Pertanika J. Soc. Sci. & Hum. 26 (T): 77 - 94 (2018)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Has the Environment Changed – What Can Be Done to Help the Fishermen Community? The Views of the Small Scale Fishermen in Malaysia

Khairuddin Idris[1]*, Mahazan Muhammad[1], Asnarulkhadi Abu Samah[1,3], Turiman Suandi[2] and Hayrol Azril Mohamed Shaffril[1]

[1]Institute for Social Science Studies, Universiti Putra Malaysia (UPM), Putra Infoport, 43400 Serdang, Selangor, Malaysia
[2]Faculty of Educational Studies, Universiti Putra Malaysia (UPM), 43400 Serdang, Selangor, Malaysia
[3]Faculty of Human Ecology, Universiti Putra Malaysia (UPM), 43400 Serdang, Selangor, Malaysia

ABSTRACT

The inconsistencies among findings and lack of related studies have led to this study, the main objective of which is to gain the views of Malaysian small-scale fishermen on environmental changes and to recommend several strategies that can assist the fishermen community in coping with changes. This study is qualitative in nature. A total of three FGDs and one in-depth-interview were conducted among small-scale fishermen. Based on the thematic analysis, their awareness of environmental changes, the causes of environmental changes, the impact of these changes on the community and measures taken to absorb this impact have been identified. A number of recommendations related to providing alternative skills, conducting research, encouraging proactive roles by influential persons, using fisheries technology, conducting extra monitoring activities and making conservation efforts are highlighted.

Keywords: Climate change impacts, environment changes, small-scale fishermen

ARTICLE INFO

Article history:
Received: 30 June 2017
Accepted: 11 May 2018

E-mail addresses:
kidin@upm.edu.my (Khairuddin Idris)
mahazanmuhammad@gmail.com (Mahazan Muhammad)
asnarulhadi@gmail.com (Asnarulkhadi Abu Samah)
turiman55@gmail.com (Turiman Suandi)
hayrol82@gmail.com (Hayrol Azril Mohamed Shaffril)
* Corresponding author

ISSN: 0128-7702

INTRODUCTION

Agriculture is an important income-generating sector in Malaysia. The contribution of industries such as palm oil, rubber, livestock and paddy are significant towards the nation's income. In 2012 for example, these industries managed to generate more than RM16 billion (roughly

equal to USD4 billion). Additionally, the Malaysian economy is also benefiting from the significant contribution of another agriculture branch, the fisheries industry. In 2015 for example, the industry managed to generate a total of RM10.2 million (roughly equal to USD2.25 million) and employed more than 144,000 registered fishermen, most of whom were settled in rural areas (Department of Fisheries Malaysia, 2016).

Similar to other agriculture industries, the fisheries industry faces problems that threaten its sustainability. One of the most obvious problems is environmental changes. Within the marine-related scope, there are inconsistencies among scholarly findings on the causes of environmental changes. Some scholars relate the causes to certain fishing techniques (Cho, 2012; Kelleher, 2005), while others relate them to climate change (Awang & Abdul Hamid, 2013; Kajikawa, Yasunari, Yoshida, & Fujinami, 2012; Subramaniam, Kwok, & Wan Azli, 2011; Suhaila, Deni, Wan Zin, & Jemain, 2010; Tangang, 2007; Wan Azli, 2010; Zubaidi, 2010). Halfar and Fujita (2007), Darwin (2008) and Schmidt, McCleery, Seavey, Devitt and Schmidt (2012) claimed that the physical environment and pollution cause damage to the marine environment. These inconsistencies have led to confusion among researchers and policy-makers on what actually contributes to the changing environment in Malaysia.

Furthermore, although there is an abundance of international studies focussing on marine-related environmental changes such as by Kelleher (2005), Cho (2012), Halfar and Fujita (2007), Darwin (2008), Ottersen, Kim, Huge, Polivina and Stenseth (2009), Kennedy (2010), Schmidt et al. (2012), and Kwiatkowski et al. (2015), a similar scenario cannot be found in Malaysia, as most existing literature focusses on scientific findings (Awang & Abdul Hamid., 2013; Kajikawa, 2012; Subramaniam et al., 2011; Suhaila et al., 2010; Tangang, 2007; Wan Azli, 2010; Zubaidi, 2010).

The inconsistencies in the findings and the lack of related studies have led to this study, with its main objective being to gain Malaysian small-scale fishermen's views on environment change and to produce several recommendations that can assist the fisherman community in coping with the worsening situation it finds itself in. Within the scope of this study, the small-scale fishermen's views are based on 1) their awareness of environmental changes; 2) their perception of the causes of such changes; 3) the impact of the changes on them and the community; and 4) their response towards the changes.

