

# A Review of Changes in the Use of Whale Resources over Time in Japan, with a Specific Example of the Hand-harpoon Fishery of Nago, Okinawa Prefecture

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# **A Review of Changes in the Use of Whale Resources over Time in Japan, with a Specific Example of the Hand-harpoon Fishery of Nago, Okinawa Prefecture**

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### Abstract

There have been small-scale coastal whaling operations in the area currently known as Nago, located in present day Okinawa Prefecture, since the beginning of the Meiji Era (1868–1912). Fishermen traditionally harvested small cetaceans ('Hetu' in the local dialect) such as pilot whales and bottlenose dolphins, and, before the international moratorium on commercial whaling, meat from this fishery was distributed within the Nago area and consumed by the local population. Since the moratorium, however, most whale meat caught in the district goes to supplement the supply for the Japanese mainland. As a consequence, the supply of whale meat to the Nago region has been reduced significantly. The purpose of this study is to analyze the relationships between whale resources and local societies, as well as to examine the changes in the use of whale resources in Nago.

### 1. Introduction

There are currently five different types of whaling activities in Japan, (1) pelagic scientific whaling, (2) coastal scientific whaling, (3) small-type coastal whaling, (4) drive and hand-harpoon fisheries, and (5) incidental by-catches from fixed shore nets.

Pelagic scientific whaling is conducted by the Institute of Cetacean Research (ICR) through a special permit system purely for research purposes. The target species are the Antarctic minke whale (*Balaenoptera bonaerensis*) in the Antarctic Ocean, and the common minke whale (*Balaenoptera acutorostrata*), Bryde's whale (*Balaenoptera edeni*), sei whale (*Balaenoptera borealis*) and sperm whale (*Physeter Facrocephalus*) in the northwest Pacific Ocean. Coastal scientific whaling, conducted by small-type coastal whalers off the coasts of Kushiro and Sanriku in the northwest Pacific Ocean, is also a non-commercial activity. Its purpose is to identify the feeding habits of the common minke whale.

Conversely, small-type coastal whaling, drive fisheries and hand-harpoon fisheries are commercial whaling activities that take place within the 200 nautical-mile Economic Exclusion Zone of Japan. All target species are currently outside the control of the International Whaling Commission (IWC). Small-type coastal whaling operates in Abashiri and Hakodate, in Hokkaido Prefecture, Ayukawa, in Miyagi Prefecture, Wada, in Chiba Prefecture, and Taiji, in Wakayama Prefecture, and is authorized by the Minister of Agriculture, Forestry and Fisheries. Currently, the Minister has authorized nine whaling permits for this activity to eight whalers, including individuals and corporations. However, only five of these nine boats are in use at present for commercial whaling

ventures. Drive and hand-harpoon fisheries, which operate in Hokkaido, Aomori, Iwate, Miyagi, Chiba, Wakayama, and Okinawa prefectures, are authorized by the prefectural governor (Iwasaki 2002). Table 1 shows the target species and total allowable catch for each type of fishery. Several target species are governed by more than one authority and/or whaling methods.

Small-scale coastal whaling activities have been conducted since the beginning of the Meiji Era (1868–1912), in the area now known as Nago, located in Okinawa Prefecture. This used to be a drive fishery with collaborative efforts between fishermen and the local population in Nago Bay. The target species were short-finned pilot whale (*Globicephala macrorhynchus*), melon-headed whale (*Peponocephala electra*) and bottlenose dolphin (*Tursiops truncatus*), all of which are termed ‘Hetu’ in the local dialect (Nago Museum 1994: 5), and all of which previously migrated to Nago Bay from early spring to early summer. Local people were dependent on Hetu for survival since they were too poor to afford other meat, such as beef, pork, chicken, and goat, which until the mid-20th century were too expensive for all except the very richest families (Nago Museum 1994: 25). Therefore the extremely cheap Hetu meat used to make-up a large portion of the daily diets of the local population. However, since the global whaling moratorium most whale meat from short-finned pilot whales and false killer whales (*Pseudorca crassidens*) caught in the district has become much more valuable and has been used to supplement the supply for the Japanese mainland, where the best prices can

**Table 1** Catch quotas and sizes for small-scale whaling in 2009

	Scientific permit catches		Authorized by MAFF		Authorized by prefectural governor	
	Small-type coastal whaling	Catch quota	Small-type coastal whaling	Catch quota	Drive fishery	Hand-harpoon fishery
Minke whale	120 (catch quota) 119 (sizes)	-	-	-	-	-
Baird’s beaked whale	-	67	67	-	-	-
Short-finned pilot whale	-	72	22	307	219	54
Risso’s dolphin	-	-	-	523	336	94
False killer whale	-	20	0	100	-	1
Striped dolphin	-	-	-	655	321	98
Bottlenose dolphin	-	-	-	903	352	81
Spotted dolphin	-	-	-	788	-	3
Pacific white-sided dolphin	-	-	-	360	14	7
Dall’s porpoise	-	-	-	15,748	-	9,540
Total	120 119	159	89	19,384	1,242	9,878

Source: National Research Institute of Far Seas Fisheries (2010)

**Table 2** Catch quotas and sizes from hand harpoon fisheries in Okinawa<sup>1)</sup>

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Short-finned pilot whale	sizes	79	89	92	38	36	72	90	56	79	n/a
	Catch quotas	100								92	85
False killer whale	sizes	5	8	8	0	4	3	1	5	4	n/a
	Catch quotas									20	20
Bottlenose dolphin	sizes	8	8	8	3	7	10	10	12	4	n/a
	Catch quotas	10								9	9

be obtained. As a consequence, the supply of whale meat to the Nago region has been reduced significantly, although dolphin meat, which is unprofitable in the mainland, is still distributed and consumed in the area.

This fishery became a Fisheries Adjustment Commission licensed hand-harpoon fishery in 1989, and a prefectural governor licensed fishery in 2002. Currently, six boats are operating and the catch quota in 2008 was 85 short-finned pilot whales, 20 false killer whales, and nine bottlenose dolphins. The total allowable catch of short-finned pilot whale (which is of high commercial value in the Japanese mainland) for the whole of Okinawa Prefecture has decreased from 100 to 92 since 2007. An alternative catch quota has been requested from the prefectural government by the fishermen in this industry (Table 2).

This recent alteration in the distribution channels of whale products has brought many corresponding changes to the relationships between whale resources and local societies. In addition, the increase of whale products resulting from the expansion of the scientific whaling programs has had an enormous influence on small-scale hand-harpoon fisheries, such as those in Nago, but they are not well studied, despite their impact on local people and communities. Therefore the purpose of this paper is to present the results of an analysis of the relationships between whale resources and the local societies that depend on them, using Nago as an example. The study had the following four main objectives:

1. To analyze the changes and features of whale products dealt in Japanese municipal wholesale markets;
2. To identify the structure of the hand-harpoon fishery in Nago as well as the associated production and distribution system, including distribution channels and market prices of short-finned pilot whale, false killer whale, and bottlenose dolphin;
3. To clarify the regional consumption of whale meat products supplied to the local populace in Nago; and
4. To examine the multiple uses and functions of whale resources and hand harpoon fisheries in Japanese society.

