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BARRIERS TO PARTICIPATING IN THE COLLECTION OF TRACEABLE CATCH LANDING DATA FOR SHARKS AND RAYS: FOCUS GROUP DISCUSSIONS (FGD) OF SMALL- SCALE FISHERMEN IN PAHANG, MALAYSIA

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Abstract: The objective of this study is to identify barriers in participating in the collection of traceable catch landing data for shark and ray species among small-scale fishers in Pahang, Malaysia. As one of the major shark catchers in the world, Malaysia has been recommended to implement a traceability system to manage its supply chain process, starting from catch landings, to ensure sustainable fishing of sharks and rays. The participation of of small-scale fishers in this effort is crucial due to the significant impact of shark and ray population to their livelihood, even though they have limited capability to record catch data due to lack of resources and education. A purposive snowball sampling was used to identify participants for focus group discussions (FGD). A semi-structured open-ended proforma was used as a discussion guide. The findings suggest that there are five barriers to participation, namely (i) shark and ray resources; (ii) governance and management support; (iii) infrastructure and management information system; (iv) fishers' commitment and buy-ins; and, (v) collaboration effort among stakeholders. It is important for policymakers to consider mandatory registration of shark and ray fishers, besides encouraging them to report their catch up to species level with incentives and training programs, as well as information technology improvements, to overcome the barriers. Future studies might expand into quantitative analysis and include other players in the shark and ray supply chain.

Keywords: Sustainability, traceability, shark, ray, focus group discussion, small-scale fisher.

Introduction

Sharks and rays are cartilaginous fishes that have gradually evolved for more than 400 million years. Sharks are known as apex predators, whose key roles are to maintain a balanced ecosystem, prevent the spread of diseases, improve the gene pool and help create a healthy environment (Camhi *et al*., 1998; Griffin *et al*., 2008; Felipe *et al.,* 2019). Sharks have been identified as one of the most endangered species and a priority group for conservation action (Booth *et al*., 2018). Their population has dwindled mainly due to high demand for human consumption and substantial commercial value (Lehr, 2015). Approximately 100 million sharks are killed annually and the total declared value of shark products traded globally is US$1 billion (Dent & Clarke, 2015). An estimated 25% of 1,038 sharks, rays and chimaera species that have been assessed by the International Union for Conservation of Nature (IUCN)'s Shark Specialist Group are threatened with extinction, making them the most threatened vertebrate group (Bräutigam *et al.*, 2016).

The main factor for this is their vitality, which is hindered by slow growth, late maturity and few offspring (Camhi *et al.*, 1998; Susan *et al.,* 1998; Walker 1998; Cortes, 2000; Frisk *et al.*, 2001; Fowler *et al*., 2002; Dent & Clarke, 2015). In addition, the rapid growth in commercial fisheries targeting high-value species, a lack of specific management, as well as poor recording mechanisms of mixed-species fisheries make it difficult to precisely predict shark extinction

(Camhi *et al.*, 1998; Griffin *et al.*, 2008; Field *et al*., 2009). Therefore, it is crucial to conserve shark species to protect the ocean ecosystem, as well as marine biodiversity at national and international levels (Otway *et al*., 2004; Yokoi *et al*., 2017) through the strengthening of standard data recording systems in both fisheries and trade (Camhi *et al*., 1998; Dent & Clarke, 2015).

Malaysia has been identified as the second largest importer of shark fin from 2000 to 2016, with an annual average of 2,556 metric tons (mt). It was also the eight-largest producer of shark products with an annual capture production average of 21,459 mt from 2007 to 2017 (Nicola & Sant, 2019). Thus, all signatory nations in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) need to urgently identify measures to improve real-time collection of accurate trade information and implement traceability systems to prevent overexploitation of their endangered species (Bräutigam *et al*., 2016; Nicola & Sant, 2019). Catch or landing data for sharks and rays have been reported to the Food and Agriculture Organization (FAO) of the United Nations since 1950. However, difficulties in reporting shark products still persist in most countries, thus affecting data quality and reliability on the trade (Dent & Clarke, 2015). Many have suggested a standardized traceability system to efficiently manage the overall supply chain of shark products, beginning from the landing of catch at fishing jetties. This is to ensure that the traded products are sustainable, transparent, authentic and compliant with regulations (Lehr, 2015; 2016; Mundy & Sant, 2015; Bräutigam *et al.,* 2016; Marshall & Barone, 2016; Nicola & Sant, 2019).