LITERATURE REVIEW

Small-Scale Fishermen in Malaysia

Fishermen play an important role in the country, especially in ensuring consistent marine supply to the public. In Malaysia, fishermen are registered under the Department of Fisheries Malaysia (DOF) and receive a monthly allowance of RM300 and subsidised fuel worth 65 cents (per litre), which is cheaper than the market price (Shaffril & Hamzah, 2016). Generally, fishermen in Malaysia are grouped based on

their catching areas. Zone A fishermen, also known as small-scale fishermen, operate their fishing routine less than 5 nautical miles from the shore while the other three groups, Zone B fishermen, Zone C2 fishermen and Zone C0 fishermen, also known as deep-sea fishermen, operate their fishing routine more than 5.1 nautical miles from the shore. To date, there are no official statistics on the number of small-scale fishermen in Malaysia; however, local studies done by Osman et al. (2014), Ramli et al. (2013), and Omar, Shaffril, Bolong and D'Silva (2013) have consistently proven that this group holds more than 65% of the overall registered fishermen in Malaysia. There are several characteristics of small-scale fishermen in Malaysia such as operating with a smaller vessel (fibre or sampan), conducting daily operations (less than 24 hours), having smaller horse power for boat engines, having a mobile phone as a basic communication tool at sea and conducting their fishing operation at a substantial level. These characteristics have led to problems for small- scale fishermen, especially with regard to environmental changes.

Potential Causes of Environmental Changes

Under this section, the discussion focusses on two main causes of environmental changes i.e. the human factor and the natural factor.

The human factor. Under this section, the discussion focusses on marine pollution, physical development, bottom trawling and overfishing.

Marine pollution. Marine pollution can be in several forms such as land runoff, ship pollution, atmospheric pollution and deep-sea mining (Darwin, 2008; Halfar & Fujita, 2007). Marine resources can result in the entry of chemicals, particles, industrial, agricultural and residential waste, noise or the spread of invasive organisms into the sea (Darwin, 2008). Several toxic chemicals adhere to tiny particles, which are then taken up by plankton and benthos animals, and then becomes either deposit or filter feeders. These toxins are concentrated upward within ocean food chains. Many particles combine chemically in a manner highly depletive of oxygen, causing estuaries to become anoxic. When pesticides are incorporated into the marine ecosystem, they can negatively impact the food web as these pesticides can cause deaths or intoxication to several marine species or their food resources, making them unsafe for consumption by the public (Darwin, 2008).

Physical development. The impact of physical development, especially in coastal areas covers a wide scope; however, in general, the development of coastal areas results in formidable challenges for conservation efforts related to marine fauna due to the loss and deterioration of their habitat that eventually will result in the decreasing quantity and quality of marine flora and fauna (Schmidt et al., 2012).

Bottom trawling. Bottom trawling is one of the fishing tools used by fishermen. It relies on a large net with heavy weights that is dragged across the seafloor; it catches almost everything in its way from big to small fish. Bottom trawling is unselective and results in severe damage to seafloor ecosystems (Kelleher, 2005). The net will drag everything in its way, including the reef, which is the main habitat of several marine species. Via this tool, many marine creatures end up being mistakenly caught and are thrown overboard dead or dying, including endangered fish and even vulnerable deep-sea coral that can live for several hundred years (Kelleher, 2005). This collateral damage, called bycatch, can amount to 90% of a trawl's total catch. Furthermore, the weight and width of a bottom trawl can destroy a large area of the seafloor, which provides shelter and food for marine species. Understandably, using bottom trawling can lead to permanent damage to our marine ecosystem (Cho, 2012).

Overfishing. Overfishing happens when marine resources are captured much faster than the rate at which they can reproduce. Overfishing is said to have exploited or significantly depleted 70% of the world's marine resources (Jetson, 2014). The main cause of overfishing is commercial fishing, which requires most of the ships or boats used to be equipped with advanced catching tools for greater productivity (Jetson, 2014; Pontecorvo, 2008). Overfishing posts a formidable challenge to small-scale fishermen as it reduces the harvest of targetted fish and untargetted/protected/endangered marine species, brings changes to the ecosystem and impacts the socio-economic condition of small-scale fishermen (Jetson, 2014).

The natural factor. Under this section, the impact of climate change on the environment and the impact of climate change on the quantity and quality of marine species are discussed.

Impacts of climate change on the environment. Studies by local and international scholars confirmed the impact of climate change on the environment, and among the obvious ones is rising temperature (Intergovernmental Panel on Climate Change, 2007; Kwan, Tangang, & Juneng, 2011), sea-level rise (Awang & Abdul Hamid, 2013; Zubaidi, 2010), unstable rain pattern (Subramaniam et al., 2011; Wan Azli, 2010), unstable monsoon pattern (Kajikawa, 2012; Suhaila et al., 2010), strong wind and waves and extreme events (Tangang, 2007). Climate change has also eroded coastal areas. A study conducted by Ekhwan (1997) concluded that 29.1% of coastal areas in Malaysia are considered as eroded, caused mostly by extreme waves and the rising sea level (Awang & Abdul Hamid, 2013). Mangrove areas are another affected component and according to the Food and Agricultural Organisation (FAO) (2007), the extinction rate of mangrove areas in Malaysia is 0.8%.

Impact of climate change on the quantity and quality of marine species. Ottersen et al. (2009) has looked into the impact of rising temperature on the quantity and quality of certain marine species, while Kwiatkowski et al. (2015) has confirmed that rising temperature can cause disease such as coral bleaching to the reef, the main habitat for marine species.

What Small-Scale Fishermen Can Expect from Environmental Changes?

Environmental changes are expected to pose problems and challenges to the fishing operations of small-scale fishermen. Among the expected problems and challenges are enhanced risks, lower productivity and lower income.

