catch season. Whale Shark meat was much less readily available in Kaohsiung with (85%) of the restaurants in the city confirming that no Whale Shark was available and the remainder indicating they could provide Whale Shark only if the customer requested it.

Whale Shark meat dishes available in restaurants typically weigh between 262 and 375 g and serve four people. Forty-five percent of restaurants at recreational fishing harbours sold Whale Shark meat for TWD 250 (USD 7.36) per dish. Whale Shark meat cost more in Taipei where 29% of restaurants asked TWD 350 (USD 10.30) per dish.

A Whale Shark meat dish commonly served at seafood restaurants in Taiwan.

Vincent Y. Chen,
TRAFFIC East Asia-Taipei

Table 8. Availability of Whale Shark in restaurants in Taiwan (number)

Location / Response	Recreational fishing harbours	Taipei	Ilan	Taichung	Kaohsiung
Do not have now	19	12	20	8	3
Yes	49	37	4	10	0
No	5	73	8	25	17
Total	73	122	32	43	20

DISCUSSION

Catch data

The catch data available indicate that 113 Whale Sharks were taken in the period January 2001 to March 2002. This is a significant decrease (58%) from the annual catch of 272 estimated by Chen et al., in 1997. This apparent decline in catch could be attributable to a reduction in Whale Shark numbers. However a misunderstanding of the reasons for the introduction of the Reporting System could have resulted in under-reporting of catches.

Some fishermen in Taiwan mistakenly think that the Whale Shark is listed as a protected species. From their experience with whale and dolphin conservation efforts, they think that conservation means banning, and they believe that the Harvest Reporting System has been instituted to monitor illegal catch. In the marketplace, some stall owners claimed that the Whale Shark was a protected animal and it would not be available in the future, using this as a justification for a higher price. As a result of this misunderstanding the catch data reported in the Reporting System are likely to be an underestimate of true catches. A comparison of the limited press reports available and harvest reporting data lends weight to this. For example, two Whale Shark catches reported in the media in October 2001 (October 18 in Taichung and October 19 in Tainan) (see Table 4) are not recorded in the Harvest Reporting System database. However, under-reporting is considered by some researchers to represent less than 5% of all local harvest. (Joung, S-J. pers. comm. to V. Chen, June 2002).

Data from the Harvest Reporting System also show that all Whale Sharks harvested around Taiwan were smaller than seven metres in length and averaged 4.65 m. Whale Sharks are thought to average 7.7 m at maturity (Fowler, 2000), suggesting that those caught off Taiwan are likely to be immature . It is unclear whether the relatively small size reflects a decreasing population, changes in fishing methods, natural migration routes or some other aspect of Whale Shark behaviour. Further research will be required to clarify this.

Market data

The main Whale Shark product in Taiwan is the meat with the market having grown significantly since the mid-80s. There appears to be no domestic market for Whale Shark fins.

The survey found that the retail sale of Whale Shark meat was not widespread and that supply fluctuates considerably. Only 4.6% of the seafood stalls surveyed had Whale Shark meat for sale. The sale of fresh Whale Shark meat was mainly limited to recreational fishing harbours in various areas, the metropolitan area of Taipei and in Ilan and Taichung counties. This relatively localised availability may be explained by the need to process and sell fresh meat quickly owing to the rapid build up of ammonia that occurs as the meat ages.

The survey found that Whale Shark is relatively expensive, commonly sold at TWD 400/kg (USD 11.8/kg) and reaching as high as TWD 583 (USD 17.2/kg) in Taipei. This is comparable with the top choice of grass shrimp Penaeus monodon which cost TWD 350/kg (Anon., 2001).

Whale Shark was far more likely to be sold by restaurants than by seafood stalls. However the availability of Whale Shark in restaurants varied considerably. Whale Shark dishes were only available in seafood, Taiwanese and Japanese restaurants and availability was highest in restaurants in or around recreational fishing harbours and in Taipei, Taichung and the major landing district of Ilan County. As was the case with chilled and frozen Whale Shark meat, the survey did not find any restaurants serving Whale Shark in Kaohsiung, suggesting that Whale Shark meat is not popular in Taiwan's second largest city.