The inclusion of artisanal fishers in such effort will entail socio-economic consequences and potential issues. Their inclusion in a traceability system is a main challenge because of their limited capability, resources and lack of education (Lehr, 2015; 2016). The barriers to their participation include lack of incentive, current system and process integration issues, administrative burden, technical/logistical challenges, long-term commitment and buy-ins from stakeholders. Training for fishers is also needed to promote capability-building, and the appropriate infrastructure must be provided before implementing a traceability system for shark products (Lehr, 2015 & 2016; Mundy & Sant, 2015; USAID, 2018).

The Malaysian Fisheries Department (DOF) is fully committed towards sustainable conservation of shark and ray species. Its action plans are aimed at preventing the overexploitation of marine species according to guidelines of the International Plan of Action for the Conservation and Management of Sharks (IPOA-SHARKS) framework. Through its latest 2014 National Plan of Action (NPOA — Sharks), the department has taken the interest of all stakeholders into consideration through a series of discussions to ensure a balanced need between ecological, social and economic objectives (DOF, 2014). Many studies on sharks and rays have been conducted since the 1990s, but they were mostly focusing on biology, taxonomy, and marketing and trading. Despite all the studies, DOF has strongly suggested a need to close the knowledge gap in supply chain traceability for shark and ray products to balance the trilogy of market, resources and environment in a sustainable manner (Ahmad *et al*., 2019b). The cooperation of small-scale fishers is needed for the long-term as they tend to lose interest when there is a lack of clarity on the benefits or rewards of traceability programs (USAID, 2018).

The main purpose of this study is to determine the barriers faced by small-scale fishers in participating in the collection of catch landing data for shark and ray species in Pahang, Malaysia. The findings will add to the limited literature on shark and ray traceability studies. It will also help policymakers to strategize effective measures and action plans towards sustainable conservation of shark and ray species. Furthermore, the stakeholders involved in the landing data collection will have greater awareness of their role and contribute to the relevant supply chain traceability processes. The methods may also be used to measure effective traceability implementation for other

species at other locations. The findings will also indirectly benefit those who are concerned with the environmental impact of marine life overexploitation.

Materials and Method

This was an exploratory qualitative case study that relied more on the views of of participants to obtain in-depth understanding of the trade (Creswell, 2014; Creswell & Poth, 2018).

Instrument

The possible factors of barriers in participating in the collection of traceable catch landing data were identified based on recommendations by Lehr (2015 & 2016), Mundy and Sant (2015), Khan *et al*. (2018), USAID (2018) and expert elicitation from Key Informant Interviews (KII) with DOF and Malaysian Fisheries Development Board (LKIM) officials, and NPOA-Sharks committee members in April 2019. There were government and management support; information technology infrastructure; communication tools; coordination and collaboration; training, development and awareness.

A semi-structured open-ended discussion proforma sheet was prepared and divided into two sections. The first section aimed to collect information on the status of shark and ray resources, and their fishing and landing operations. The second section was to assess the current phenomena and challenges faced by small-scale fishers. The questions were suitable for discussing a specific topic, besides trying to draw out complex individual experiences, beliefs, perceptions and attitudes (Tobias *et al*., 2018). A short and simple language that is easily understandable by all participants is important to encourage cooperation and involvement throughout the study (Chan & Idris, 2017). The questions were designed to be open-ended and exploratory as the researchers had to rely mostly on the participants' views of the situation (Creswell, 2018).

Study Area

The study was conducted at selected landing sites in Kuantan and Pekan in the east coast state of Pahang in Peninsular Malaysia (Figure 1).

Between 1982 and 2019, the total marine fish landings in Malaysia had recorded an annual average of 1,175,067 mt, with shark landings contributing an average of 6,752 mt (0.57%) and ray landings at 13,432 mt (1.14%) (DOF, 1982-2019). There were at least 68 shark species, 82 ray species, four skates and one chimaera (including two freshwater species) inhabiting Malaysian waters (Ahmad *et al.,* 2014). Alongside Perak, Pahang was one of the major contributors of shark and ray landings in Peninsular Malaysia from 1991 to 2019. Pahang contributed an average of 10% (737 mt) and had the third highest annual average of the total shark landings, while for ray landings, it was recorded at 10% (1,480 mt) as shown in Figure 2. This was the fourth highest ray landings in Malaysia (DOF, 1982-2019). Pahang's shark and ray landings comprised 0.43% and 0.86%, respectively, of the state's total marine fish landings from 1991 to 2019 (DOF, 1991-2019). Its small-scale fishers contributed only 7.7% of the total marine ish catch in 2019. However, their input was crucial as the implementation of effective traceability would improve the environment and their socio-economic income (Lehr, 2016; USAID, 2018).