Enhanced risks associated with their fishing operations. Local and international studies (Awang & Abdul Hamid, 2013; Kajikawa et al., 2012; Subramaniam et al., 2011; Suhaila et al., 2010; Tangang, 2007; Wan Azli, 2010; Zubaidi, 2010) have confirmed that climate change impacts the stability of weather elements such as temperature, rain pattern, wind and waves and indicated that this change also increases the risks associated with fishing operations. As most small-scale fishermen are equipped with smaller vessels that have lower engine capacity, it makes them vulnerable to extreme weather such as strong winds and waves.

Lower productivity. Human factors such as physical development and pollution have long been identified as the major causes of the extinction, intoxication and degrading of marine resources, while climate change has been said to increase sea temperature and force some species to move to another habitat. The same phenomenon is also confirmed as the cause of coral bleaching of reefs, which are the main habitat of several marine species.

Lower income. Lower productivity among small-scale fishermen results in lower income for them, while weather effects such as strong wind and waves force some of them to delay or cancel their fishing operations. Such decisions result in fewer operation days for them, resulting in lesser income for them.

METHODS

This study was qualitative in nature. It employed Focus Group Discussion (FGD) and in-depth interviews in collecting the required data. Both methods were chosen for their advantages. FGD stimulates new thinking about a topic to produce detailed and in-depth discussion and provide access to comparisons that focus group participants make based on their experience. The in-depth interview, on the other hand, offers in-depth discussion in a relaxed atmosphere that encourages people to share their knowledge and experience (Morgan, 1997). One FGD was conducted at each location, Batu Pahat, Kuala Besut and Tanjung Piai, while the in-depth interview was conducted only at Tanjung Piai. These three places were selected as they are faced with the

results of environment change caused either by human factors or natural factors. Batu Pahat is one of the places in the country that are seriously threatened by sea-level rise and some areas there are facing serious coastal erosion (Awang & Abdul Hamid, 2013), while Kuala Besut areas, especially Kampung Pengkalan Atap, are facing serious coastal erosion that has forced some of the community to settle elsewhere. Kampung Pengkalan Atap is situated near (roughly about 3 km) from the LKIM Jetty, where vessels and ships that employ several types of fishing tool inclusive of bottom trawling are anchored, while Tanjung Piai is a coastal area located in Southern Johor. Tanjung Piai has seen a rise in sea level (Awang & Abdul Hamid, 2013) and several mega projects have been developed here, for example, the Tanjung Bin Power Station. Tanjung Piai is also a location for the visit of big ships. Table 1 provides background information on the participants such as age and experience as a fisherman.

Table 1
Information on background of participants

Participants	Age	Experience as a fisherman
Batu Pahat (FGD)		
NBP1	52	15
NBP2	50	15
NBP3	33	7
NBP4	50	15
NBP5	55	15
Kuala Besut (FGD)		
NT1	60	30
NT2	51	36
NT3	65	30
NT4	55	25
NT5	53	33
Tanjung Piai (FGD)		
NTP1	45	20
NTP2	50	25
NTP3	30	10
NTP4	35	18
NTP5	55	31
Tanjung Piai (In-depth interview)		
KNTP1	48	25

This study relied on the phenomenology approach, which emphasises a focus on people's subjective experiences and interpretations of the world (Creswell, 2007; Marshall & Rossman, 2011). This technique allowed the researchers to identify the life experience of the small-scale fishermen in relation to environmental changes based on the meaning of their experiences and at the same time, providing a rich and thick phenomenological description of the views of the small-scale fishermen on the environmental changes. The total number of participants selected for each FGD for this study was based on the quality of the data collected and the findings, as is recommended for most qualitative methodology. The FGDs

and the in-depth interview were continued until the researchers believed that they had reached the point of saturation, where full understanding of the experience was obtained that would not be altered through further discussion with the participants (Laverty, 2003).

The first FGD was conducted at Batu Pahat involving a total of five participants and lasting 45 minutes, while the second was conducted at Kuala Besut involving a total of five participants and lasting 45 minutes. The third FGD was conducted at Tanjung Piai involving a total of five participants and lasting 50 minutes. The in-depth interview was conducted at Tanjung Piai with the President of the Association of Small-Scale Fishermen of Peninsular Malaysia and lasted 1 hr and 17 min. Both the FGDs and the in-depth interview started with the researchers introducing themselves to the participants and then proceeded with collection of background information, after which the participants were informed of the purpose of holding the FGDs and the in-depth interview. From there, the FGDs moved into deeper discussion of the issue at hand. Prior to data collection, a guiding question was prepared in order to keep the interview protocol in line with the study objective and to maintain flow of conversation. These key questions were constructed based on the literature review and the documents analysed were associated with environmental changes related to the sea. The questions were designed to address the following areas: 1) their awareness of the environmental changes; 2) their views on the causes of such changes; 3) the impact of the changes on them and the community; and 4) their response to the changes. The questions also served as a guide, and the respondents were allowed a degree of freedom and flexibility in their answers. The President of the Association of Small-Scale Fishermen of Peninsular Malaysia, who was later engaged in the in-depth interview, and village leaders assisted in choosing appropriate and suitable respondents for the FGDs. To avoid bias in the selection of participants, the leaders were informed of the study objective. The researchers emphasised the criteria for recruiting suitable participants and provided a briefing on why they were needed. In general, questions related to the impact of the changes on the community took the longest time to explore in the FGDs and the in-depth interview. The data obtained were later transcribed verbatim and analysed using thematic analysis.