All four objectives were addressed through a literature study combined with surveys in Nago.

## **2. Features of Whale Products Dealt in Japanese Municipal Wholesale Markets**

The edible whale products distributed in the Japanese market are composed of the following categories: (a) by-products of whales caught in the Antarctic Ocean and the northwest Pacific Ocean for scientific purposes, (b) minke whales caught through small-type coastal whaling off the coast of Kushiro and Sanriku for scientific purposes, (c) small cetaceans caught by small-type coastal whaling, (d) small cetaceans caught by drive and hand-harpoon fisheries, (e) incidental by-catches from fixed shore nets, and (f) processed frozen by-products. The ICR allows Kyodo Senpaku Kaisya, Ltd. (Kyodo Senpaku) and the Japan Small-Type Whaling Association to sell (a) and (b) according to specific rules. The quota for wholesalers in these municipal wholesale markets is determined by Kyodo Senpaku and individual market trends (Endo and Yamao 2006, 2007).

Figure 1 shows the changes in the amount of both frozen and fresh whale meat for sale in Sendai, Osaka, Nagoya, Hiroshima, Oita, Fukuoka, Yokohama, and Tsukiji Municipal Wholesale Markets between 2000 and 2009. The changes and trends in whale products dealt in Japanese municipal wholesale markets are divided into two periods, 2000–2005 and 2006–2009. The trends in these eight markets can be categorized into four types (A, B, C, and D) based on statistics and interviews with wholesale companies and middlemen (Figure 2).

### **2.1 The Period from 2000 to 2005**

The amount of frozen meat for sale on the Sendai Municipal Wholesale Market (Sendai market) increased between 2000 and 2005. Sendai market was of Type A during this period, when there was an increase in the amount of both frozen and fresh whale meat for sale. Osaka, Nagoya, Yokohama, and Tsukiji markets were of Type B, with constant amounts of both frozen and fresh whale meat. Hiroshima and Oita market were of Type C, and either ceased selling or decreased their amount of both frozen and fresh whale meat for sale. Fukuoka market belonged to Type D, which deals with fresh whale meat only.

#### **2.1.1 Type A - Sendai Market**

Sendai market increased its amount of frozen whale meat because its larger production made it possible to sell in larger quantities. In addition, frozen by-products were used for many purposes and were easy to handle and process, and the quantities transmitted to these large markets had been increasing between 2000 and 2005. Indeed, Sento Gyorui Co., Ltd., one of the wholesale companies in Sendai market, drew up its “Proposal for the sales reinforcement of frozen whale meat” in order to expand the consumption of frozen whale products. In principal, wholesalers sell frozen by-products on consignment

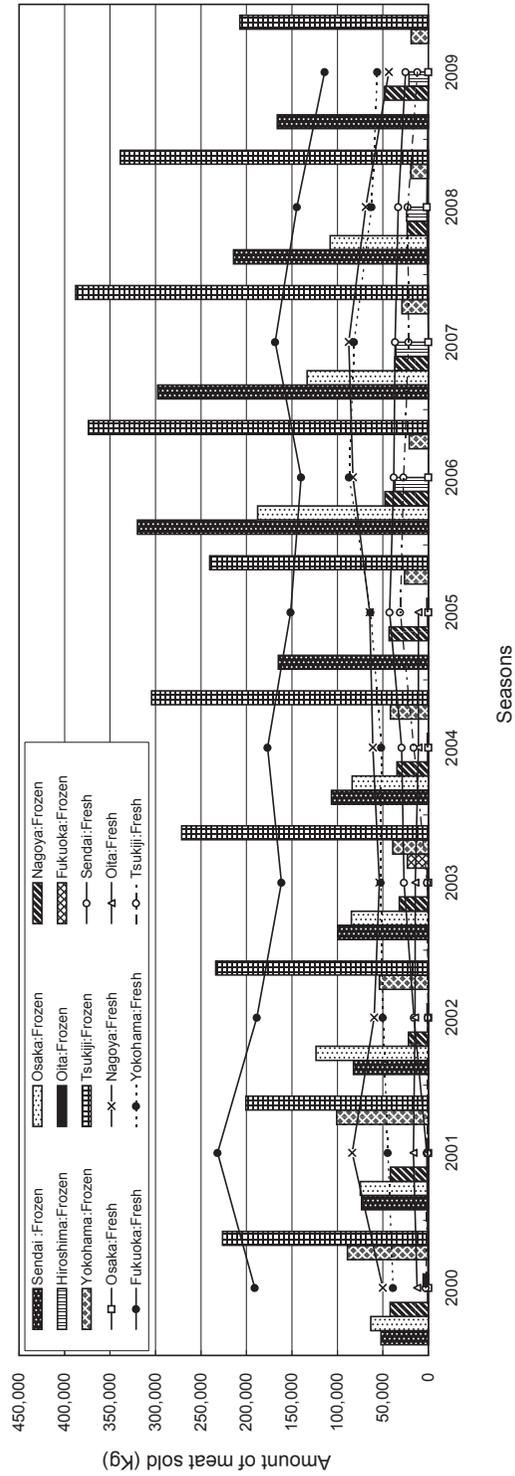
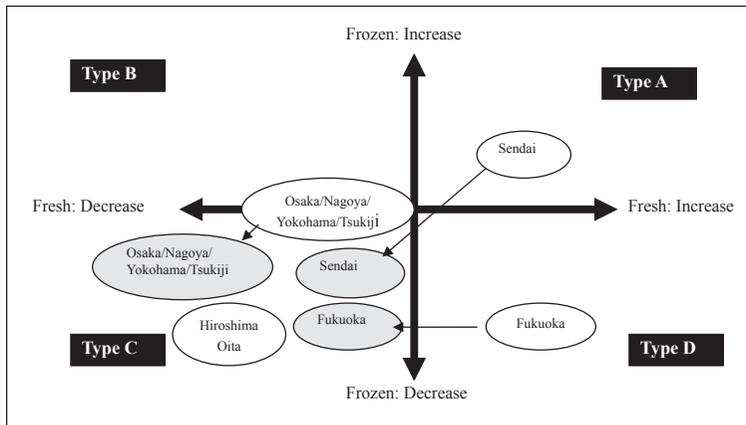


Figure 1 Changes in the production levels of fresh and frozen whale meat in 8 municipal wholesale markets<sup>2)</sup>



**Figure 2** Trend of dealing with whale products in the 8 markets categorized into four types<sup>3)</sup>

to middlemen and designated buyers through negotiated transactions at fixed prices. However, defrosted products had been sold by auction at Sendai market since 2005, thereby expanding the distribution channels.