Data Collection

In order to build trust and generate referrals and secure more interviews (Kirchherr & Charles, 2018), three meetings were conducted with fishery officials of Pahang (DOF, state LKIM and the Fishermen's Association of Pahang) to identify participants. Based on the DOF's 2019 annual fishery statistics, there were 551 registered small-scale fishers owning fiberglass boats with outboard engines (<40 GRT) who were using gill/drift nets and hook lines as their fishing gear. A total of 22 landing sites were surveyed in Kuantan and Pekan, where the former is the state capital, while the latter is a coastal district (both adjacent the South China Sea).

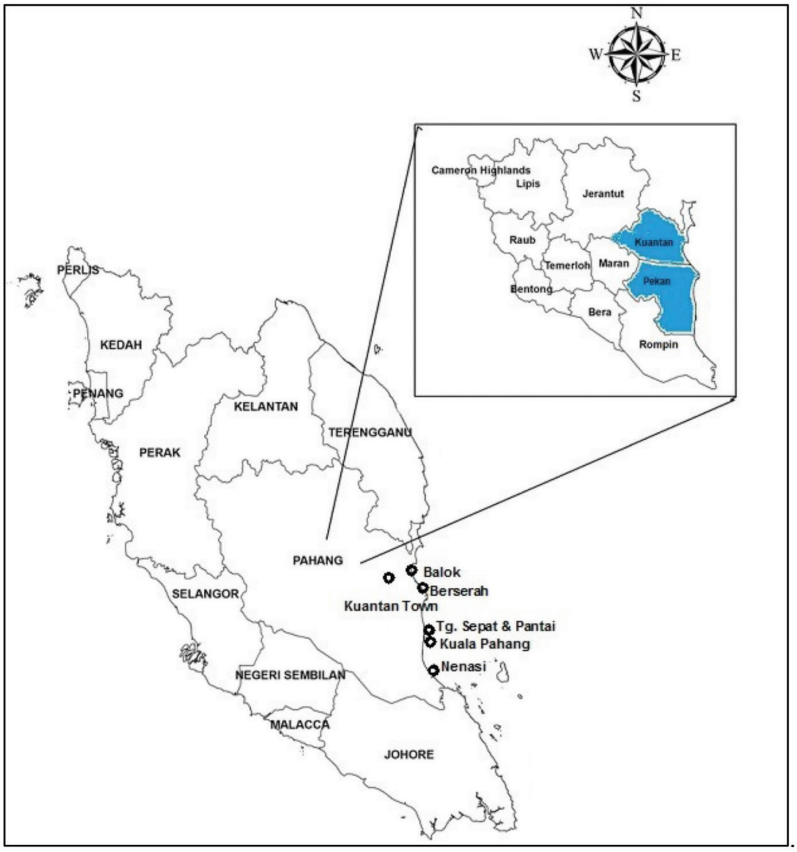

Figure 1: Study locations represented by districts within the state of Pahang, Malaysia
Source: Atroosh et al. (2012)

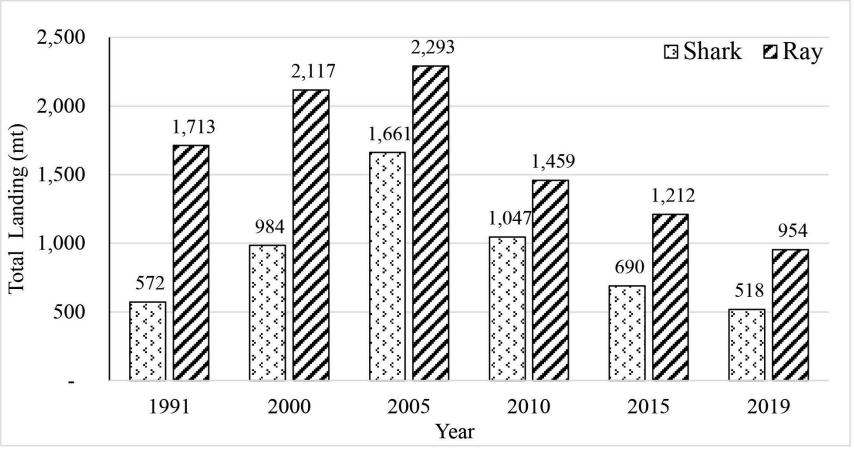

Figure 2: Total shark and ray landings in Pahang, Malaysia, from 1991 to 2019 (mt)
Source: Department of Fisheries, Annual Fisheries Statistics (1991-2019)

A purposive snowball sampling technique, in which one interviewee would be asked to provide the name of at least one or more potential participants, was used to identify the small-scale fishers involved in shark and ray catches with more than 10 years'experience (Kirchherr & Charles, 2018). These strict criteria reduced the size of qualified participants so that accurate information on shark and ray fishing over a long period could be obtained. This technique was appropriate when the target participants were not easily available (Naderifar *et al*., 2017) with the aim of obtaining data from selected groups, rather than referring to a probability of a total population (Tobias *et al.,* 2018).