RESULTS AND DISCUSSION

Are They Aware of the Changes?

Several themes emerged during discussion, namely awareness of the changes, temperature rise, difficulty in predicting the climate, extinction of mangrove swamps, eroded coastal areas, unstable rain pattern and decreasing marine resources.

Awareness of the changes. Most of the participants were aware of the environmental changes in their areas; studies done by local and international scholars have confirmed that the climate in Malaysia is changing

(Awang & Abdul Hamid, 2013; Kajikawa et al., 2012; Subramaniam et al., 2011; Suhaila et al., 2010; Tangang, 2007; Wan Azli, 2010; Zubaidi, 2010). Shaffril et al. (2015a) has stated that local fishermen communities are aware of environmental changes as they impact their daily routine. This was acknowledged by NBP2, who stated, "There are lots of differences (regarding the climate nowadays)." This was supported by NBP 1, who claimed that the season nowadays was no longer the same as before: "The season nowadays is not similar to the past."

Temperature rise. The participants stated that rising temperature was among the obvious changes to the climate in their areas. Kwan et al. (2011) and IPCC (2007) have confirmed the phenomenon of rising temperature in several coastal areas in Malaysia, while social studies by Abu Samah, Shaffril, D'Silva and Uli (2011), and Shaffril et al. (2015b) have confirmed that awareness of rising temperature in their areas is growing among small-scale fishermen. NTP 1 confirmed this, saying, "It is very hot nowadays." NT6 also supported the researchers' findings with this insight: "In my early days as [a] fisherm[a]n, the temperature [was] less hot than this day."

Difficulty in predicting the climate nowadays. The participants also confirmed that it was difficult to predict the climate nowadays. This was highlighted by Suhaila et al. (2010) and Kajikawa (2012), who looked into the instability of the weather in Malaysia, and Omar et al. (2013), who explained that indigenous knowledge in predicting the climate is no longer reliable nowadays. Indeed, according to one of the participants, "We cannot predict (the climate), the climate nowadays is too difficult to predict" (NBP 1). NP 2 said that it was difficult to predict the climate nowadays and stressed the instability of the wind, adding, "The wind nowadays is unpredictable. In the previous days it is easier to predict on what type of wind that you are expecting to face at the sea."

Extinction of mangrove swamps. The extinction of mangrove swamps is another change mentioned by the participants. Sea-level rise is one of the many causes of this (Awang & Abdul Hamid, 2013) and human development (FAO, 2007) is another. In Malaysia, according to the FAO (2007), the rate of extinction of mangrove swamps has reached 0.8%. Data extracted from the participants of this study seemed to echo the findings of other studies on this matter. According to NTP 1, for instance, "(Due to the development) There [are] no more mangrove trees in front of my house, all of them [are] extinct." Another participant from the FGD group in Batu Pahat stated, "The mangrove areas over here are degrading, we need to think [of] the best way . . . to preserve the remaining areas" (NBP 2).

Eroded coastal. Most of the participants explained that some coastal areas where they lived were eroded. This agreed with the findings of Mohd Ekhwan (1997), who stated that out of 4,809 km of coastal land

in Malaysia, 29.1% was considered eroded. Serious erosion can be seen in areas such as Kuala Besut, Tanjung Piai and Batu Pahat (Awang & Abdul Hamid, 2013). NTP 5 referred to this, stating, "Here, the coast has been eroded." This was confirmed by NTP 4, who referred to the main cause of erosion, stating, "The coastal is eroding over here and it is mostly caused by extreme waves and in certain situation, (the waves) can reach 3 metres in height."

Unstable rain pattern. Unstable rain pattern is another phenomenon of changing climate highlighted by the participants. This was in line with the findings of Wan Azli (2010) and Subramaniam et al. (2011), who confirmed that rainfall pattern, particularly in the West and East Coast of Peninsular Malaysia was unstable. One of the participants said, "The rainfall has decreased, in the previous days, before going out to the sea, due to frequent rain, I need to take out all of the water inside the boat almost every day, but not anymore in this day." Another participant shared that it sometimes rained for a week, stating, "It (the rain) can be up to three days, and sometimes even up to a week." (NT1)

Decreasing marine resources. According to the participants, marine resources, especially fish, are reduced. NP 1 said that compared to his early days as a fishermen, the number of fish how has significantly decreased in number. He further stated, "No, the number of the fish is decreasing, in my early days as a fisherman the situation was different." Another participant in the group, NT 2, stated that "the sea produces less fish for us, it affects our income."

What Are the Causes?

With agreement among the participants that there were visible signs of weather change such as temperature rise, difficulty in predicting the weather, extinction of mangrove swamps, an eroded coastline, unstable rain pattern and decreasing marine resources, the discussion then moved on to their views on the causes of these changes. Two themes emerged, namely the human factor and the natural factor.

The human factor. Further discussion with the participants yielded several sub-themes under this topic, namely physical development, overfishing, intrusion of foreign fishermen and bottom trawling.

Physical development. Schmidt et al. (2012) and Devoy (2015) found that physical development was one of the causes for changes in the weather. The participants seemed to agree with this. One of them, NTP 4, stated, "There is a lot of physical development over here." This was supported by KNTP, who stressed on the impact of physical development in coastal areas, saying, "[C]oastal erosion for me is not caused by the climate change, it is caused by the physical development."

