Shark fisheries and trade characteristic in North Maluku, Indonesia

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Abstract. The waters of North Maluku Province are known as a hotspot for sharks in Indonesia. However, despite the richness and importance of shark population in this area, information about shark fisheries and trade remains limited. The aim of this research was to fill this knowledge gap by identifying the characteristics of shark fisheries and trade in this region. We conducted interviews and field observations during August 2017 in two case study regencies: South Halmahera and Morotai. The result show that targeted shark fishing is practiced in Mano village, Gomumu Island, South Halmahera and Posi-posi and Leo-leo Villages of Rao Island, Morotai Island. Mano village’s fishery consists of 48 vessels, with the main fishing grounds in Halmahera and Papua waters. Posi-Posi and Leo-Leo Villages operate a fleet of 12 vessels, within the main fishing ground in northern Morotai waters. We identified two traders of shark products in Morotai Island Regency, and seven traders in South Halmahera Regency. The primary traded commodities are shark fins and meat, predominantly. Fins are transported by boat to traders in Manado, Surabaya, Bau-Bau and Makassar, while meat is sold on to traders in Jakarta. We expect that the results of this research can be used to direct attention and resources towards managing shark fisheries and trade in North Maluku Province in the future.

1. Introduction
Indonesia is the biggest shark and ray fishing nation in the world, landing more than 100,000 tons of sharks and rays per year [2]. The waters of North Maluku province are an important hotspot for sharks, in particular North Maluku is home to the endemic halmahera walking shark and a growing shark dive tourism sector [4]. It is also known as a province with huge fisheries resources, which are important for coastal livelihoods, however data and information on fisheries resources and trade, particularly sharks, are very limited for this area [5].

Limited data and information hamper effective management of sharks, and implementation of national plans and international commitments such as the NPOA sharks and the Convention on the International Trade of Endangered Species (CITES). Hence, monitoring and research efforts relating to fisheries and trade are needed to evaluate the status of the species, and provide recommendations in supporting the national action plan for conservation [6]. The purpose of this study is to understand the characteristics and map the locations of shark fisheries and trade in North Maluku.

2. Materials and Methods
We used a mixed methods approach for this study, including a literature review, field observation, and collection of primary and secondary data. Primary data was collected through interviews, using a snowball sampling technique, since it was not possible to make a priori sampling decisions [7]. This
technique is used to identify, choose and take samples from a network or chain of key actors [7]. In this study, key actors included fishers, community leaders and traders. Interview topics focused on the state of general fisheries; characteristics of fishing fleets, fish catch, seasonal patterns in fishing; and characteristics of trade such as post-harvest processing, product types and prices. The data was collected in August 2017 in South Halmahera and Morotai Island (Figure 1).

3. Results and Discussions

3.1. Fisheries

Our results indicate that sharks are caught as both target and unintentional or secondary catch. Targeted shark fisheries operate from from Mano Village, Gomumu Island, South Halmahera District and from Posi-Posi and Leo-Leo Village, Rao Island, Morotai District. Unintentional or secondary shark catch occurs throughout small-scale fisheries in North Maluku.

In Mano, a fleet of 48 5GT vessels specifically target sharks [8]. Generally, the boats are equipped with a double engine of 300 and 22 PK. The fishing grounds include Halmahera, Siko, Ternate, Kayoa, Gebe, Widi, Papua, and Seram waters. Fishers use shark longlines with 100-155 fishing hooks. Catch volumes depends on seasonal patterns, during the peak season shark catch can reach 40-50 sharks per trip, with requiem shark (Carcharhinidae) as the main catch.

Fishers from Posi-Posi and Leo-Leo use 3 GT boats with an estimated 12 active vessels. Generally, these boats have double engines of less than 30 PK each. The fishing ground is located around 20 to 30 miles Northwest of Rao Island. Fishers use shark longlines with 125-205 hooks. During peak season fishers can catch 20 to 30 sharks per trip, through more often catch is approximately 5 sharks of fewer, with requiem sharks (Carcharhinidae) as the main species. The types of vessels and gears are presented in Figure 2 and 3.

Figure 1. Survey Location in North Maluku Province.
Figure 2. Fishing boats of fishers from Mano, South Halmahera (Left) and boat of fishers from Leo-Leo, Morotai (Right).

Figure 3. Fishing hooks of shark longline that used by fishers in North Maluku.

Fishers from Bajo, Laiwui and Jikotamo in South Halmahera commonly catch shark as unintentional or secondary catch while fishing for reef shark in nearby shore. The boats used vary, though are predominantly small boats less than 1 GT in size. The fishing grounds are generally located in the coastal waters surrounding the islands. Fishing gear is also varied, including reef-fish long-line, hand-line, and gillnet (Table 1).

| District     | Fishers origin | Fisheries Characteristic | No. of Fleets | Fishing Gear | Fishing Gear |
|--------------|----------------|--------------------------|---------------|--------------|--------------|
| South Halmahera | Mano          | Target                   | 48            | Shark Longline | Halmahera, Siko, Ternate, Kayoa, Gebe, Widi, Papua, and Seram waters |
|               | Bajo          | Unintentional            | -             | Reef-fish longline, handline, gillnet | Bajo |
|               | Laiwui        |                          | -             |              | Obi strait, Bisa waters |
|               | Jikotamo      |                          | -             |              | East Obi, Pisang Island waters |
| Morotai      | Posi-Posi and Leo-Leo | Target | 12            | Shark Longline | 20-30 miles Northwest Rao Island |

3.2 Trade
Shark trade patterns in North Maluku are dominated by shark fin products. Shark fins that are landed are directly purchased by a local buyer. The local buyers will partially dry fins, then sort them based on the species and size, before packing and selling on to second tier traders (Figure 4).