The DOF and state LKIM recommended six study locations based on the landing data volume for sharks and rays species. Six focus group discussion (FGD) sessions were conducted with six participants in each session, including a researcher as the moderator and a representative from the authorities, as shown in Table 1. It was quite a challenge to gather the participantss at each session due to the nature of their work and locality. As such, the sessions were conducted near their landing sites and, at the same time, the researchers took the opportunity to observe the nature of their operations and species of sharks and rays that were caught.

In this setting, the researcher played the role of a moderator to gain in-depth understanding of the issues with the flexibility to adapt to the flow of discussion. Discussions were kept impartial to build rapport and encourage an open and honest dialogue among diverse individuals (Tobias *et al.,* 2018). It was a good way to gather people from similar backgrounds or experiences to get their insights on certain topics of interest (Lokanath, 2016).

These FGD sessions were observed, notes were taken, and discussions were tape-recorded, transcribed and summarized to categorize the input to relevant factors. The purpose of the discourse analysis was to analyze the language used to describe the subjects' norms, preferences and expectations (Kamalu & Osisanwo, 2015). It channelized interest towards detecting regularities, through which coherence of phrases was achieved therein to understand the interactions in society (Suciu, 2019). The steps to conduct a discourse analysis are shown in the Table 2.

Table 1: Focus group discussion sessions by location

No.	Date	Location	No. of Participants (including moderator and authority)
1.	5 July 2019	Pantai Balok, Kuantan	6
2.	5 July 2019	Pasar Beserah, Kuantan	6
3.	8 July 2019	Pantai Sepat, Kuantan	6
4.	8 July 2019	Pantai Chempaka, Kuantan	6
5.	9 July 2019	Kuala Pahang, Pekan	6
6	10 July 2019	Nenasi, Pekan	6

Table 2: Discourse analysis components

Steps to Conduct Discourse Analysis	
Reading	Read through transcripts and listen to interview tape recordings to gain overview of the data.
Coding	Select the materials for analysis using research questions as the basis of selection. Develop coding from reading and re-reading of data.
Analysis	Read through the coded data. Focus on the functional aspects of the discourse or text.
Writing	Write the analysis to present results and findings.

Source: Ussher and Perz (2014).

Results and Discussion

Through the discourse analysis, the five main factors perceived to be barriers in participating in the collection of traceable catch landing data for sharks and rays have been identified. They are (i) shark and ray resources and operations; (ii) governance and management support; (iii) infrastructure and information system management; (iv) fishers' commitment and buy-ins; and, (v) collaborative effort by stakeholders.

Shark and Ray Resources and Operations

All groups were represented by small-scale fishers with more than 10 years' experience. Small-scale fishers were defined as having a valid license to operate a vessel with outboard engine (<40 GRT) using either drift nets or/ and longlines within fishing Zone A (0-5nm). Upon registration and licensing approval, they and their vessel would be assigned a unique identifier.

Shark and ray fishing and landing operations are summarised in Table 3. Fishers would land their catches at registered landing sites either at a jetty, complex or beach, and they could report their catch to the nearest declaration centers, namely Pantai Beserah, Pantai Cempaka, LKIM Kuantan Complex, LKIM Kuala Pahang Complex or LKIM Nenasi Complex. These landing and declaration sites were registered and monitored by the state LKIM. Fishers could sell their catch directly to consumers, wholesalers and/or at fish markets.

Table 4 shows that all participants agreed the demand for sharks and rays was high, and supply was not enough. The demand for rays would spike during Ramadan, when it would be cooked as a popular grilled dish for breaking fast. Although sharks and rays were by-catch products, there were occasions when fishers specifically caught rays for a season, usually from February to June. However, this season was not consistent every year.

Participants mentioned that sharks and rays comprised at least 10% of their total catch and income. For targeted ray fishers in Nenasi, Pekan, the catch could sometimes comprise between 50% and 90% of the fishers' income, as the fish there was larger. When participants were asked for the average catch on a daily or monthly basis, the information could not be provided as they did not keep track of such data.

The most commonly caught sharks were bamboosharks (*Chiloscyllium indicum, Chiloscyllium plagiosum, Chiloscyllium hasseltii, Chiloscyllium punctatum),* blackspot sharks *(Carchahinus sealei),* common blacktip sharks *(Carcharhinus limbatus)* and the spottail shark *(Carcharhinus sorrah)*. The price depended on the species and size. The wholesale shark price ranged from RM3 to RM4 per kilogram. The most expensive and rare catch was the Zebra shark *(Stegostoma fasciatum)*, which could fetch up to RM60 per kg.