Overfishing. According to one of the participants, overfishing was caused by big boats engaged in commercial fishing operations. This agreed with the findings

of Jetson (2014) and Pontecorvo (2008), who claimed overfishing by commercial fishermen forced small-scale fishermen to explore new catching areas. NT 4 said, "There are big numbers of big ships nowadays, which potentially cause overfishing." This was affirmed by NBP 3, who emphasised that some fishermen cared less about the environment and the future, revealing that, "Some of them, they catch everything, even the small one (fish)."

Intrusion of foreign fishermen. According to the participants, the intrusion of foreign fishermen is another reason for degrading marine resources. Shaffril et al. (2013) pointed out that the use of prohibited fishing techniques used by foreign fishermen degraded local marine resources; this issue is a major concern among local fishermen. The participants shared possible reasons for foreign fishermen intruding in Malaysian waters. NT4, for example, said, "It is difficult for the fish to sustain in our sea. Comparatively, in the previous days, there is plenty of fish in their areas (the neighbouring states), but nowadays, fish in their sea are decreasing and as the solution, they intrude our sea and catch our fishes."

Bottom trawling. One of the participants highlighted that bottom trawling is a fishing technique that has many negative consequences. According to Kelleher (2005) and Cho (2012), it is one of the most destructive ways to catch fish and it causes up to half of fish and marine life worldwide to be discarded. One of the participants, NT 5, said, "With bottom trawling, they take almost everything – small fish, big fish, the seedlings and even the egg." Another participant from the FGD group in Kuala Besut, NT 1, stated, "It (bottom trawling technique) is the fishermen's worst enemy, it takes almost everything from our sea and leaves nothing for us."

Natural factors – The changing climate. In addition to human factors, the participants also referred to natural factors such as climate change. Several studies have also pointed out that the impact of climate change such as rising temperature, a rise in sea level, extreme wind and waves and coastal erosion (Awang & Abd. Hamid, 2013; Kwan et al., 2011; Mohd Ekhwan, 1997; Razali, Sapuan, Ibrahim, Zaharim, & Sopian, 2010). According to NBP 5, "The changing environment is caused by the climate change." NBP 2 agreed with this, adding, "It is the natural causes that cause the changes (the environment)."

Impact of Environmental Changes on the Community

The discussion then focussed on the impact of these changes on the community. Sub-themes such as lower marine productivity, pollution, decreased income, unpredictable fishing season, impact on fishing routine, damaged marine habitat, increased risk to their fishing routine and increase in pressure to explore new catching areas emerged. The details of these findings are discussed below.

Lower marine productivity. One of the participants stated that productivity had decreased and some of the causes for this were rising temperature, bottom trawling and overfishing, as echoed in the literature (Jetson, 2014; Kelleher, 2005; Ottersen et al., 2009; Pontecorvo, 2008). According to NBP 5, "In the previous days, we can easily bring back 10 kilos of fish, but nowadays, it is difficult for us to catch even five kilos (marine catches)." Another participant, NBP 1, referring to the decreasing sources of prawns in his catching areas, stated, "At my places there is no more prawn." Despite the impact on the quantity of the marine sources, the environmental changes are also detrimental to the size of fish caught in this area. One of the participants expressed his view on this issue, saying, "The size (of the catch) nowadays is smaller, it is not [the] same as during my early days as a fisherman" (NTP 2).

Pollution. The participants claimed that the sea and coastal areas were polluted. They further stated that most of the pollution in their areas were caused by development. One of the participants stated, "Our sea and the coastal are polluted, when there [is] development at your place, there is high potential for such problem" (NTP 5).

Unpredictable fishing season. The participants found it difficult nowadays to predict the actual catching season. NBP 1 explained, stating, "During the previous days, our catching season is in April, but not more in this day, we do not know the actual time for catching the fish." The participant added, "Sometimes, it (the catching season) [is] delayed for three months. For example, during West Season (local name for the prawn-catching season), supposedly there should be plenty of prawns, but surprisingly, there is no prawn for us to catch during that season."

Damage to marine habitat. Although damage to the marine habitat can be caused by climate change, especially rising temperature (Kennedy, 2010; Ottersen et al., 2009), most of the participants in this study highlighted the disastrous impact of the bottom trawling technique on the marine habitat. According to NTP 2, simply put, "it destroys the coral reef." NTP 4 agreed, saying, "Sometimes, they trawl including our artificial reef, it destroys everything, and it destroys the ecosystem."

Increased risk to their fishing operations. As climate change brings a number of extreme events (Tangang, 2007), the risks to fishing routines are increased. The fishermen shared that the situation is worsening as they are only equipped with a small vessel and smaller engine capacity, and this increases their vulnerability to extreme events. One of the participants stated, "We cannot go out to the sea during September and October, the rain is too heavy and the waves are too big, it is too dangerous for small-scale fishermen like us" (NT 3). NBP 5 agreed, stating, "We cannot go out to sea, we just stay at home."