The reason that the wholesale companies in Sendai were keen on dealing with fresh whale meat is that the regional population had maintained its consumption of fresh whale products, which had almost ceased in other areas following the 1986 moratorium (although the demand and consumption of fresh products recovered immediately after whales entangled in fixed shore nets began to be distributed as fresh products, in 2001). Sendai is also located near Ayukawa, another local community that maintains its whaling culture and the consumption of whale products. Frozen by-products do not sell as well as fresh products, although a synergistic effect between the two was to be expected since middlemen tend to buy fresh products along with frozen by-products. Minke whale is a favored among fresh whale products in Sendai market, where it sold for an average of 3,400 yen/kg (about 43 US dollars/kg as of May, 2012) during the period 2000–2005. In contrast, the meat of pilot whales, which is very popular in Fukuoka market, is not handled in Sendai market.

### 2.1.2 Type B - Osaka, Nagoya, Yokohama, and Tsukiji Markets

Osaka, Nagoya, Yokohama, and Tsukiji markets remained stagnant during 2000–2005 for both frozen and fresh whale meat, owing to low demand. Whale products were too expensive in these areas and many people were not used to eating and/or cooking them. Another reason that the distributors hesitated to deal with these whale products is that whereas the quality of the frozen by-products caught for scientific purposes was not consistent, the price set by the ICR rarely reflected this inconsistent quality. In addition, the products from each whale were sold at the same price, and selling commodities of different qualities at the same price is very difficult for distributors.

Owing to the need to reserve their quota for future years, after the moratorium the middlemen organized themselves into associations, such as the Geigo-kai Association in Osaka, and this became an important factor in maintaining their rights. However, as the demand for the products decreased, and since having whale products in stock carries a business risk, the number of middlemen likewise declined, and membership of the association decreased sharply from about 30 people following WW2, to seven in 2005.

### 2.1.3 Type C - Hiroshima and Oita Markets

Oita market stopped dealing with frozen by-products mainly owing to a decrease in demand. Stock management costs (such as freezing) were high, and it was more profitable to buy whale products at the neighboring wholesale markets. Because the price of fresh minke whales was very high, Oita market could not afford to collect the products. A similar condition exists at present in Hiroshima market, where people are generally not in the habit of eating fresh whale meat, so there is very little demand.

### 2.1.4 Type D - Fukuoka Market

The Fukuoka market is a typical municipal wholesale market in a large-scale consumption area. Fresh marine products from China and South Korea are also landed here. The wholesale companies do not handle frozen by-products, for the same reasons already mentioned for the other markets.

The edible whale products for sale in the Fukuoka market are composed of the following categories: a) minke whales caught through small-type coastal whaling off the coast of Kushiro and Sanriku for scientific purposes, b) small cetaceans caught through small-type coastal whaling, c) small cetaceans caught through drive and hand-harpoon fisheries, and d) incidental by-catches from fixed shore nets. At present there are ten non-local middlemen, 39 local middlemen, and 340 designated buyers, and approximately 20 companies that handle fresh whale products.

The coastal scientific whaling permitted catch of 50 minke whales had been taken alternatively in Kushiro and Sanriku annually between 2002 and 2004. The program expanded in 2005, and 60 minke whale were caught in Sanriku between April and May, and in Kushiro between September and October of 2005. The sales policy of fresh by-products is regulated by the "Uses and Sales Guidance of Fresh By-Products from Scientific Whaling". The same applies to the frozen by-products of the program, which the ICR commissions the Japan Small-Type Whaling Association to sell to wholesale markets in Japan.

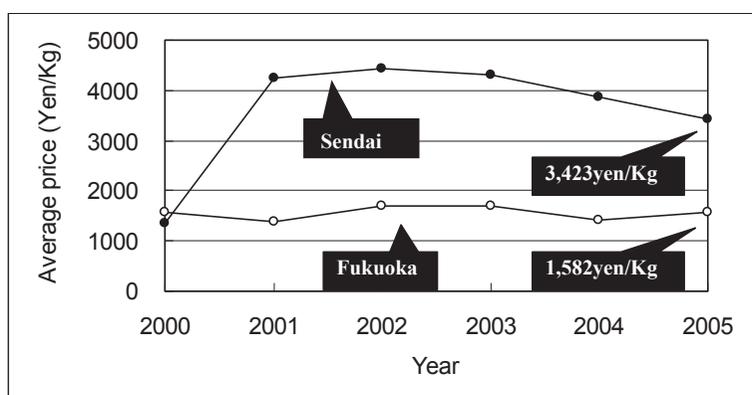
The target species of small-type coastal whaling activities are short-finned pilot whales, Risso's dolphins (*Grampus griseus*) and Baird's beaked whales (*Berardius bairdii*) caught in Abashiri and Hakodate, in Hokkaido, Ayukawa, in Miyagi Prefecture, Wada, in Chiba Prefecture, and Taiji, in Wakayama Prefecture. These all are handled in the Fukuoka market. Only short-finned pilot whales and Risso's dolphins harvested through the drive and the hand-harpoon fishery in Taiji are sold on the Fukuoka market. Short-finned pilot whales and false killer whales are harvested through the hand-harpoon fishery in Nago and also sold on the Fukuoka market.

Whale by-catches from fixed set nets can now be sold under certain conditions, because of amendments to the Fisheries Law made in 2001. The fresh meat of minke whales obtained as incidental by-catches in Tsushima, Oita and Kagoshima is traded mainly in the Fukuoka market. Fresh whale products are handled almost year-round in the Fukuoka market.

The middlemen sell their products to shops and fishmongers, sushi bars, restaurants, whale meat restaurants, supermarkets, and to other middlemen. Approximately 60% of fresh whale products are consumed in the Fukuoka region, while the remaining 40% are shipped to areas outside the prefecture. If the wholesale price of fresh products is expected to be lower in the markets than that in the production areas (because of oversupply or low quality) then they are not sold by auction, but to remote dealers in Kagoshima, Miyazaki, and Kumamoto prefectures through negotiated transactions in order to keep the price from going down.

Figure 3<sup>4)</sup> shows changes in the average price of fresh whale meat in the Sendai and Fukuoka markets between 2000 and 2005. The average price was 3,400 yen/kg in the downside in the Sendai market in 2005, while the price in the Fukuoka market was only about 1,500 yen/kg. The average price in Fukuoka was found to be lower than in Sendai because many different types of whale meat were sold there, whereas Sendai specializes in minke whale meat. The price of minke whale red meat in Fukuoka was between 2,000 and 5,000 yen/kg, and that of pilot whale red meat was 2,000 to 6,000 yen/kg<sup>5)</sup>. The popularity of the latter is a special characteristic of Fukuoka market, because the demand for this product is high in the Kyushu region (centered in Fukuoka Prefecture).

The fresh whale products from Taiji, Okinawa and Ayukawa are collected in the Fukuoka market, and there is competition in both price and quality among the products from the three production areas. The main pricing factors for whale meat are related to its quality, and include freshness, fat levels, color, and blood content.