The most popular ray species was the whitespotted whipray (*Maculabatis gerrardi*), with a wholesale price of between RM12 and RM16 per kg. During the FGD session at Pantai Sepat fish market, the retail price for this species was at RM27 per kg. Other commonly caught species were the bottlenose wedgefish (*Rhynchobatus australiae*), pale-edged sharpnose ray (*Telatrygon zugei*), coach whipray (*Himantura uarnak*), banded and spotted eagle ray (*Aetomylaeus nichofii* and

Table 3: Shark and ray fishing and landing operations in Kuantan and Pekan, Pahang

Fishing and Landing Operations
1. All : Zone A vessel (outboard engine) using drift net and longlines.
2. All : More than 10 years fishing experience.
3. All : Have a valid fishing license with unique ID and registered vessel with unique ID.
4. All : Land catches at LKIM registered landing sites.
5. All : Report their catches at nearest declaration center.
6. All : Sell catches to the consumers/wholesalers at nearest landing site or/and fish market

Aetomylaeus ocellatus), narrow and roughnose cowtail ray (*Pastinachus gracillicaudus* and *Pastinachus solocirostris*), Japanese and long-tail butterfly ray (*Gymnura japonica* and *Gymnura poecilura*) and the Javan cownose ray (*Rhinoptera javanica*). All species were caught throughout the year.

The pricing was determined by local wholesalers on a daily basis. Fishers had their own preferred wholesalers based on the highest price offered and good relationship. The wholesalers would collect and distribute the catch to local and external markets. Transactions were conducted in cash and recorded in sales receipts.

The commonly caught species mentioned by the small-scale fishers in FGDs are shown in Table 5 and Table 6. They were identified using a reference book by Ahmad *et al.* (2017).

In summary, sharks and rays were caught in small quantities, but ray species could contribute more to the small-scale fishers' income due to high demand. From the list and evidence at landing sites, no endangered species were found among the fishers'catch.

Table 4: Demand for shark and ray resources

Shark and Ray Resources
1. All: High demand and not enough supply. Rays highly in demand during Ramadan.
2. All: Sharks and rays are by-catch products, but are sometimes targeted during season.
3. All: Peak season is usually from February to June.
4. Almost all : Catch >10% and during peak season, may go up to 50% (according to ray fishers in Nenasi).
5. All: Agreed the catch could provide good income (>10%) and may go up to 90% in peak season (according to ray fishers in Nenasi)
6. All: Wholesale shark (yu) price RM3 to RM4 for yu cicak and yu bodoh. Most expensive is the zebra shark (*Stegostoma fasciatum*).
7. Popular species: *Maculabatis gerrardi* sold between RM12 and RM16; Retail is RM27 per kg. Other common species sold as whole fish and caught throughout the year.
8. All: Price depends on the species and size, and is determined by wholesalers. Fishers have their own preferred wholesalers (1 or 2). The wholesalers collect, distribute and record the catch. Transactions carried out in cash.

Table 5: List of caught sharks species in Pahang, Malaysia

No.	Scientific Name	Common Name	Local Name
1.	*Carcharhinus limbatus*	Common blacktip shark	*Yu sirip hitam*
2.	*Carcharhinus sealei*	Blackspot shark	*Yu pasir*
3.	*Carcharhinus sorrah*	Spottail shark	*Yu sorah*
4.	*Chiloscyllium hasseltii*	Brownbanded bambooshark	*Yu cicak*
5.	*Chiloscyllium indicum*	Slender bambooshark	*Yu bodoh*
6.	*Chiloscyllium plagiosum*	Whitespotted bambooshark	*Yu bodoh*
7.	*Chiloscyllium punctatum*	Indonesian bambooshark	*Yu cicak*
8.	*Galeocerdo cuvier*	Tiger shark	*Yu tenggiri*
9.	*Hemigaleus microstoma*	Weasel shark	*Yu bintik putih*
10.	*Rhizoprionodon acutus*	Milk shark	*Yu pasir*
11.	*Rhizoprionodon oligolinx*	Grey sharpnose	*Yu minyak*
12.	*Scoliodon macrorhynchos*	Pacific spadenose shark	*Yu padi*
13.	*Stegostoma fasciatum*	Zebra shark	*Yu bintik kuning*