Decreased income. One of the participants referred to the decreasing income of small-scale fishermen due to the impact of development, pollution and the changing climate. This is in line with a study done by Shaffril et al. (2013). According to the participant, "Most of our income is coming from the fish and prawn, nowadays, the number is decreasing and it means less money for us" (KTNP). Another informant from the FGD group stated, "During September and October, the small-scale fishermen need to stop their fishing operation, the weather by that time is very unpredictable. They need to stop their works" (NT3).

Increased pressure to explore new catching areas. As the fish in their waters have depleted in number, some of the participants said they were taking the risk of intruding into international waters. Some of them have been unlucky and have got caught. The informant in the in-depth interview, KNTP, said, "Some of us get caught and get warned by the authorities, but what to do, we need to catch more fish, and we need money." Another participant from the FGD group in Batu Pahat said, "The only thing to do is to explore new areas; however, the risk increases as we do not know things to expect at the new places" (NBP 4).

What They Have Done in Response?

As the environmental changes are threatening their socio-economic life, the participants are taking several initiatives to adapt to the changes. Among the themes that emerged are enhancing their safety and security, practising information and experience sharing, seeking alternative sources of income, wearing the right clothing, and practising systematic record keeping.

Enhance safety and security aspects. Most of the participants said they took their mobile phone during their fishing operations, the main purpose of which was to enhance their chances of safety and security. According to Shaffril et al. (2015a) and Omar et al. (2012), a mobile phone can act as an emergency communication tool for the SSFM. Previously, the only thing they could do during an emergency (engine breakdown, bad weather) was to wait for someone to appear to rescue them; this could result in days or weeks of waiting. However, a mobile phone allowed them to raise the alarm and seek help immediately. NBP 2 stressed the importance of taking along a mobile phone when out at sea, saying, "We need to bring mobile phone together (to the sea) that is the most important thing." NBP 5 agreed with this, adding, "It is like our life," in referring to the mobile phone.

Practise information and experience sharing. For the participants, information and experience sharing is an effective method for minimising the impact of environmental changes. This is common practice among fishermen, and such sharing usually occurs in places of communal gathering such as the *waqaf* and coffee stalls (Shaffril et al. 2013). Shaffril et al (2015a) claimed that this practice strengthens social

relationships and allowed smooth flow of related information among the fishermen. One of the participants stated, "Everyone has their own information and they can share it among them" (NT4). Another participant stated, "We can consider others' experience and apply it in our fishing routine if we find it suitable" (NBP 5).

Alternative sources of income. Some of the participants have alternative sources of income and this offers them multiple sources of income. As financial sources are important for any reactive and proactive plans to combat environmental changes, having multiple financial sources can strengthen their flexibility and stability in adapting to any change in the system (Islam, Sallu, Hubacek, & Paavola, 2014). One of the participants stated, "That's why now I turn my attention to business" (NBP 5). According to KNTP, boat rental for angling is among the popular alternative income-generating activities. Such activities, according to him, provide a stable income for the fishermen. He said, "They rent their boat to anglers for RM350 (roughly equal to USD90) for a trip. Sometimes, they can get up to 20 trips in a month."

Clothing. To adapt to the rising temperature, the participants have changed their style of dressing for sea. On hot days, for example, NTP 1 said he wore a hat to reduce the impact of being exposed to the excruciating heat, while NTP 5 said he wore thin clothing on hot days. He stated, "It depends on the weather… if it is hot… we will wear ultra-thin clothing." On cold days, they wear thicker clothing.

Systematic record system. One of the participants shared that one of his friends kept a systematic written record and it allowed him to track and identify the changing patterns of weather and catching seasons. "He has a systematic report, he makes a record on the season, on the tide, the patterns of current and wind, fishing tools that suit to be used in different season, he has that record" (KNTP).

IMPLICATIONS, CONCLUSION AND RECOMMENDATIONS

This study succeeded in gaining the views of small-scale fishermen on the changing environment. Their views are valuable for constructing effective community adaptation strategies, and should be considered as reliable and should be emphasised by the parties concerned as they consistently 'communicate' with nature. Understandably, their experience from interacting with Mother Nature can yield valuable information and can be used by the parties concerned for helping other community groups to deal with the changing environment.

It can be concluded from this study that the effects of the changing environment in the views of the small-scale fishermen included temperature rise, difficulties in predicting the weather, extinction of mangrove swamps, eroded coastal areas, unstable rain pattern and decreasing marine resources. The fishermen believed that

among the main contributors to these problems are people and nature. As the fishermen relied heavily on weather stability, they believed that the changing environment posed several problems such as decreasing marine productivity, decreasing income, pollution, unpredictable fishing season, damaged marine habitat, increasing risks associated with their fishing operations and increased pressure to explore new catching areas. In order to overcome these challenges, these small-scale fishermen have taken several initiatives such as enhancing their safety and security, practising information and experience sharing, acquiring multiple sources of income, using protective clothing and keeping a systematic record system on the weather pattern. In addition to the recommendations made by the small-scale fishermen, this study would like to suggest a number of additional recommendations as given below.

More Research into the Causes of Environmental Changes and Its Impact on SSFM

There is a need to conduct more research related to the causes of environmental changes and their impact on SSFM. More research into this topic will assist the parties concerned to develop strategies based on in-depth understanding of the problems affecting SSFM that will suit their needs, ability and interests. Several research grants are offered by the related ministries and international agencies for local researchers such as the Fundamental Research Grant Scheme (Ministry of Higher Education), e-Sciencefund (Ministry of Science and Technology Innovation) and Research University Grant Scheme (Ministry of Higher Education), Sumitomo Grant (Sumitomo Foundation), Toyota Foundation Grant (Toyota) and many more. It is important to research findings are shared with and disseminated among SSFM so that they will be informed and will know how to address problems that affect them and their livelihood.