**Figure 3** The annual change 2000–2005 in the average wholesale price of fresh whale meat in Sendai and Fukuoka municipal wholesale markets

## 2.2 The Period from 2006 to 2009

The amount of both frozen and fresh whale meat for sale in the eight markets shows a downward trend in the period 2006–2009 (Figure 1), and all the markets are categorized into Type B or Type C, based on statistics and interviews with wholesale companies and middlemen (Figure 2).

## 3. Structure of the Production and Distribution Systems of Hand-harpoon Fisheries in Nago, Okinawa Prefecture

### 3.1 Outline of Fish Marketing in the Production Area

Nago City has a population of 60,160 (2011), which is increasing steadily. Primary industry accounts for 8.3% of employment, but of the 1,978 people employed in primary industry in 2005, only 150 were fishermen<sup>6)</sup>. The main target species for local fishermen are tuna and bonito (using fish aggregating devices), dolphin fish, and diamondback squid. Gill net fisheries, pole-and-line fishing using 1.5-ton wooden boats equipped with outboard engines, and dive fishing are also conducted in the area. The total fish production area market in Nago, which is operated by the Nago Fisheries Cooperative Association, is 493 tons, comprised of 131 tons of tuna, 24 tons of marine mammals, 13 tons of dolphin fish, and five tons of bonito. The total number of fishing boats is 135<sup>7)</sup> and whales account for 25% of the total production value, which was 636 million yen in 2005, but declined by 10% in 2010<sup>8)</sup>. The fish market in the production area in Nago is the second largest among Okinawan local markets, and there are 50 local middlemen in the Nago fish production area.

### 3.2 The Hand-harpoon Fisheries

#### 3.2.1 Whaling Methods

The hand-harpoon fishery of Nago is also sometimes known as the crossbow (or pachinko) fishery, after the armed harpoon launcher carried at the bow of the boats involved. The launcher was originally inspired by Western-style archery, but it has been modified repeatedly by the local fishermen and private companies in Hyogo Prefecture (Nago Museum 1994: 37). During fishing the harpooner attempts to hit the target around the dorsal fin from a range of approximately 30–50 m. The harpoon is 2.7 m long and made of stainless steel. It is attached to the boat by a 20 m rope 5–9 mm in diameter. In contrast, the rope used for hauling the catch on board the boat is much thicker, at 13 mm diameter. The diameter of rubber used in the barrel of the harpoon launcher is 12–13 mm, and has a total length of 50 m. There are differences in both the shape of the gun and the diameter of the rope among whaling boats, according to modifications on individual boats.

Because of its high commercial value on the Japanese mainland the current main target species is the short-finned pilot whale, although false killer whales and bottlenose dolphins are also targeted. Short-finned pilot whales are difficult to catch because once they dive they may not surface for 30–60 minutes, so it is difficult to predict where they will surface. This means that sometimes fishermen can pursue one target whale for an

entire day. When the whale does come up for air it remains at the surface for 30 to 40 minutes, and it is at this point that the harpooner tries to make the kill. False killer whales do not dive for such a long period, so it is much easier both to predict where they will surface and to catch them. Bottlenose dolphins are perhaps the easiest species to catch since they are attracted to the wake of the whaling boat and will often ‘play’ near the bow. This makes them very easy to harvest using hand-harpoons.

### 3.2.2 Whaling Boats

The capacity of boats used in the hand-harpoon fishery is 4.6–9.8 tons. Only one boat of the six is outfitted with modern equipment such as GPS, radiotelephone, and sonar. The number of crew varies between two to four people and consists of a harpooner, a steersman (who also searches for whales), and a winch operator (in the case of a two-man crew, one person will do two of these jobs). The crews of four of the boats are composed of families, and many members are now quite old. It takes about two hours for a three-man crew to harvest and haul aboard a large catch, and a further two hours to process a short-finned pilot whale (20 minutes in the case of the bottlenose dolphin).

### 3.2.3 Whaling Grounds

The Hetu whaling grounds are divided into a southern and a northern region. From February to March, often characterized by inclement weather, whaling activities are concentrated around Iheiya Island in the northern grounds, and Kume and Tokashiki Islands in the southern grounds. These areas are relatively close to the coast, although it is still a four to five hour boat trip from the Nago and Ginama fishing ports, where the whaling boats are moored, to the whaling grounds. After April, when the weather conditions are comparatively constant, fishermen spend 12 hours travelling to Yoron and Tokunoshima Islands in the northern grounds, and Miyako Island in the southern grounds; these trips may last up to four days. The six whaling boats normally operate separately, but often exchange information by mobile phone on whale sightings. Other fishermen, whose target species is Diamondback Squid (*Thysanoteuthis rhombus*), which are preyed on by dolphins, also give the whalers information, hence this fishery is a highly cooperative one.

### 3.2.4 Preservation of Whale Meat

Red meat from short-finned pilot whales and false killer whales is preserved in salt and ice. The white blubber is stored in ice below deck to prevent discoloration by the sun. Unfortunately, when whale meat is preserved by this method it becomes stiff and the quality decreases. Therefore, one of the whaling boats is equipped water-based cooling tanks, which keep the meat at -5 °C without affecting the quality.

### 3.2.5 Whaling Season

The Nago hand-harpoon fishery lasts from December to August, but the number of operating days is less than 150 (approximately five months) a year, because going to sea is not generally possible during most of the rainy and typhoon seasons. Whaling is

influenced more by sea conditions than by the weather because, as mentioned previously, whalers sight their target from aboard ship. Some whalers also conduct long-line fishing, fixed netting, and sea-urchin fishing as side businesses during the rainy, typhoon, and closed seasons. In addition, in the near future some also intend to start working as recreational fishing guides in order to secure an alternative income.

### 3.2.6 Whaling Expenditures

The main operating expenditures for whaling ships are (1) A-grade heavy oil (three tons/month), (2) lubricants (50 liters/three months), (3) ice (three tons/per trip), and (4) food (30,000 yen/per trip). In common with many industries, whaling in Japan is also now under increasing financial pressure owing to the recent steep rise in the price of fuel oil.

Whaling equipment, such as the ropes and rubber used for the launchers, are bought from the Nago Fishery Cooperative Association (FCA). The rope is usually replaced every three years, while the rubber (1,200 yen/m) is replaced every three months. Additional costs include both sales charges and transportation of the whale products (via air and land) to the Fukuoka Municipal Wholesale Market.