Table 6: List of caught ray species in Pahang, Malaysia

No.	Scientific Name	Common Name	Local Name
1.	*Aetomylaeus nichofii*	Banded eagle ray	*Pari helang*
2.	*Aetomylaeus ocellatus*	Spotted eagle ray	*Pari helang*
3.	*Gymnura japonica*	Japanese butterfly	*Pari kelawar/*
4.	*Gymnura poecilura*	Longtail butterfly ray	*Pari tembaga*
5.	*Himantura uarnak*	Coach whipray	*Pari harimau/lalat*
6.	*Maculabatis gerrardi*	Whitespotted whipray	*Pari pasir/bunga*
7.	*Neotrygon orientalis*	Oriental blue spotted mask ray	*Pari bintik biru*
8.	*Pastinachus gracillicaudus*	Narrow cowtail ray	*Pari daun*
9.	*Pastinachus solocirostris*	Roughnose cowtail ray	*Pari daun*
10.	*Rhinoptera javanica*	Javan cownose ray	*Pari susun*
11.	*Rhynchobatus australiae*	Bottlenose wedgefish	*Yu kemejan*
12.	*Taeniura lymma*	Bluespotted fantail ray	*Pari batu*
13.	*Telatrygon zugei*	Pale-edge sharpnose ray	*Pari ketuka*

In terms of data traceability, the current registration and licensing process for vessels and fishers were already established to support traceable catch landing data, as they met the basic Key Data Elements (KDE) of a unique identification as recommended by Lehr (2015 & 2016) and USAID (2018). Currently, the catch reporting only required fishers to state the species name, which was "shark" or "ray". The authorities might consider assigning a unique code for each species in the catch landing data system since there were only 13 commonly caught species.

Governance and Management Support

All participating groups reported that public awareness programs on the plight of endangered sharks and rays were limited among the fishing community in Kuantan or Pekan, except Nenasi. However, the fishers were very much aware on turtle conservation as awareness programs were frequently carried out among them.

In terms of legislation, participants were aware that the use of *pukat pari* or gill net with mesh size exceeding 25.4 cm had been banned to protect large-sized marine species like turtles from being caught. However, they did not know of any endangered shark or ray species that could not be caught. When shown some examples, the fishers said they used to spot whale sharks (*Rhinchodon typus*), but the species could no longer be seen today.

The fishers were worried as they were not sure what to do if they caught an endangered species, especially when the fish was only identified upon landing. They feared that they would be penalized by the authorities if they reported their catch. They also did not agree to ban the catching of all sharks and rays because they could signifiantly contribute to their income.

The fishers in Nenasi acknowledged the ban on shark "finning" as mentioned in their vessel license book. The fishers were also fully aware of LKIM's Fish Landing Control Regulation that required them to report their catch to claim cash incentives and fuel subsidies; though they stated that there was no verification done on their reports. They perceived that rule enforcement at landing sites was not practical as it was quite challenging for the authorities to deploy sufficient personnel to check all the catch landings. The summary of the discussion on governance and management support is shown in Table 7.

In summary, awareness programs and the enforcement of regulations are lacking. As such, all participants agreed that there was an

Table 7: Discussion on governance and management support

Governance and Management Support
1. All groups except Nenasi: No awareness on programs conducted. No posters of endangered species distributed or seen at landing sites. One awareness program was conduted by UPM in Nenasi in 2018. Groups have high awareness on turtle conservation efforts.
2. All: Many not aware of shark and ray regulations, but are fully aware on the protection of turtles and ban on the use of gill nets (*pukat pari*) with mesh size exceeding 25.4 cm (10 inches).
3. All: Do not agree on total ban as the fish are good sources of income.
4. All: Confused with the current regulations on endangered species.
5. Nenasi: Aware about finning ban
6. All: Catch declaration to state LKIM to claim cash incentives and fuel subsidy.
7. All: No verification on the accuracy of data reported to LKIM.
8. All: Enforcement of regulations at landing sites is challenging.

urgent need to conduct awareness programs on the importance of shark and ray species to the marine ecosystem and biodiversity. Posters of endangered shark and ray species could be distributed at landing sites, fish markets and on social media. This program should be conducted with a long-term plan to inculcate awareness in the younger generation at schools and universities. This could be a starting point to get buy-ins from small-scale fishers and other stakeholders to understand the importance of these species in terms of social, ecological and sustainable fishery management in Pahang.

The authorities should register all shark and ray fishers since their role and input were significant in the sustainable management of the species. The current cash incentives and diesel subsidy of RM1.65 flat rate could be considered successful in encouraging the fishers to participate in the voluntary declaration of their catch landings. These incentives could be extended to other stakeholders to promote accurate traceable data recording and reporting of shark and ray landings.

Infrastructure and Management Information System

All participants agreed that jetties managed by LKIM were adequate in providing basic needs for landing activities. The declaration centers and fish markets also had adequate facilities for fishers to declare and market their catch. There were 10 LKIM-registered landing jetties and 12 beach landing sites for small-scale fishers in Kuantan and Pekan as described in Table 8. The landing sites were accessible to all small-scale fishers regardless of their license validity. On top of that, there were also several jetties managed by private companies. No landing site was dedicated for shark and ray species.