Role of Influential Persons

As information and experience sharing is important for enhancing SSFM awareness of environmental changes, it is suggested that the influential people among SSFM such as the skipper, jetty leaders and village leaders be enlisted to help in strengthening environmental awareness among SSFM. These influential persons can act as 'volunteer extentionists' who will relay important information to SSFM first before they disseminate and share the information with SSFM either in formal or informal ways. This would be a successful dissemination strategy as, according to Hassan et al. (2011), rural communities consider information received from influential persons such as village leaders as being reliable and highly trustworthy.

Additional Monitoring and Enforcement of Illegal Bottom Trawling

Monitoring and enforcement activities are needed to lessen any illegal bottom trawling activities and the intrusion of

foreign fishermen in local waters. Although monitoring and enforcement activities are conducted periodically, their frequency should be increased for adequate enforcement and penalties should be imposed to deter illegal, unreported or unregulated trawling activities. Furthermore, on-board observers should be hired to monitor bycatch and ecosystem-habitat interaction to identify and report evidence of bottom trawling activities.

Conservation Activities

Small-scale fishermen through their fishermen's association need to conduct conservation activities as one of their initiatives to take care of the environment. Cooperation with NGOs, universities, private companies and government agencies for the purpose of conserving the environment needs to be conducted, while at the same time public awareness of the importance of the environment needs to be enhanced. Among potential conservation activities that can be conducted are mangrove replanting and artificial reef placing in potential catching areas.

ACKNOWLEDGEMENT

This study would like to thank Universiti Putra Malaysia for providing the research grant (GP-IPB/2014/9441301).

REFERENCES

Abu Samah, B., Shaffril, H. A. M., D'Silva, J., & Uli. J. (2011). The negative environmental changes on the sea and its impact on the aspects of economic, social and health of the fishermen living in the east coast zone of Peninsular Malaysia. *American Journal of Environmental Science, 7*(6), 534–541.

Awang, N. A., & Abdul Hamid, M. R. (2013). Sea level rise in Malaysia. Retrieved on 2015, October 4 from http://www.iahr.org/uploadedfiles/userfiles/files/47-49.pdf

Cho, D. (2012). Eliminating illegal bottom trawling in the coastal waters of Korea. *Marine Policy, 36*(2), 321–326.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Darwin, H. J. (2008) *Poison in the well: Radioactive waste in the oceans at the dawn of the nuclear age.* New Jersey: Rutgers University Press.

Department of Fisheries Malaysia. (2013). *Landings of marine fish by state and fishing gear group, 2012*. Retrieved October 25, 2015 from http://www.dof.gov.my/c/document_library/get_file?uuid=17bb9e10-7ccc-40dd-9be8-f753adbd1754&groupId=558715.

Department of Fisheries Malaysia. (2016). *Landing of marine fish by state and fishing gear group 2015*. Retrieved August 22, 2016 from http://www.dof.gov.my/dof2/resources/user_29/Documents/Perangkaan%20Perikanan/2015/2.Perikanan_Tangkapan_.pdf

Devoy, R. J. N. (2015). Sea level rise: Causes, impacts and scenarios for change. *Coastal and Marine Hazards, Risks and Disasters, 2015*, 197–241.

Food and Agriculture Organization. (2007). *The world's mangroves 1980-2005.* Italy: Food and Agriculture Organization.

Halfar, J., & Fujita, R. M. (2007). Ecology: Danger of deep-sea mining. *Science, 31*(5827), 987.

Hassan, M. S., Yassin, S. M., Shaffril, H. A. M., Othman, M. S., Abu Samah, B., Abu Samah, A., & Ramli, S.A. (2011). Receiving the agriculture information through mass media and interpersonal sources among the rural community. *American Journal of Agricultural and Biological Sciences, 6*(3), 451–461.

Intergovernmental Panel on Climate Change. (2007). Contribution of working group ii to the fourth assessment report of the intergovernmental panel on climate change, 2007. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden & C. E. Hanson (Eds.), *Asia. Climate Change 2007: Impacts, adaptation and vulnerability* (pp. 469–506). Cambridge, United Kingdom: Cambridge University Press.

Islam, M. M., Sallu, S., Hubacek, K., & Paavola, K. (2014). Limits and barriers to adaptation to climate variability and change in Bangladeshi coastal fishing communities. *Marine Policy, 43*(2014), 208–216.

Jetson, K. (2014). *Impact of overfishing on human live.* Retrieved October 30, 2015 from http://marinesciencetoday.com/2014/04/09/impact-of-overfishing-on-human-lives/

Kajikawa, Y., Yasunari, T., Yoshida, S. & Fujinami, H. (2012). Advanced Asian summer monsoon onset in recent decades. *Geographical Research Letters, 39*(3), 1-5.

Kelleher, K. (2005). *Discards in the world's fisheries an update*. Rome: Food and Agriculture Organization of the United Nations.