Figure 4. Dried fins in Posi-Posi (left) and Mano (right).

Local traders sell shark with fins for around Rp.320,000 - 1,500,000 per kilogram to the second tier traders. Some first traders practice commission based trade where from the purchased product. The number and location of local traders in North Maluku is summarised in Table 2:

| District       | Sub-district | Location             | No. of Traders |
|----------------|--------------|----------------------|----------------|
| South Halmahera| South Bacan  | Labuha               | 1              |
|                |              | Gandasuli            | 2              |
|                |              | Kupal                | 2              |
|                | Obi          | Laiwui               | 2              |
| Morotai        | Southwest Morotai | Posi Posi and Leo-Leo | 2            |

At the local-level, fins are transported by boat. Traders from Bacan usually use a sea transportation service company to send the fins directly to major cities in Indonesia, while traders from Morotai sell their products to Tobelo, where the fins are later send through Ternate. The domestic destinations such as Manado, Makassar and Surabaya are export hubs, from where the products will be internationally traded.

The fin price is highly influenced by several factors such as size, species and market demand. The price of the highest quality fins can range from Rp.1,100,000 - 1,500,000 per kilogram, with the highest price reportedly around Chinese new year.

Locals generally do not eat shark meat. When fishing, fishers usually fin the sharks on-board and discard the body in to the sea. Only a few traders from Bacan sell shark meat products to Jakarta, to be processed into variety of derivative products. Shark meat products are purchased from fishermen for...
IDR 10,000 per kilogram, and are sold with a commission system. A summary of the trading patterns of shark products from North Maluku can be seen in Table 3.

Table 3. Trade patterns of shark products in North Maluku.

| Product | Selling Price (Rp.) | Traders Origin | Domestic Trade Destinations | Export Destinations |
|---------|---------------------|----------------|----------------------------|---------------------|
| Fin     | Rp. 320,000 - 1,500,000 | South Halmahera | Manado, Surabaya, BauBau, Makassar | Singapore, China, Hong Kong, Taiwan and Japan. |
| Meat    | Purchase price Rp.10,000, sold with commission system | Morotai | Jakarta | - |

Our study shows that there are both target and unintentional fisheries for sharks in North Maluku. In the past, sharks were caught by fishers in North Maluku only as unintentional catch, however targeted fisheries for sharks began in the 1990s, driven by growing international demand for shark fins [10]. We expect that information on shark fishing and trade in the province of North Maluku can help to inform better conservation and management of sharks in Indonesia, especially at the local level. Given the importance of small-scale fisheries for coastal livelihoods and well-being, conservation and management of sharks should aim to maintain healthy shark populations, while still ensuring the welfare of coastal communities. Based on the results of this study, potential recommendations to support shark management in North Maluku are: 1) strengthening traceability systems for monitoring shark trade; 2) improving local fisheries management measures; 3) increasing public awareness regarding the conservation status of sharks, and 4) Exploring options to shift shark fishers to more to sustainable fishing practices and livelihoods.

Traceability is the capability to trace the source, treatment and location of a product in trade, including the content of the product, processing and its destination [1]. Traceability also provides information about the storage and transfer of products during and between traders in a trade chain. A robust traceability system can ensure a product is traced entirely, from its point of origin to point of consumption. If used in conjunction with fisheries management measures, traceability can help to assess whether a product is derived from a legal and sustainable source, and thus support compliance with regulations and sustainable utilisation, as per CITES implementation commitments. Fisheries management measures would also be needed to ensure that shark products are sourced from healthy stocks, and to minimise capture of threatened, protected or particularly vulnerable species. Measures might include spatial closures in critical habitat, or limitations on effort or use of particularly damaging gear types.

Awareness of shark fisheries and trade issues in Indonesia is relatively new, and regulation sometimes causes public concern and conflict [6]. Improving public knowledge and acceptance of the important role of sharks in marine ecosystems, and their threat status, as well as understanding of regulations, is important. As such, stakeholder engagement during management planning, and systematic dissemination of regulations, will be important for ensuring compliance and controlling the unsustainable utilization of sharks. For traders, communication and engagement can support implementation of traceability systems. For consumers, awareness of legal, sustainable marine products can lead to better consumer choices, that can support the growth of domestic and international markets for sustainably-sourced marine products.

Shifting fishers to sustainable livelihoods, such as tourism, is also proposed as a solution, since revenues from tourism can far surpass those of shark fishing [9][3]. However, at present, the shark tourism industry in Indonesia occurs in locations that are not accessible for the North Maluku shark fishers. Nonetheless, the shark diving industry is developing in Morotai, and is projected to be one of
the main tourist attractions in North Maluku in the future [4]. As such, this could provide an important source of sustainable revenue to support and incentives shark conservation. Until then, it may be more realistic to promote more sustainable management of existing fishing practices. Overall, it is clear that North Maluku Province requires further attention in terms of shark research and management, and that an integrated approach will be necessary to maintain healthy shark populations and ensure the well-being of vulnerable coastal communities in the long-term.

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