The summary of the current infrastructure and data information system for landing activities are shown in Table 9. The wholesalers would arrange transport to collect and distribute the catch. Fishers and wholesalers used handphones to communicate and do business. Almost all participants owned handphones with basic features. it was interesting to note that some fishers were using old models when they went out to sea as they thought the battery could last longer. Every transaction from a fishing trip would be recorded by the wholesaler on a hardcopy receipt. The fishers used these hardcopy receipts as their declaration to claim cash incentives and fuel subsidy from LKIM. LKIM, in turn, used these receipts to record the monthly catch at landing sites through its *e-pengisytiharan* system. The information included volume, price and identified species, These information were compiled together with other unique identifications required by the traceable catch landing data known as Key Data Elements (KDE), such as vessel identification, fisher's identification and trip date.

All participants said they had no issues in declaring their catch, but some admitted that

Table 8: LKIM registered landing sites for fiberglass boats in Kuantan and Pekan, Pahang

Kuantan/Pekan	Jetty/Base	Jetty/Beach
Kuantan	LKIM Complex Kuantan (Declaration center)	LKIM Jetty
Kuantan	Pantai Cempaka (Declaration center)	Beach
Kuantan	Ceruk Paloh/Penor, Balok, Tanjung Api	LKIM Jetty
Kuantan	Pantai Kempadang, Pantai Beserah, Pantai Sepat	Beach
Kuantan	Sungai Ular, Pantai Chendor, Tanjong Lumpur	Beach
Kuantan	Cherating (Declaration center)	Beach
Pekan	LKIM Complex Kuala Pahang (Declaration center)	LKIM Jetty
Pekan	Tanjung Selangor	Beach
Pekan	Pasir Panjang/Sekukuh (Declaration center)	LKIM Jetty
Pekan	Tanjong Agas	LKIM Jetty
Pekan	Sungai Miang, Tanjung Batu, Merchong	Beach
Pekan	Kampung Marhum, Pengkalan Badong	LKIM Jetty
Pekan	LKIM Complex Nenasi (Declaration center)	LKIM Jetty

Source: LKIM Pahang (2021)

the data provided in their receipts were not fully accurate because they were meant to claim incentives, and there was no verification being done. However, they believed that the LKIM could detect discrepanies in the data provided if they skewed too much from their normal claims. In terms of transparency in information sharing, all participants agreed that they had no issues for their catch landing data to be shared with other stakeholders.

During the FGDs, the LKIM *e-pengisytiharan* system officer highlighted that the number of unlicensed fishers was almost double than those with license. For example, in Pantai Balok, approximately 70 were unlicensed compared with 50 of their peers. The situation was the same in Nenasi, where approximately 120 were licensed compared to almost 200 unlicensed ones. These unlicensed fishers did not report any catch information. The unreported catch might have big impact on the landing data

Table 9: Infrastructure and management information system

Infrastructure and Management Information System
1. All: Adequate basic infrastructure and facilities provided by LKIM. Registered landing sites, declaration centers and fish markets.
2. Two types of jetties: LKIM and private jetties. All landing sites are accessible to all fiberglass boats.
3. No dedicated landing site for shark and ray species.
4. The wholesalers collect the catches at landing sites using their own transport.
5. Everybody uses handphones to do business.
6. All declared catch landing data for each trip are recorded in LKIM's *e-pengisytiharan* system.
7. All: Declared using a hardcopy sales receipt provided by wholesalers. The details may include species type i.e " Shark" or "Ray", volume and price.
8. Fishers have no issues in declaring their catch using the current LKIM system to claim cash incentives and fuel subsidy.
9. All agree to share information with other stakeholders.
10. Data accuracy is affected by undeclared catch of unregistered and unlicensed fishers.

as the officer believed what LKIM had was only around 40% to 50% accurate.

In summary, current infrastructure and management information system for catch data landing provided by the authorities were accessible and adequate, but needed a few improvements. This finding supported the recommendation by USAID (2018) for LKIM to review the management of fish landing sites to improve the efficiency of its traceability system.

Most importantly, there was a need for the state authorities to record shark and ray catch up to the species level as being done in other states like Perak and Sabah (Ahmad *et al*., 2019b).

Fishers' Commitment and Buy-ins

The participants said they were hesitant in reporting their catch up to the spesies level. They said their nature of work did not permit them to record all those details as it was tedious and time-consuming, and they had to deliver their fish as fast and fresh as possible. They claimed that the wet and smelly conditions of their working environment made it difficult to record the data on paper or handphone. They also had other priorities to attend to, such as maintaining their fishing gear and boats. Reporting their catch species also required effort and time. Furthermore, their catch were large in quantity and did not omprise sharks and rays only.