The volume of Whale Shark meat traded at the Taipei market has continued to increase in recent years and has been accompanied by a dramatic fall in price from an average annual price of TWD 231.8 in 1998 to TWD 71.4 in the period January to August 2001. The prices for Whale Shark identified by the survey at the various market levels in 2001 (see Table 9) warrant some consideration. It would be expected that the price/kg would increase as the product was processed, that is that the retail price of raw fresh meat would be higher than the landed price of whole shark. However a comparison of the albeit limited data available on landing prices for whole fish and the wholesale price for

Table 9. Price structure of Whale Shark meat on the market in Taiwan

Market	Average Price (TWD/kg)
Landing prices for whole shark (August 1999 to April 2002)	123.13
Wholesale price for Whale Shark meat at Taipei Fishery Marketing Corporation (Jan 1999-Aug 2001)	109.5
Retail price for fresh uncooked meat	167-600 (400[1])
Whale Shark dish at a restaurant	825-1 155

1. The most frequently seen price.

Whale Shark meat at Taipei's wholesale market does not reflect the expected relativity (see Table 9). The average wholesale price at Taipei's wholesale market is in fact lower than the landed price. This may imply that the Whale Shark meat being sold is not locally harvested and hence the prices are not comparable with landing prices. More accurate, species specific data at the point of landing would be required in order to investigate this further.

Taiwan appears to have no domestic market for Whale Shark fin although the lack of reliable identification techniques made survey of this segment of the market difficult. The difficulty of identifying fins may also compromise the accuracy of Customs records against the new Whale Shark Codes. Customs officials may not be able to identify and hence record Whale Shark fins even where there is a specific code for that commodity.

Comparing catch and market data

Both catch and wholesale market data are available for the period January to August 2001. During that period 63 catch records were lodged, of which 45 contained weight details. The average weight of Whale Shark caught during this period was 946 kg. Applying this average to the 64 records gives an estimated weight of catch of approximately 60 t. It is estimated that meat comprises 45% of the body weight of a Whale Shark (Chen et al., 1997), so approximately 27 t of meat could be obtained from this catch. However, a single wholesale market in Taipei sold a total volume of 42 t of Whale Shark between January and August 2001 (see Table 7). The current reported Whale Shark harvest does not account for the level of wholesale trade in Taipei's wholesale market alone. The discrepancy between domestic catch data and the quantity of Whale Shark product on the domestic market may be explained by either under-reporting of catch or by imports. A possible explanation for under-reporting of catch has been discussed above. Customs statistics show no imports of Whale Shark since the Whale Shark codes were introduced in March 2001. However these statistics may understate legal imports and there are a number of reasons to suspect that product on the domestic market may be imported illegally.

Given the relatively recent introduction of the Whale Shark codes it is quite likely that legitimate Whale Shark imports are still being recorded under the general shark import codes. However, given the banning of Whale Shark catch in an increasing number of countries in recent years it might be expected that the availability of Whale Sharks on the international market could be declining. It is known, for example, that prior to the implementation of bans on the harvest of the species in the Philippines (in 1998) and India (in 2001) that these countries exported this product to Taiwan (Anon., 1998; Hanfee, 2001), although the quantity is not known since export data was not shark species-specific.

The current political situation between China and Taiwan may also affect the accuracy of Whale Shark data. "Direct" links between China and Taiwan, in the form of

transportation, post and trade, are not allowed. This situation, coupled with depleted coastal fishery resources and rising labour costs, including fishing crew costs, in Taiwan, has resulted in the phenomenon of 'cross-strait swaps' between fishermen in China and Taiwan. Many Taiwanese fishermen, especially those on the western coast, trade fish products with mainland boats on the open sea and then land the cargo in Taiwan. It is estimated that fishery products smuggled from mainland China may account for as much as 40% of total fishery production in some counties along Taiwan's western coast. (Anon., 1999). TRAFFIC East Asia-Taipei's research has indicated that Whale Shark meat is likely to be included in these products.

Alava (2002) reported that despite the ban on harvesting there are still many Whale Shark poaching incidents in the Philippines. The meat may flow into international markets through trade on the open ocean. A number of fishermen and retailers interviewed claimed that over half of the Whale Shark meat in the marketplaces was not harvested by Taiwanese fishermen.

During interviews conducted in this study it was claimed that frozen Whale Shark meat was brought back to Taiwan, by deep-sea fishing boats, mixed with other fishery products. Whale Shark meat suspected of being imported was found in the market and some seafood stall owners claimed that the Whale Shark meat they sell is imported from Indonesia or Hainan Island, China. Such claims have not been confirmed.