Kennedy, J. (2010). *What is ocean acidification?* Retrieved 2015, October 10, 2015 from http://marinelife.about.com/od/conservation/f/acidification.htm

Kwan, M. S., Tangang, F. T., & Juneng, L. (2011). Projected changes of future climate extremes in Malaysia. *Sains Malaysiana, 42*(8), 1051–1058.

Kwiatkowski, L., Cox, P., Halloran, P. R., Mumby, P. J., & Wiltshire, A. J. (2015). Coral bleaching under unconventional scenarios of climate warming and ocean acidification. *Nature Climate Change, 5*(8), 577–581.

Laverty, S. M. (2003) Hermeneutic phenomenology: A comparison of historical and methodological considerations. *International Journal of Qualitative Methods, 2*, 1–29.

Marshall, C., & Rossman, G. B. (2011). *Designing qualitative research* (5th eds.). Thousand Oaks, CA: Sage Publications.

Mohd Ekhwan, T. (1997). Critical coastal erosion: A dynamic analysis of the impact on the coastal communities in Kuala Kemaman, Terengganu. *Conference on Social Science Research.* Universiti Malaya.

Morgan, D. L. (1997). *Focus groups as qualitative research* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Omar, S. Z., Shaffril, H. A. M., Bolong, J. L., & D'Silva, J. L. (2013). Weather forecasting as an early warning system: pattern of weather forecast usage among coastal communities in Malaysia. *Life Science, 10*(4), 540–549.

Osman, M. N., Omar, S. Z., Bolong, J., D'Silva, J. L., & Shaffril, H. A. (2014). Readiness of young Malaysian fishermen to use geographical positioning system within the fishing operation. *Asian Social Science, 10*(14), 1–7).

Ottersen, G., Kim, S., Huge, G., Polovina, J. J., & Stenseth, N. C. (2009). Major pathways by which climate may force marine fish populations. *Journal of Marine Systems, 79*, 343–360.

Pontecorvo, G. (2008). A note on overfishing. *Marine Policy, 32*(6), 1050–1052.

Ramli, S. A., Omar, S. Z., Bolong, J., D'Silva, J. L., & Shaffril, H. A. M. (2013). Behavioral Intention towards ICT usage among fishermen in Malaysia. *Research Journal of Applied Science, 8*(3), 221–224.

Razali, A. M., Sapuan, M. S., Ibrahim, K., Zaharim, A., & Sopian, K. (2010). Mapping the annual extreme wind speed analysis from 12 stations in Peninsular Malaysia. In *WSEAS International Conference on System Science and Simulation in Engineering* (pp. 397–403). Japan: World Scientific and Engineering Academy and Society.

Schimdt, J. A., McCleery, R., Seavey, J. R., Devitt, S. E. C., & Schmidt, P. M. (2012). Impacts of a half century of sea-level rise and development on an endangered mammal. *Global Change Biology, 18*(12), 3536–3542.

Shaffril, H. A. M., & Hamzah, A. (2016). The potential benefits of GPS for small scale fishermen in Malaysia. *The Social Science, 11*(3), 205–208.

Shaffril, H. A. M., Abu Samah, B., D'Silva, J. L., & Yassin, S. M. (2013). The process of social adaptation towards climate change among Malaysian fishermen. *International Journal of Climate Change Strategies and Management, 5*(1), 38–53.

Shaffril, H. A. M., D'Silva, J. L., Kamaruddin, N., Omar, S. Z., & Bolong, J. (2015b). The coastal communities' awareness towards the changing climate in Malaysia. *International Journal of Climate Change Strategies and Management, 7*(4), 516–533.

Shaffril, H. A. M., Hamzah, A., Md. Yassin, S., Abu Samah, B., D'Silva, J. L., Tirayaie, N., & Muhammad, M. (2015a). The coastal community perception on the socio-economic impacts of agro-tourism. *Asia Pasific Journal of Tourism Research, 20*(3), 295–313.

Subramaniam, K., Kwok, L. L., & Wan Azli, W. H. (2011). Extreme rainfall changes over Malaysia: Observation and projection. In *National Symposium on Climate Change Adaptation* (pp. 16–17). Pullman Putrajaya Lakeside: Ministry of Natural Resources and Environment (NRE) and Universiti Kebangsaan Malaysia.

Suhaila, J., Deni, S. M., Wan Zin, W. Z., & Jemain, A. A. (2010). Spatial patterns and trends of daily rainfall regime in Peninsular Malaysia during the southwest and northeast monsoon: 1975-2004. *Meteorology and Atmospheric Physics, 110*, 1–18.

Tangang, F. (2007). Climate change and global Warming: Malaysia perspective and challenges. *UKM Public Speech, Anuar Mahmud Hall*, Universiti Kebangsaan Malaysia.

Wan Azli, W. H. (2010). Paper presented at Influence of climate change on Malaysia weather pattern. In *Malaysia Green Forum 2010 (MGF2010)* (pp. 26–27). Putrajaya: Landskap Malaysia, Universiti Putra Malaysia, & Perbadanan Putrajaya.

Zubaidi, J. (2010). Climate change: Potential impacts on water resources and adaptation strategies in Malaysia. In *1st WEPA International Workshop* (pp. 11–22). Hanoi, Vietnam: Ministry of Natural Resources and Environment (Vietnam) and Ministry of the Environment (Japan).