Most participants could identify sharks and rays only by their local names. They also mentioned that the names might differ in other locations. They faced difficulty in matching the local names with scientific ones when shown a reference book by Ahmad *et al.* (2017). To them, some species looked similar to each other. Most of them were not concerned about the species they caught and not willing to learn unless there was an incentive.

In terms of training and awareness programs, the fishers would consider attending them if an allowance was provided to compensate their daily income. This attitude was also enountered by USAID in 2018 while studying social acceptance issues among small-scale fishers in Tok Bali, Kelantan. The Kuantan and Pekan fishers also suggested that the new system must be user friendly, easy to use and robust enough to cater to any new requirements in future; they saw this new system application was only relevant to the younger generation of fishers, as the older generation was not keen to participate. Two groups strongly disagreed on participating in training and awareness programs as they did not see the importance of recording the data of sharks and rays to their livelihood. The summary of the discussions is shown in Table 10.

Table 10: Discussions on fishers' commitment and buy-ins

Fishers Commitment and Buy-ins
1. Fishing is tiring and landings need to be fast to maintain freshness.
2. Recording and reporting catch data not a priority and are troublesome.
3. Focus more on fishing operations and maintenance of their fishing gear and boats.
4. More time and effort needed for recording, especially by species on daily basis.
5. Difficulty in mathing local species with their scientific names.
6. Will consider reporting up to species level if more incentives are given.
7. Fishers not willing to produce written reports and some are illiterate.
8. Training: Most willing to attend if given large allowance.
9. Training to use new technologies is only for the younger generation.
10. Do not keep any catch data except to fulfil the *e-pengisytiharan* system requirement.
11. New system must be easy and user-friendly for fishers to participate in.
12. Two groups strongly disagree to participate as they don't see the importance of species traceability.
13. Mostly all groups mentioned that the older generation is not willing to learn new things.
14. Most agree that business transactions are totally based on trust.

Collaboration Effort by all Stakeholders

At present, small-scale fishers and wholesalers said they faced no issues in doing business even without legal instruments such as contracts. Fishers ould approach any wholesaler who offered a higher price. Most transactions were simple and arried out in cash. Wholesalers were also very accommodating in producing receipts required by LKIM for data landing records. As for the relationship with government agencies, the fishers urged the authorities to be fair when enforcing regulations between them and trawler owners as the latter's shark and ray catch were much larger. They also highlighted that the authorities should show commitment in implementing long-term initiatives that did not solely focus on the protection of endangered species, but also consider their economic interest. The summary of the discussion is shown in Table 11.

Above all, participants agreed that collaboration among stakeholders was the most important factor and each party could not work in their own silos to ensure the effective implementation of traceable catch landing data for shark and ray species.

Conclusion

This study found that shark and ray landings could significantly contribute to the income of small-scale fishers in Pahang due to their high demand. There were 13 species each of shark and rays that were commonly caught by small-scale fishers. The catch were usually mixed in small quantities and not involve endangered species.

The current infrastructure and data system were accessible and adequate to implement traceable catch landing data collection for shark and ray species, with a few opportunities for improvement. In order to achieve an effective implementation, policymakers might have to consider mandatory registration of fishers, vessels, jetties and other industry players involved in the shark and ray supply chain. As such, the policymakers might consider providing appropriate incentives, subsidy, awareness and training programs to encourage small-scale fishers' commitment and buy-ins to report accurate traceable catch landing data up to the species level. Small-scale fishers' involvement and roles were essential towards sustainable conservation management for shark and ray species. However, they needed support from other industry players and government authorities. A collaboration effort among all stakeholders would be crucial to ensure the effective implementation of traceable catch landing data for shark and ray species.

Future studies on species traceability should be extended to other locations and stakeholders, which included government agencies, commercial vessel fishers, wholesalers, retailers, jetty owners, processors, transporters, exporters, importers, agents and consumers throughout the supply chain of shark and ray products. Future studies might use quantitative or mixed research approach to support this finding.

Table 11: Collaboration effort by all stakeholders

Collaboration Effort by all Stakeholders
1. The business relationship among industry players is good.
2. All: Legal instruments like ontrats are not used in business.
3. Majority deals in cash and a few only will take credits.
4. Authorities must show commitment in long-term initiatives.
5. Fair enforcement among all fishing categories.
6. Enforcement is very challenging. Need to focus more on trawlers.
7. Currently fishers already receive subsidies and incentives. To encourage fishers to record their shark and ray landings, support is needed from all industry players.
8. The collaboration effort is important, especially during implementation and enforcement.
9. Cannot work in silos, government agenies and industry players must work together.

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