Although some experienced people claimed to be able to discriminate between imported and locally harvested products, the lack of objective evaluation standards makes it difficult to estimate the percentage of imported and locally-harvested products in the market. While consumers may be able to differentiate locally-caught product by the freshness of the meat, they are unlikely be able to discriminate between imported and locally-caught frozen products. Since fresh meat commands better prices than imported product (imported meat is more likely to be frozen and defrosted than locally harvested meat) price might be expected to be a guide to the origin of the product. However, depending on demand, some locally-caught product may also be frozen and defrosted. As a result price does not provide a consistent basis for differentiation between imported and local product.

Some stall owners claimed that Whale Sharks caught near Taiwan have tender meat, while imported meat is tough due to the larger size of the sharks. The relatively small size of Whale Sharks recorded in the Harvest Reporting System suggests that these claims may have some validity.

Given the uncertainty surrounding true catch levels of Whale Shark by Taiwan's fishermen, the likelihood that the Whale Shark import codes may not be identifying all Whale Shark imports and the possibility of a number of unofficial channels through which Whale Shark meat can find its way on to markets in Taiwan, it is not possible to be definitive about the trends in catch of Whale Shark in Taiwan.

IMPLICATIONS FOR TAIWAN'S MANAGEMENT OF WHALE SHARK

Strengthening the regulatory system

The current regulatory system comprises the Harvest Reporting System and the trade codes for Whale Shark. These initiatives have the potential to provide a strong basis for monitoring and managing Taiwan's Whale Shark fishery and trade. However this survey has found that there are a number of areas where the effectiveness of these initiatives could be enhanced and where additional initiatives are required to fill gaps in market data.

There is a lack of wholesale market data reported by species for Whale Shark, both whole and meat. The detailed, species specific data maintained by the Taipei Fishery Marketing Corporation should become the standard for the markets of all fishermen's associations and fishery marketing corporations. The introduction of similar recording practices for Whale Shark should be considered a high priority in the markets of the major landing counties of Taichung and Ilan.

Additional education and extension programs for fishermen could significantly improve the effectiveness of the Harvest Reporting System and encourage fishermen to contribute to scientific and conservation efforts for Whale Sharks. These programs should provide guidance to fishermen on standard procedures for collecting and recording data. This may reduce the errors in data and subsequent difficulties in data analysis.

This study suggests that it is highly likely that undeclared imported meat is traded in the markets of Taiwan. The capacity of Customs and the Maritime Police Bureau need to be increased in order ensure that Whale Shark products are correctly identified and to prevent unregulated imports.

FAO-NPOA guidelines

The guidelines for sustainable management of shark species as outlined in the IPOA-Sharks provide a sound basis for Taiwan's management of Whale Sharks and other Shark species. The aims of developing a National Plan of Action for Sharks include: to fully use the whole shark; assess threats to shark populations; determine and protect critical habitats; facilitate species-specific catch, landing, biological and trade data; and to implement strategies consistent with biological sustainability and long term economic use so as to ensure the sustainability of shark fisheries.

Taiwan has begun to address some of these issues in relation to Whale Sharks. For example, each part of the Whale Shark is used in Taiwan and Taiwan has set up a species-specific monitoring system for Whale Shark catch and trade to provide an information base for a sustainable fishery. However other aspects of the NPOA have yet to be addressed.

Research has shown that about half (44%) of Whale Sharks are caught by set nets fixed at certain locations. Mapping these catch spots shows that Whale Sharks are inclined to regularly visit certain areas. Further research may identify this as critical habitat of the Whale Shark. If so, habitat protection may be considered appropriate. For example, the WCL might be used to announce a Whale Shark marine protection area, or to encourage fishermen to release certain numbers of Whale Sharks caught in set nets, recognising that the release of sharks may involve damage to nets and costs to fishermen.

This study suggests that catches of Whale Shark in Taiwan may be decreasing although the possibility of under-reporting of catch means that it is not possible to be definitive about this. There is, therefore, a pressing need to improve the quality of the Harvest Report data so fishery managers can be confident in the data it is providing. If catches are declining this may indicate a reduction in Whale Shark numbers and the need for the introduction of restrictions on catches in order to minimise the threat to Whale Shark populations. However while uncertainty surrounds the accuracy of catch data, managers may be reluctant to introduce such measures.