## 3.3 Distribution Channels and Price Determination

### 3.3.1 Bottlenose Dolphin

Figure 4 illustrates the distribution channels of bottlenose dolphin meat. The whalers boil the meat in outdoor facilities at the Nago FCA that were built by one of the whalers and shared by the others. The whale flesh is first divided into red meat, white blubber, or internal organs. Each is then boiled until it tender. Approximately 150 kg of red meat, white blubber or internal organs can be boiled at a time, and this takes from two to eight hours, during which the meat must be stirred to avoid scorching and overcooking. The

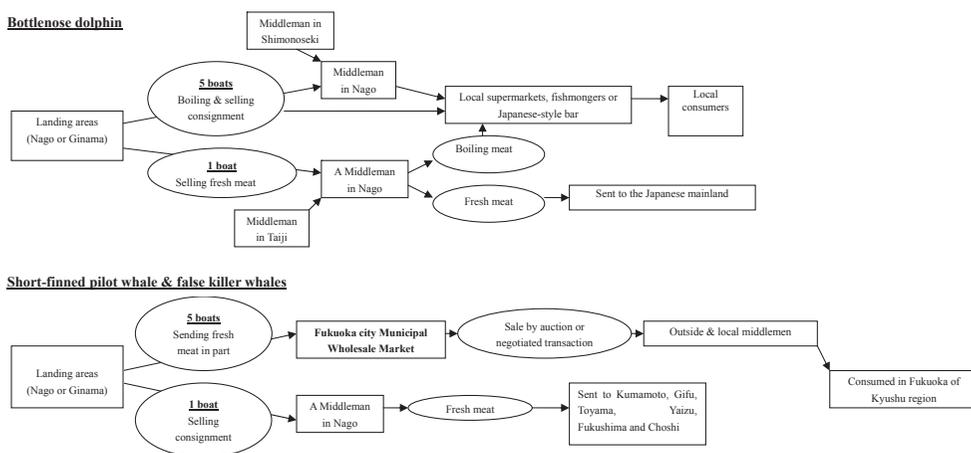


Figure 4 Distribution channels for edible whale meat in Nago<sup>9)</sup>

boiled meat is then cooled in air or in a refrigerator for 30 minutes before being cut into 300–500 g pieces and packed into 10–11 kg sacks. It is then sold either by middlemen to local supermarkets or directly to local restaurants by the fishermen. Although some internal organs are also sold to local middlemen, they are consumed mainly by the whalers themselves. In addition, the whalers in one of the boats sell fresh bottlenose dolphin meat to a middleman, who then boils part of it, and sells it to the local supermarket, fish stores, taverns, or sends it to the Japanese mainland via a negotiated transaction. In the latter case the selling price is twice that obtained from local supermarkets.

Not all the whales caught by the six boats are sold by auction at Nago FCA market. Instead some are sold directly by pre-negotiated transaction to local middlemen. It has been a custom since hand-harpoon fisheries started in Nago that each boat deals with only one particular middleman. So it is difficult for new middlemen to enter the market. Therefore, those who cannot buy directly from the whalers, stock whale meat bought from other middleman and supermarkets. Dolphin meat is mostly consumed locally, and when the supply is short, local middlemen bring in supplies from Shimonoseki City, in Yamaguchi Prefecture, and Taiji, in Wakayama Prefecture.

Table 3<sup>10)</sup> indicates the number of supermarkets in Okinawa Prefecture and the number to which two specific middlemen sell whale products. Both sell whale products to supermarkets located in the northern part of Okinawa Prefecture because it is possible to sell large amounts of products at the same time. Although the demand for whale products from local restaurants and taverns is high, it is not possible for all of them to have business relationships with the limited number of middlemen. Therefore, for whale products, the customers are limited to the supermarkets, restaurants and taverns which the middlemen or whaler's relatives and/or their acquaintances operate.

The boiled meat sold to the supermarket by the middlemen is sliced, packaged and sold at the fresh fish counter. Both red meat and white blubber are mixed and packaged for sale. Demand for white blubber is especially high in Nago, whereas processed whale products like canned meat, sliced tongue, and boiled caudal fin are not sold in Okinawa.

Table 4<sup>11)</sup> indicates the selling price of whale products from supermarket 'D' in Nago, which buys whale products from two different middlemen and sells them over the counter. The whalers sell boiled meat of bottlenose dolphin to the middlemen at 1,400–1,500 yen/kg, and at 500–600 yen/kg for fresh meat. The middlemen sell the same meat to the supermarket at 1,800 yen/kg and the supermarket retails it at 2,500 yen/kg. The same type of meat was sold at 3,490 yen/kg in a different supermarket in a different area. Similarly, raw red meat was sold at 2,500 yen/kg by the middlemen to the supermarket 'D', which retailed it at 3,500 yen/kg. Boiled rib meat was sold at 1,000 yen/kg by the middlemen to the supermarket, which in turn sold it for 1,500 yen/kg (as of 2010).

The gross profit of whale products for the supermarket is 20 to 30%, and approximately 3 kg of whale products are sold each day. Since the products are out of stock for two to three months a year, it is usually necessary to keep some frozen. Boiled red meat from bottlenose dolphins can be frozen for about one year, but the catch quota from bottlenose dolphin is only ten, which means they are usually in short supply.

**Table 3** The supermarkets to which the local middlemen sell Hetu meat

Supermarkets	Number of the branches in Okinawa	Number of the middleman's customers	
		A middleman	B middleman
A	55	4 (2 in Nago, 2 in the central part of Okinawa Island)	—
B	69	4 (in the central part)	6 (4 in Nago, 1 in Kin, 1 in Motobu)
C	8	1 (in Nago)	—
D	13	1 (in Nago)	—
Total		10	6

**Table 4** Sale price of dolphin meat in supermarket D

Meat used in	Average production per head	Price (yen/kg) Fishermen ⇒ Middlemen	Price (yen/kg) Middlemen ⇒ Supermarkets	Retail price (yen/kg)
Red & blubber boiled meat	300 kg	1,400–1,500	1,800	2,500
Raw meat		unknown	2,500	3,500
Rib boiled meat		unknown	1,000	1,500

Moreover the price of dolphin meat at the supermarket was 250 to 350 yen/100 g as of 2010, which is very high. However, despite this, it was found that the supermarkets do not need to advertise whale products, since they sell out very quickly once they are in stock.

### 3.3.2 Short-finned Pilot Whale and False Killer Whale

The marketing channels for short-finned pilot whale and false killer whale are divided into two routes (Figure 4). The meat is classified by part, e.g., red meat, internal organs, head, jaw, and fins. The whalers of five boats cut the meat up, pack it in ice, and ship it directly through Nago FCA to Fukuoka Municipal Wholesale Market (Fukuoka market) as fresh whale products. Very little of the meat from pilot whales is sold at the production area. Instead, most is transported by air directly to the Fukuoka market, although some is also sold to Kumamoto, Gifu, Toyama, Yaizu, Fukushima, and Choshi Municipal Wholesale Markets.

There are two wholesale companies operating in Fukuoka market; four boats do business with one of the companies, while two boats do business with the other. The fresh whale products are sold by auction or negotiated transaction in the Fukuoka market, and pilot whale meat is mostly consumed in northern Kyushu.

A short-finned pilot whale yields an average of about one ton of meat. The wholesale price of short-finned pilot whale red meat declined from 2,000 yen/kg in 2006 to 1,000 yen/kg in 2010, while short-finned pilot whale white blubber decreased from 800 yen/kg to 500 yen/kg. Premium meat (known as Oniku) sold at the higher average price of 10,000 yen/kg in 2006, but for 8,000yen/kg in 2010, owing to the low demand for whale meat.