International co-operation

Both the Bonn Convention (The Convention for the Conservation of Migratory Species of Wild Animals) and UNCLOS identify Whale Shark as a highly migratory species requiring international co-operation in research and management. In order to facilitate this more biological data is required on the species. Opportunities for collection of morphological, physiological and genetic data on Whale Sharks caught in Taiwan's fisheries should be investigated and the co-operation of fishermen in collecting this data encouraged. Such data will provide a basis for Taiwan to co-operate with other countries to protect Whale Sharks.

A proposal to list the Whale Shark in Appendix II of CITES was tabled at the last CITES CoP (CoP11). Although this proposal was not accepted, ongoing international concern over the conservation status of the Whale Shark means that a similar proposal will be presented to the upcoming CoP12 in Santiago, Chile (November 2002). If successful, an Appendix II listing of Whale Shark would allow international trade to continue, however a permit would be required for trade with the more than 150 CITES Parties. The permit system allows trade to be monitored and provides a mechanism to verify catches. By assembling information on catch and trade that are not currently collected, but are crucial to proper fisheries management, a CITES Appendix II listing could contribute to better management of Whale Sharks (Weber and Fordham, 1997).

Should an Appendix II listing be successful, BOFT would apply Article 11 of the *Foreign Trade Act* to regulate the import and export of Whale Shark by issuing CITES permits. BOFT would then issue CITES permits to itself, when fisherman catch Whale Shark outside Taiwan's jurisdiction (CITES Article I (e) and Article IV-6). The COA (the Scientific Authority for CITES purposes) would need to advise whether the introduction from the sea was detrimental to the survival of the species (CITES Article IV-6 (a)).

Under the CITES permitting system, Whale Shark products exported to Taiwan would not require an import permit; however they would require a CITES export permit from the exporting country. Given the lack of information available on Whale Shark populations, the country of export may find it difficult to assess the non-detriment findings needed to issue such a permit.

Management options

As mentioned previously, some countries have attempted to protect the Whale Shark by imposing a ban on its harvest and trade. Where countries do not have a market for Whale Shark product or have developed ecotourism to protect Whale Sharks, banning the catch may be an attractive option. However, in those communities where Whale Shark has been harvested traditionally, banning would have significant economic consequences. In the absence of adequate enforcement, banning may simply turn the legal catch into illegal poaching, as appears to be the case in the Philippines (Alava, 2002). Banning the harvest of Whale Shark in Taiwan would undoubtedly affect some fishermen's livelihood. It would also remove the opportunity to collect data on Whale Shark through fishermen's records.

Bans on catch would need to be supplemented with restrictions on the possession and trade of Whale Shark. It would currently be impossible to enforce a ban on catch if Whale Shark product continued to be imported, legally or illegally, into Taiwan.

Taiwan could regulate the possession and domestic trade of Whale Shark by applying Article 22, Section 2 of the *Fishery Law*, or by listing Whale Shark as an endangered wildlife species under the WCL. Although the current study reveals that Whale Shark markets are limited to certain areas and are not widely distributed around the island, a ban on trade could seriously affect traders and potential consumers and thus be a challenge to the government's implementation and enforcement of the regulation. Any regulations to prohibit trade will require enforcement and involve substantial costs.

Rather than banning catch and trade it may be more effective and feasible to implement management measures that are consistent with sustainable management of the species. Chen et al. (1997) recommended establishing size and catch limits for Whale Sharks caught by harpoon rather than banning the catch. This approach may address both the conservation needs of the species and the economic needs of fishermen. Fishermen's understanding of and willingness to participate in Whale Shark conservation would be central to the success of catch limits.

Ideally the setting of catch and/or size limits for Whale Shark would be based on a time series of reliable data. However since this data is not yet available, and may not be available for some years, Taiwan's fisheries management authorities may need to adopt a precautionary approach to management of Whale Shark. The precautionary approach suggests that management action should not be delayed because all the information is not available. The risks associated with delaying management action until data exists on which to base a decision need to be weighed up against the difficulties in getting fishermen's support for and co-operation with management measures in the absence of data that clearly demonstrates the need.

Other uses of Whale Shark

The sale of Whale Shark for food and as a source of fishing income may not be sustainable at current levels. An alternative use, which protects rather than depletes Whale Shark populations, but also allows income to be derived, is ecotourism. Whale Shark watching and diving with Whale Sharks are valuable aspects of tourism in many sites around the world. Countries such as South Africa, the Maldives, the Philippines, Thailand, Mexico and Australia have Whale Shark ecotourism programs which produce attractive revenues, such as AUD 12 million in Australia in 2000 and USD 3 million in the Phuket area of Thailand (Newman, in press).

At Ningaloo, in Western Australia, 500 Whale Shark sighting opportunities can be found every year, and this brings in revenue of around AUD 5 million (around TWD 100 million) (Norman, 2000). An average of more than 30 male Whale Sharks around the size of 8.5 m visit the same area every year and could generate AUD 150 000 per Whale Shark per year. An 8.5 m Whale Shark weighs about 5.5 t, and would produce about 45% of its body weight, or around 2475 kg, in edible meat which would only generate up to TWD 990 000 (AUD 49 500), if sold at the most common retail price of TWD 400/kg (USD 11.8/kg). This suggests that the potential economic benefits

from Whale Shark watching may be far greater than those arising from consumption of the animals, although it is recognised that this simple comparison does not take account of the economic flow-ons associated with catch and sale of Whale Shark. Whale Shark sighting information provided by such programs can also contribute significantly to scientific research of this species.

There are no Whale Shark ecotourism activities in Taiwan, although whale watching is gaining in popularity. The feasibility of Whale Shark ecotourism in Taiwan should be evaluated. Included in this evaluation should be consideration of how the income generated by such activities would be distributed.

CONCLUSIONS AND RECOMMENDATIONS

Taiwan's Fisheries Administration has set up the first shark species-specific monitoring system for catch and trade of Whale Shark in order to provide information to underpin a Whale Shark management system. The data available to date suggest a decrease in catch compared to previous estimates and indicate that the Whale Shark taken off Taiwan are relatively small in size. This has increased conservation concern for the species as it may indicate a reduction in the availability of Whale Shark in Taiwan's waters as a result of overfishing.

The results of the survey of Taiwan's markets for Whale Shark meat indicate that there is significantly more Whale Shark meat on the market than can be accounted for by reported domestic catch and imports. This creates uncertainty as to whether domestic catch has in fact declined and lends weight to the possibility that catch is being under-reported. Alternatively, or perhaps in addition to under-reporting of catch, it is possible that the official import data under-reports the total quantity of imports flowing onto the domestic market in Taiwan.

It is important that the apparent reduction in catch of Whale Shark is explained and that the quantity of Whale Shark meat on Taiwan's market can be accounted for through the official catch and trade monitoring systems. The appropriate management for Whale Shark in Taiwan will depend in large part on the reasons for the apparent decline in catch and the explanation for the gap between market availability and official catch and import data.

Urgent consideration of the development of appropriate management measures for Whale Shark is also required. The FAO's IPOA-Sharks provides a framework for undertaking development of these measures. Consistent with the precautionary approach it may be prudent to introduce management measures even in the absence of all the necessary data and despite uncertainty as to the accuracy of the available data. Taiwan's recent announcement that a quota of 80 fish will be imposed for the 2002/2003 year is a positive step towards effective conservation and management of the species.

Evaluation of alternative opportunities for deriving economic benefits from Whale Sharks should also be initiated to determine if the potential exists in Taiwan for the development of ecotourism ventures based around Whale Sharks.

The following recommendations are directed primarily to the Fisheries Administration, Council of Agriculture (unless otherwise specified) for the management and conservation of Whale Sharks in Taiwan:

1. Develop constructive dialogue between relevant government authorities, proponents of Whale Shark conservation (including domestic and international conservation NGOs) and the fishing community to encourage development of a more sustainable Whale Shark fishery. Stakeholders in the fishing community include the Taiwan Set-Net Association and local fishermen's associations, particularly in the counties of Ilan, Taitung, Taichung, Hualien, and Penghu where Whale Shark harvest commonly occurs.

2. Improve the Whale Shark harvest and trade monitoring systems:

   a. Undertake further promotional and educational seminars for fishermen to ensure they understand the purpose of the Whale Shark Harvest Reporting System and to overcome the perception that the System is designed to detect illegal fishing of Whale Shark.

   b. Develop and provide clear guidelines for fishermen to assist them to provide accurate and comprehensive information to the Whale Shark Harvest Reporting System.

   c. Conduct further research on techniques to identify Whale Shark products, such as meat and fin, so as to

increase the capacity of enforcement staff of Customs and the Coast Guard to detect these products.