### 3.3.3 Changes in the Distribution Structures of Whale Products

There have been three significant changes in the distribution structures of pilot whale products in recent years. One was a change of the distribution channels, the second a change of shippers to the Fukuoka market, and the third a reduction in the amount of products shipped to the Fukuoka market.

First, the transport of whale products from Nago to the Fukuoka market began approximately 15 years ago. Before this time all whale products were sold directly to middlemen in the Nago area, at a relatively low price. However, now that most pilot whale meat is sold on the Japanese mainland at a large profit, they are no longer distributed or consumed in Nago.

Second, when dealing with wholesale companies in the Fukuoka market began, all six boats in the fishery previously sold their products on consignment to one middleman to send on to Fukuoka, but now there is only one boat which still has dealings with this person, since it is much more profitable for whalers to send their catch to Fukuoka without going through the middleman. Doing this means that the whalers have to master methods of sending their catches to the market, thus becoming independent of the middleman. This is not as difficult as it may seem since the shipment destination is limited to the Fukuoka market, and thus the distribution channels are narrow. The advantage of selling through a middleman is that they have other sales channels besides Fukuoka. For example, a middleman may have many clients on the Japanese mainland. The other advantage of selling through a middleman is that there are alternative choices as to how the meat is sold, for example by negotiated transaction or via advanced sales outside municipal wholesale markets.

Third, since 2009 local fishermen have stopped shipping white blubber of short-finned pilot whales to the Fukuoka market. Instead it has been distributed within the Nago area and consumed by the local population. The first reason is that white blubber frozen by-products from scientific research programs in the Antarctic Ocean and/or the northwest Pacific Ocean is continuously in stock because the supply has exceeded demand by a wide margin. The red meat from short-finned pilot whales is valuable as fresh whale meat in the municipal wholesale market, giving fresh red meat a competitive advantage over frozen red meat. On the other hand, white blubber is frozen and utilized for processed food. Therefore, there is no differentiation in market value between white blubber obtained from local whalers and that from pelagic scientific whaling, and both are continually overstocked in the market. The second reason is that some distributors hesitate to deal in white blubber of toothed whales are concerns over food safety. The third is that the consumption of whale meat has declined overall.

### 3.3.4 Problems of Price Determination

The first problem in determining a price for pilot whale meat shipped to Fukuoka is that its value varies greatly according to quality (e.g., freshness, fat, color, and blood content). Second, the amount of frozen by-products from scientific research programs in the Antarctic Ocean and of fresh whale products from Taiji and Ayukawa increases each year, which lowers the price.

A third problem is that the price of fresh whale meat has been low in recent years, again to the result of an increase in the amount of the whale meat distributed from the expansion of the scientific whaling activities. For example, the number of minke whales caught in the Antarctic Ocean increased from 440 in 2005 to 853 in 2006. When the frozen by-products from these catches were distributed within the Japanese markets in June, the wholesale price of fresh pilot whale meat dropped to the very low price of 800 to 1,000 yen/kg in the Fukuoka market.

Although wholesale companies do not deal with frozen by-products and do not sell them to middlemen directly, the price of fresh whale meat is influenced by that of frozen by-products, because the middlemen stock them (frozen by-products) outside of the municipal wholesale market routes. Moreover, in addition to the influence on the price of fresh products from frozen by-products, there is also an influence from the price and quality from fresh whale meat produced in Taiji and Ayukawa. In addition, since the meat of short-finned pilot whales is not suitable for use in frozen products, it is not widely used compared to frozen by-products and fresh meat from minke whales. Overall then, the price competitiveness of pilot whale is weaker than that of frozen by-products and fresh minke products. These factors combine to make the Hetu fishermen's business inherently unstable.

### 3.4 Resource Management

The Society for the Study of Small Cetaceans was established in 2005 and includes all the Hetu fishermen. It was established to strengthen and unify the management of whaling operations between whalers. This was deemed necessary since previously the whalers frequently concentrated on the same individual whales. This obviously caused many problems, and eventually the whalers recognized the need for clear operating rules. Now, if two or more boats are after the same whale, the first one to sight it has priority in harvesting it. If they should fail, the next boat may try. Other activities of the society include requesting new catch quotas for various species, and the exchange of information among whalers. The whalers also submit DNA samples and part of the jaw from all their catches to the fisheries section of the Okinawa prefectural government, for whale research.

## 4. Materials and Methods

### 4.1 Outline of the Questionnaire Used to Assess Hetu Meat Consumption in Nago

A questionnaire-based survey was conducted in the fresh fish corner of supermarket ‘D’ in Nago, which sold Hetu meat (Table 4). The respondents were 14 men and 36 women. There were seven people in their twenties, two in their thirties, nine in their forties, 17 in their fifties, five in their sixties, and ten in their upper seventies.

It was found that more than 80% of respondents had eaten Hetu cuisine (Figure 5), and more than 70 % of those in their twenties had eaten it. More than half the people questioned liked Hetu cuisine (Figure 6), whereas only 21% disliked it. Age was not a determining factor regarding whether or not a person liked this kind of food. However, despite many people liking it, most did not eat it very frequently, with 48% saying ‘hardly eating’ it, 14% eating it once every six months, and 21% eating it only once a year (Figure 7).

Question 4 (Figure 8) asked whether or not respondents had recently started eating Hetu cuisine. Most people (74%) do not eat Hetu meat, and only 12% of respondents were recent converts to the food. The reasons for not eating it (Figure 9) were given as low supply (14 respondents), high-price (10 respondents) and dislike of the taste (10 respondents). Some respondents stopped buying Hetu meat at the supermarkets because the quality is not constant and because there are many other kinds of food available that were cheaper and of better quality. There was also one person who felt that “Dolphins were not for eating but for watching”.

In contrast, the reason that some respondents had recently started to eat Hetu meat was that they felt it was of high nutritional value. Some also bought Hetu meat as a traditional medicine that they believe alleviated the symptoms of neuralgia, arthritis, and asthma. The Hetu fishermen themselves believe that whale meat cleans the intestines and has a beneficial effect on overall health. Nevertheless many people felt Hetu meat was expensive (Figure 10), although most people still ate it at home (Figure 11).

Question 7 (Figure 12) asked what kind of Hetu cuisine was usually eaten. Forty people answered that they ate it as a fried dish or with slices of raw meat. According to the interviews with Hetu fishermen, they eat steak and deep-fried Hetu cutlet. However, local supermarkets deal primarily with boiled and sliced dolphin meat and therefore it is impossible for most local people, except Hetu fishermen, to cook the steak, cutlet, sashimi and *soki* soup on a regular basis.

Question 8 (Figure 13) asked when people ate Hetu cuisine. People who answered “on a normal day” accounted for 98% of responses. Surprisingly, despite the high price, Hetu cuisine is a one of the home-cooked meals prepared not only on special days such as the New Year or anniversaries, but on normal days. However, Hetu fishermen do put it on a tier in lacquerware boxes on special days, such as traditional events in Okinawa.