3. Improve the data on Whale Shark collected at wholesale fish markets by encouraging these markets to add a specific category item for recording sales data (volume and price) for Whale Shark and incorporate this data into the established monitoring system.

4. Investigate the claims that imported Whale Shark meat is entering Taiwan through unofficial channels and, if necessary, introduce measures to address this.

5. Initiate the development of a Shark Assessment Report and a National Plan of Action for Sharks (NPOA-Sharks) as recommended in the Food and Agriculture Organization's International Plan of Action for Sharks. The development of measures to identify and protect vulnerable species, such as the Whale Shark, would form part of the NPOA-Sharks.

6. Undertake a full evaluation of management options for Whale Shark in Taiwan. This evaluation should consider both the ecological and economic impacts of the options.

7. Review the merits of alternative uses of Whale Shark, such as ecotourism, by conducting a feasibility study.

8. Promote international co-operation for the conservation of the Whale Shark. This co-operation may involve research, for example, tagging studies at National Taiwan Ocean University to identify migration routes, and the collation and analysis of catch and trade data among range and consumer states.

REFERENCES

Alava, M. (2002). Conservation and management of Whale Sharks in the Philippines. In: Shark Conference 2002: Sustainable Utilization and Conservation of Sharks, Taipei, Taiwan, May 13-16, 2002.

Anon. (1998). Killing of Whale Sharks banned. Biota Filipina, Newsletter of the WWF- Philippines, (Philippines), March

Anon. (1999). Impact of smuggling fishery products from Mainland China. Fishery Weekly Vol. 642, Council of Agriculture, Taipei, Taiwan.

Anon. (2000a). CITES Decisions on Amendment Proposals. CITES Secretariat, Geneva, Switzerland. 12pp.

Chang, T-C. (Ed) (1998). Seafood Guide (in Chinese). Sunkids Cultural Co., Taipei, Taiwan. 259pp.

Chang, W.-B., Leu, M.-Y. and Fang, L.-S. (1997). Embryos of the whale shark, Rhincodon typus: Early growth and size distribution. Copeia Vol. 97, No.2, pp. 444-446, American Society of Ichthyologists and Herpetologists, Allen Press, Kansas, USA

Chen, C-T, Liu, K-M and Joung, S-J. (1997). Preliminary report on Taiwan's Whale Shark fishery. TRAFFIC Bulletin, 17(1):53-57.

Chen, C-T, Liu, K-M, Joung, S-J. and Phipps M. (1996). Shark Fisheries and Trade in Taiwan. TRAFFIC East Asia-Taipei. 48pp.

Council of Agriculture, Fisheries Administration (2001). Fisheries Yearbook Taiwan Area, Taipei, Taiwan.

Directorate General of Customs (2001). Statistics of Imports and Exports, ROC Taiwan District, Statistical Department, ROC.

Eckert, S.A., Dolar, M. L., Kooyman, G.L., Perrin, W. F. and Rahman, A. R. (2000). Are the Whale Sharks of Southeast Asia resident or migratory? American Elasmobranch Society Annual Meeting, La Paz, Mexico.

Food and Agriculture Organization (FAO). (1999). International Plan of Action for the Conservation and Management of Sharks. FAO, Rome.

FAO Fisheries Department, Fishery Information, Data and Statistics Unit (2000). Fishstat Plus Version 2.3, FAO, Rome.

FishBase (2002) http://www.fishbase.org, Viewed May 2002.

Fowler, S (2000). Whale Shark Rhincodon typus Policy and Research Scoping Study. Nature Conservation Bureau, Berkshire UK. 22pp.

Hanfee, F. (2001). Trade in Whale Shark and its Products in the Coastal State of Gujarat -India. TRAFFIC-India. 38 pp.

Hilton-Taylor, C. (2000). 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK. xviii + 61pp.

Hsu, C.-K., Chang, T.-Y. ,Zu, H.-C., Huang, K.F. and Tsai, W.S. (2000). Preliminary attempt on Whale Shark ranching (in Chinese). TFRI Newsletter 143:6-11.

IUCN Species Survival Commission's Shark Specialist Group and TRAFFIC (2002). Implementation of resolution conf. 9.17 and subsequent decisions, (draft) paper prepared for the 12th Meeting of the Conference of the Parties to CITES, Chile, November 2002

Joung, S.J., C.T. Chen, E. Clark, S. Uchida and W.Y.P. Huang. (1996). The Whale Shark, Rhincodon typus, is a livebearer: 300 embryos found in one 'megamamma' supreme. Environ. Biol. Fish. 46:219-223.