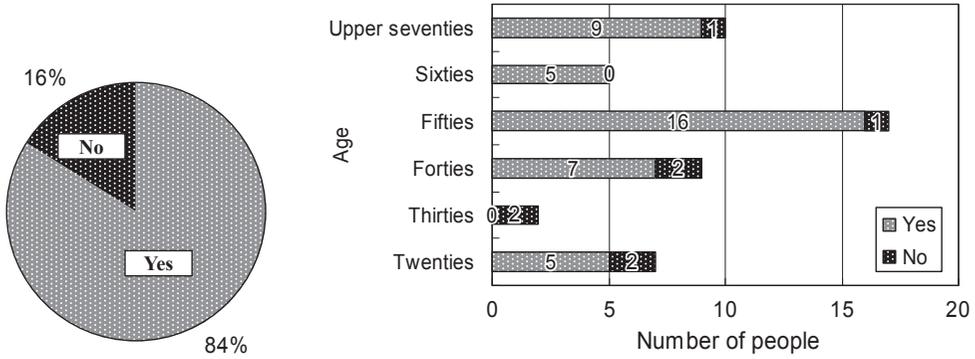


Figure 5 Q1 Have you ever eaten Hetu cuisine?



Figure 6 Q2 Do you like Hetu cuisine?

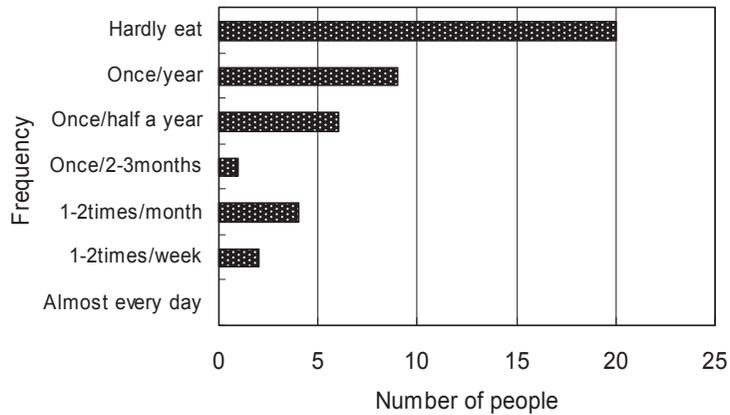
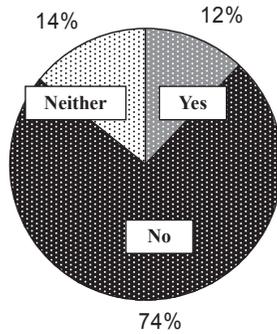
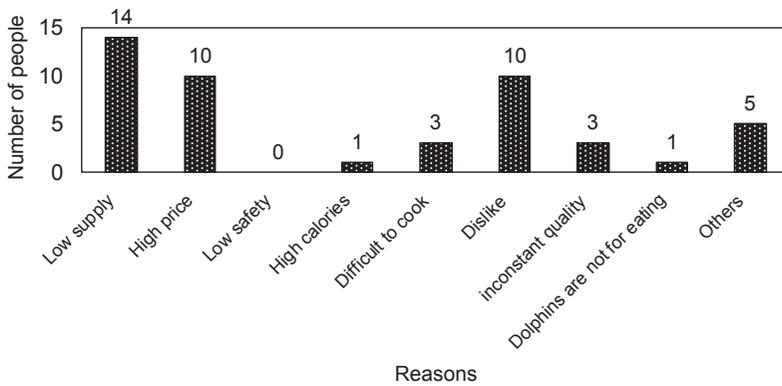


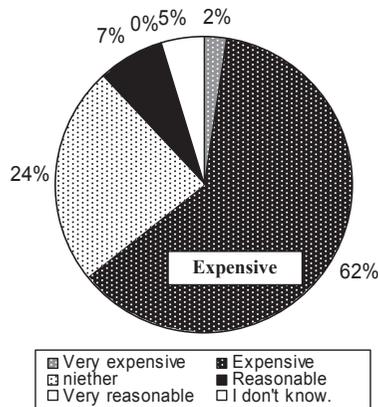
Figure 7 Q3 How often do you eat Hetu cuisine?



**Figure 8** Q4 Have you recently started eating Hetu meat?



**Figure 9** Reasons for not eating Hetu meat



**Figure 10** Q5 What is your impression of the price of Hetu?

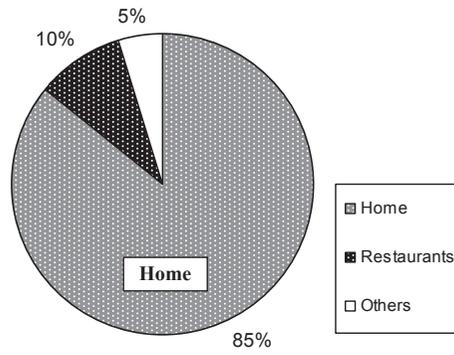


Figure 11 Q6 Where do you mainly eat Hetu cuisine?



Figure 12 Q7 What kind of Hetu cuisine do you eat (multiple answers possible)?

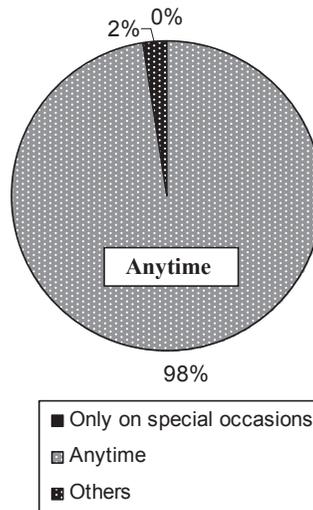
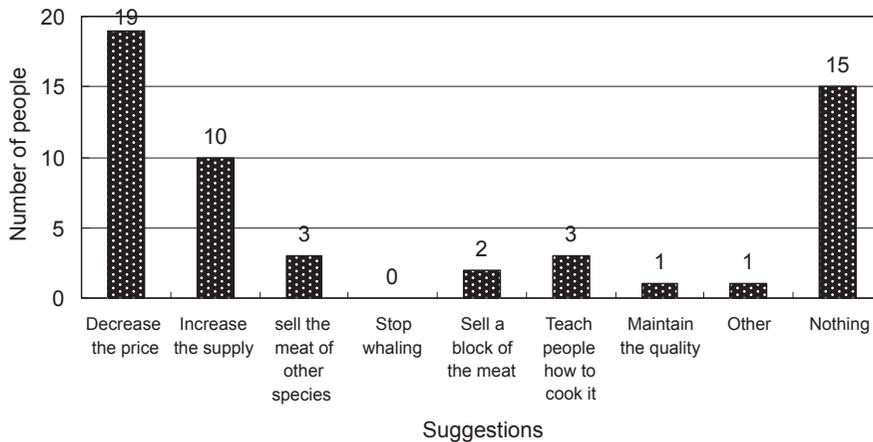


Figure 13 Q8 When do you eat Hetu cuisine?