Liu, K-M. (2001). A Precautionary Approach to Fishery Management of the Shark Fisheries in the coastal and off-shore waters of Taiwan. In: Anon. (Ed.), Proceedings of Fishery Technique and Resource Management Workshop, Keelung, Taiwan. Pp. 72-76.

Newman, H.E., Colman, J.G., and Medcraft, A.J. (In press). Whale shark tagging and ecotourism. In: Fowler S.L., Reid, T. and Dipper, F.A. (eds) Elasmobranch Biodiversity, Conservation and Management. IUCN, Gland, Switzerland.

Norman, B. (2000). Whale shark conservation via a collaborative approach, American Elasmobranch Society Annual Meeting, La Paz, Mexico.

O'Sullivan, J. B., Mitchell, T. (2000). A fatal attack on a Whale Shark Rhincodon typus, by killer whales Orcinus orca off Bahia de Los Angeles, Baja California. American Elasmobranch Society Annual Meeting, La Paz, Mexico.

Rose, D. A. (1996). An Overview of World Trade in Sharks and Other Cartilaginous Fishes. TRAFFIC International, Cambridge, UK.

Shieh, D.-W. (2002). Shark Fishery in Taiwan, Fisheries Administration, Council of Agriculture, Taipei, Taiwan

Uchida, S., Toda, M., Kamei, Y., Teruya, H. (2000). The husbandry of 16 Whale Sharks, Rhincodon typus, from 1980 to 1998 at Okinawa Expo aquarium. American Elasmobranch Society Annual Meeting, La Paz, Mexico.

Waller G. (Ed.) (1996). Sealife. Pica Press, UK.

Weber, M. L. and Fordham, S.V. (1997). Managing Shark Fisheries: Opportunities for International Conservation. TRAFFIC International and the Center for Marine Conservation, Cambridge, UK.

Wu, M.-Y. (1995). Mystery about the birth of Whale Shark (Rhincodon typus) (in Chinese). The NMMBA Column, no. 14. National Museum and Marine Biology and Aquarium, Pingtung, Taiwan.Pp. 6-11.

Yang, W.-S., Lin C.-J. and Chao, P.-Y. (1995). The Complete Book of Dried Seafood & Foodstuffs (in Chinese). Tau-Liueh Publication Co., Taipei, Taiwan. 246pp.

Appendix I : Life history parameters of the Whale Shark

Life history parameters	FishBase[1]	Fowler (2000)
Maximum length (L_{max})	2000 cm TL	2000 cm TL
L infinity (L_{inf})	1400 cm TL	2000 cm TL
K (very approximate)	0.05	0.02
Natural mortality (M)[2]	0.07/year (s.e. 0.04-0.10)	0.03/year (s.e. 0.02-0.05)
Life span (approx.)	58.8 years	147.1 years
Generation time	24.3 years	63.0 years
Age at first maturity	8.9 years	21.4 years
Length at maturity (L_m)	558.6 cm TL	769.5 cm TL
	(s.e. 417-748.4 cm)	(s.e. 574.4-1030.9 cm)
L max. yield (L_{opt})	1010.1 cm TL	1464.9 cm TL
	(s.e. 853.8-1195 cm)	(s.e. 1238.2-1733 cm)
Intrinsic rate of increase	0.22 m/year	0.08 m/year
Resilience/productivity	Very low, decline threshold of 0.70	Very low, decline threshold of 0.70

Sources: FishBase (2002) and Fowler (2000)

1. Definitions of some parameters are provided below

2. Calculated at a mean annual temperature of 23 ℃.

Max. length: The default value used here is the maximum length (L_{max}) ever reported for the species in question, which is in principle available for all species of fish. If no other data are available, this value is used to estimate asymptotic length (L_{inf}), length at first maturity (L_m), and length of maximum possible yield (L_{opt}), as defined in more detail below. However, Lmax may be much higher than the maximum length reached by the fish population being studied by the user, in which case the derived estimates will be unrealistically high.

L infinity: This is the length (L_{inf}) that the fish of a population would reach if they were to grow indefinitely (also known as asymptotic length).

K: This is a parameter of the von Bertalanffy growth function (also known as growth coefficient), expressing the rate (1/year) at which the asymptotic length is approached.

Appendix II: Whale Shark harvest data

Date	Weight (kg)	Total Length (m)
2001/01/03	NA	NA
2001/01/03	NA	NA
2001/01/03	NA	NA
2001/01/18	NA	NA
2001/02/23	NA	NA
2001/02/25	NA	NA
2001/03/15	NA	NA
2001/03/17	310	363
2001/03/17	700	441
2001/03/18	750	435
2001/03/19	1650	598
2001/03/24	680	420
2001/03/28	1500	556
2001/03/29	640	425
2001/03/30	NA	NA
2001/04/03	NA	NA
2001/04/05	NA	NA
2001/04/07	800	478
2001/04/14	250	340
2001/04/14	900	490
2001/04/16	1250	525
2001/4/16	1180	530
2001/04/17	NA	NA
2001/04/17	NA	NA
2001/04/19	600	420
2001/4/23	758	430
2001/04/26	880	485
2001/04/27	1150	505
2001/4/30	502	390
2001/4/30	NA	NA
2001/5/3	750	435
2001/5/4	880	482
2001/5/4	1000	450
2001/05/05	NA	NA
2001/05/06	NA	NA
2001/05/07	800	480
2001/5/8	760	400
2001/5/8	1100	550
2001/05/10	950	500
2001/5/12	660	400
2001/5/16	850	420
2001/5/16	1100	500
2001/5/19	400	800
2001/5/19	1200	490
2001/5/20	1400	550
2001/5/22	900	500
2001/5/22	1500	560
2001/5/22	800	440
2001/5/25	300	300
2001/5/25	560	392
2001/5/27	650	418
2001/05/30	NA	NA
2001/6/5	270	360
2001/6/6	380	380
2001/6/14	500	200
2001/6/18	800	460
2001/6/19	500	200
2001/6/22	NA	NA
2001/7/23	NA	NA
2001/7/24	447	414
2001/7/26	1000	400
2001/8/12	600	370
2001/8/17	6000	NA
2001/8/25	NA	450
2001/9/30	2500	620
2001/9/30	600	NA
2001/10/14	500	300
2001/10/17	1150	550
2001/10/21	510	410
2001/10/25	550	290
2001/10/26	1800	NA
2001/10/26	2200	647
2001/11/2	870	420
2001/11/2	1300	401
2001/11/4	1500	530
2001/11/4	2750	550
2001/11/8	566	390
2001/11/8	1300	500
2001/11/8	1321	590
2001/11/8	1000	NA
2001/11/11	1220	510
2001/11/18	1500	520
2001/11/20	550	410
2001/11/20	600	NA
2001/11/21	2870	675
2001/11/21	400	390
2001/11/23	750	430
2001/11/24	800	NA
2001/11/25	1600	520
2001/11/28	650	400
2001/12/2	2000	650
2001/12/4	1950	610
2001/12/4	750	100
2001/12/5	300	300
2001/12/5	1900	NA
2001/12/10	1500	NA
2001/12/11	2500	650
2001/12/12	1400	300
2001/12/25	1650	550
2002/1/2	1405	510
2002/1/10	1867	600
2002/1/18	500	450
2002/1/19	1800	600
2002/1/30	650	490
2002/2/1	700	520
2002/2/15	1500	530
2002/2/18	1200	450
2002/2/25	1400	600
2002/2/27	1600	500
2002/2/27	750	280
2002/3/2	1150	580
2002/3/4	1200	425
2002/3/5	2290	560
Total	**104 876**	

Source: Fishery Administration, COA and National Taiwan Ocean University; NA - not available

The TRAFFIC Network is the world's largest wildlife trade monitoring programme with offices covering most parts of the world. TRAFFIC is a programme of the conservation organization WWF and IUCN - The World Conservation Union, established to monitor trade in wild plants and animals. It works in close co-operation with the Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

For more information contact:

The Senior Programme Officer
TRAFFIC East Asia-Taipei
P.O. Box 7-476
Taipei, Taiwan 106
Tel. (886) 2-2362-9787
Fax: (886) 2-2362-9799
E-mail: treatai@ms1.hinet.net

The Director
TRAFFIC East Asia
Room 2001, Double Building
22 Stanley Street, Central Hong Kong
Tel: (852) 2530-0587
Fax: (852) 2530-0864
E-mail: tea@pccw.imsbiz.com

ISBN 957986282-6
9 789579 862820