**Figure 14** Q10 How do you feel the demands for Hetu meat could be improved in the future (multiple answers possible)

#### 4.2 Summary of Results of the Questionnaire

The relationships between Hetu meat and the local population of Nago have changed historically. The number of target species migrating to Nago Bay fell dramatically in the 1980s because of rapid construction projects and housing developments in the mountain areas of Okinawa, which were under US control until 1972. This construction resulted in the erosion of clay, which was subsequently deposited into the coastal fishing grounds thereby significantly reduced the abundance of a number of migratory species (such as reef squid), which are the main prey of Hetu target species (Nago Museum 1994: 12). Without food the whales could not survive, so the fishery collapsed. However, in recent years, the fishing grounds have recovered and, since the moratorium, meat from short-finned pilot whale and false killer whales caught in the district has become much more valuable. Nevertheless the amount of Hetu products distributed in local areas is still low because most is exported to the mainland.

The results of the questionnaire reflect this change in the production and distribution of Hetu meat. When the fishery closed, the amount of Hetu consumed dramatically decreased and the local population became increasingly indifferent to it. At present, however, edible Hetu products are a luxury rather than a cheap food item. Hetu is also seen as nutritious among health-conscious people. Nevertheless it still sells out almost as soon as it is displayed at supermarkets, because consumers and retailers such as restaurants buy it in bulk due to the perennial short supply.

#### 5. Maintenance and Succession of Hetu Whaling Culture

The Hetu prayer ceremony (‘Ugan’ in the local dialect) is held on the luckiest day in a recurring six-day series at the end of January, and is an annual event for Hetu fishermen.

During the off-season between November and January the Hetu fishermen, the staff of Nago FCA, and Nago City officers attend the ceremony to pray for Hetu migration, large catches, and safety of the fishermen. According to interviews with Hetu fishermen as part of this research, the Hetu prayer started in the Meiji Era and has been maintained for generations. The prayer ceremony is held at the beginning of spring, based on the lunar calendar, which is used by the fishermen to plan fishing activities.

The prayer is held in two places. The first is at the ruins of Nago castle (where the god of the sea is enshrined) where offerings of rice, fruits, and other gifts are made. All participants are purified by Okinawan millet brandy (*awamori*) and the prayer ends after about 30 minutes. In 1990, the Mayor of Nago attended the Hetu prayer ceremony, which was officiated over by a female spiritualist. Traditional Okinawan (Ryukyu) cuisine was offered along with rice and fruits at that time (Nago Museum 1994: 6–7). In contrast, the prayer ceremony conducted in January 2006 was much simpler than that in 1990. The mayor did not attend and one of the elderly Hetu fishermen acted as the spiritualist, instead of a female spiritualist. The prayer ceremony is also held at the place of worship in Minato Ward public hall, also where women such as fishermen's mothers and wives pray for the safety of their husbands and the children who are away fishing. While these examples of Hetu fishermen's culture continue to take place, the culture faces serious threats.

## 6. Summary

The hand-harpoon fishermen of Nago have faced various kinds of challenges. These include the reduction in the catch quota for short-finned pilot whales, false killer whales, and bottlenose dolphin in Okinawa Prefecture in recent years, a decline in whale meat consumption, a fall in whale meat prices, increases in capital investment and operating costs, and the aging of the fishermen. Vulnerability of the operation of the fisheries inevitably has an influence on local society and the community.

The total amount of whale meat available to the local populace is extremely small, and it does not constitute a major part of their food supply. Nevertheless, Hetu fishing plays a crucial social and cultural role besides supplying food. The whaling culture and local dining habits are deeply rooted in the local social and cultural fabric.

What should be done to maintain Hetu fisheries? First, extending whaling seasons is needed for stable operations. Okinawa Prefecture is a highly typhoon-prone area. Since whaling activities are conducted on the open sea and whalers sight their target from onboard ship, the number of days in which whale harvesting can actually take place is very limited.

Second, under present circumstances it is increasingly necessary for the survival of the Hetu fishermen to maintain profits by air-freighting their catch to the Fukuoka market. In addition, the development of other markets for fresh whale products besides Fukuoka is urgently needed, and methods of sale that can immediately respond to market trends need to be developed. This is easier said than done, since most municipal wholesale markets have been either stagnant in recent years or have tended to reduce

their dealing in both frozen and fresh whale products. This makes it likely that securing alternative sources of income will be very important in the future. Whale watching, which uses the local whale resources for tourism, has been successfully conducted in Okinawa. Hetu fishermen could potentially operate such a business when the fishery is closed, especially since this coincides with the annual migration of humpback whales (which are very popular with tourists) to Okinawan waters.

Third, a stable supply of whale meat for the local populace is a necessity. Since the moratorium, most whale meat caught in the district has been used to supplement the supply on the Japanese mainland. As a consequence, the supply of whale meat to the Nago region has been reduced significantly. However, since 2009 local fishermen have stopped shipping white blubber of short-finned pilot whales to the Fukuoka market, and it has been distributed within the Nago area and consumed by the local population. This presents an opportunity to resume and expand distribution and consumption of whale meat in the Nago area. The number of skilled middleman and processors who can deal with whale meat in the Nago area is much smaller than, for example, in Taiji, Wakayama Prefecture, which has a traditional whaling culture. The development of new processed whale products is needed.

A fourth challenge is expanding consumption of whale meat in the Nago area. According to the results of the questionnaires, there are requests for price reductions and increases in supply. It is thus necessary for the Nago City Government to coordinate and promote long-term integrated management for price reduction and an increase in the supply of whale meat among the local fisheries cooperative association, whalers, middlemen, and processors.

## Acknowledgments

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## Notes

- 1) The statistics were provided by the Okinawa Prefecture Office, 2010.
- 2) The statistics were provided by Sendai, Osaka, Nagoya, Hiroshima, Oita, Fukuoka, Yokohama and Tsukiji Municipal Wholesale Market.
- 3) The figure was based on statistics and interviews from wholesale companies and middlemen in the Sendai, Osaka, Nagoya, Hiroshima, Oita, Fukuoka, Yokohama and Tsukiji Municipal Wholesale Markets.
- 4) The statistics were provided by Sendai and Fukuoka Municipal Wholesale Markets.
- 5) This information was provided by the wholesale companies, middlemen, and Hetu fishermen.
- 6) The statistics were provided by the 2009 National Census survey by the Statistics Bureau of

- Ministry of Internal Affairs and Communications (<http://www.stat.go.jp/data/kokusei/2005/index.htm>).
- 7) The statistics were provided by the 11th Fishery Census of Japan, the 2006 Survey on Marine Production conducted by the Ministry of Agriculture, Forestry and Fisheries, and <http://www.machimura.maff.go.jp/machi/map2/47/209/fisheries.html>.
  - 8) This information was provided by the Nago Fishery Cooperative Association in 2006 and 2010.
  - 9) The figure was based on the interviews with Hetu fishermen, middlemen, and wholesale companies.
  - 10) The table was based on the supermarkets' web pages, telephone inquiries and interviews with middlemen.
  - 11) The table was based on interviews with Hetu fishermen, middlemen, and supermarkets.

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