



# Comparing adaptation ability towards climate change impacts between the youth and the older fishermen

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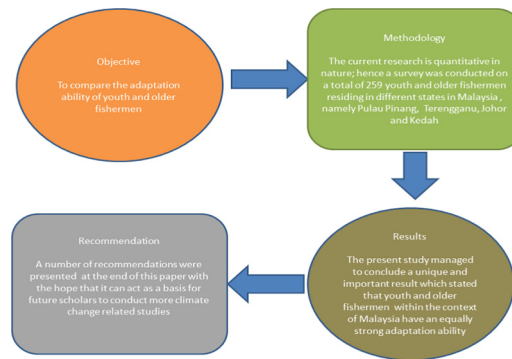
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## HIGHLIGHTS

- To compare the adaptation ability of youth and older fishermen
- Youth and older fishermen have an equally strong adaptation ability.
- Active dissemination and sharing of knowledge and experience
- A greater access to livelihood diversification

## GRAPHICAL ABSTRACT



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## ABSTRACT

In recent years, a considerable amount of studies published locally which focused on the influence of age on climate change ability. Accordingly, this has driven the present study to achieve its main objective which is to compare the adaptation ability between youth and older fishermen. The current research is quantitative in nature; hence, a survey was conducted on a total of 259 youth and older fishermen residing in different states of Malaysia, namely Pulau Pinang, Terengganu, Johor, and Kedah. The present study managed to conclude a unique and important result which stated that youth and older fishermen within the context of Malaysia have an equally strong adaptation ability. In regard to this matter, a number of recommendations were presented at the end of this paper with the hope that it can act as a basis for future scholars to conduct more climate change related studies.

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## 1. Introduction

The Intergovernmental Panel on Climate Change (2007) has been expecting a warmer world and unstable climate which subsequently increase the concerns on issues related to land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Similar to the global context, Malaysia has been faced

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with the same situation; hence, its adaptation ability towards climate change is seen as the best response in dealing with the worsening impacts that are more likely to produce formidable effects on the socio-economic routines of humans and the ecosystem. Accordingly, several adaptation definitions within the context of climate change impacts have been found and one of them is described as follows:

“Action taken to help communities and ecosystems cope with actual or expected impacts of climate change”

[(Ministry of Natural Resources and Environment Malaysia, 2010)]

On a similar note, issues related to the ability of humans to respond to the impacts of climate change have been attracting considerable scholarly attention all over the world for the past decades. Regarding this matter, [Tanggung et al. \(2012\)](#) urged a greater number of Malaysian scholars to conduct more climate change related studies due to the forecasted deterioration of nature stability. In response to this, a research was conducted by [Shaffril et al. \(2017b\)](#) on fishermen climate change adaptation, while [Idris et al. \(2018\)](#) carried out an investigation on highland farmers climate change adaptation. Meanwhile, [Gomez \(2015\)](#) observed how coastal community adapts to climate change impacts, while the study of [Epule et al. \(2017\)](#) attempted to determine farmers' ability in adapting to the worsening climate change. In addition, [Apuri et al. \(2018\)](#) carried out research on climate change adaptation ability among those involved in agroforestry. The findings of these studies have produced one concrete conclusion that highlights the crucial need to develop specific adaptation strategies for specific groups of the community. In the case of the present study, specific groups of community refers to a small scale fishermen who have been practising their unique adaptation strategies (e.g. alternative livelihood – external and internal livelihood diversification) in response towards the worsening climate change impacts, and more importantly, their strategies are entirely different from those practised by the highland farmers (usage of pesticide and high awareness on the landslide) ([Shaffril et al., 2017b](#); [Idris et al., 2018](#)). Moreover, it is important to note that local researchers have not treated this issue in much detail considering that there is still a limited number of researches that specifically investigated the influence of age on fishermen adaptation ability. In addition, the number of the available literature is still frustrating despite the existence of a few local studies (e.g. [D'Silva et al., 2012](#); [Ramli et al., 2018](#)) which had proven the influence of age on the climate change ability is related to the possession of skills, knowledge, and experience. The main objective of the present study is to compare the adaptation ability towards climate change between fishermen from two distinct age groups; youth and older fishermen.

Specifically, the current research has decided to focus on individual adaptive strategies even though it has been widely agreed that the adaptation strategy of the community or group is extensively necessary for coping with climate change. However, the present study found that the community or group adaptation strategies alone may not be enough to address the current and emerging risks of climate change which are highly complex, dynamic, and uncertain ([Boansi et al., 2017](#)).

Furthermore, it should be understood that the objective of the current research is driven by three main factors as follows: (1) the urge expressed by [Tanggung et al. \(2012\)](#) who stress on the need for Malaysian scholars to conduct more climate change related studies due to the serious impacts of climate change, (2) the limited number of studies that employ the factor of age as an influence on Malaysian fishermen's adaptation to climate change, and (3) the inconsistencies of previous results, which claims that the older fishermen showed better climate change adaptation ([Saroar and Routray, 2012](#), & [D'Silva et al., 2012](#)) whereas others claim otherwise ([Ramli et al., 2018](#), [Bukvic et al., 2018](#), [Bukvic et al., 2015](#), [Tapsell et al., 2010](#), [Andrey and Jones, 2008](#), & [Dwyer et al., 2004](#)).

The present study is deemed crucial because it aims to investigate the influence of age factor on Malaysian fishermen's climate change

adaptive abilities in the attempt of providing better understanding among scholars. More importantly, this research aims to enhance several aspects related to this field of study which include quantifying the level of fishermen's adaptation ability for the contribution to scientific knowledge, narrowing down the knowledge gaps, enhancing scientific inputs of this region to the existing literature, developing sounder policies, and offering facts and figures for better scientific adaptation measures that are in line with the fishermen's needs, abilities, and interests.

Apart from that, the present study has proven to be able to extend existing knowledge on this issue based on several facts. First, this study is expected to produce new results on the influence of age on Malaysian fishermen's adaptive abilities toward the impacts of climate change. Notably, it can be clearly observed that most previous studies only focused on climate change adaptation perspectives among other community groups (e.g. highland farmers, coastal community, and general community) rather than the fishermen ([Apuri et al., 2018](#); [Epule et al., 2017](#); [Idris et al., 2018](#)), non-Malaysian context (e.g. Australia, Bangladesh, Western countries) ([Bukvic et al., 2018](#); [Saroar and Routray, 2012](#); [Dwyer et al., 2004](#)), and inconsistency of previous findings ([Saroar and Routray, 2012](#); [D'Silva et al., 2012](#); [Ramli et al., 2018](#); [Bukvic et al., 2018](#); [Bukvic et al., 2015](#); [Tapsell et al., 2010](#); [Andrey & Jones, 2008](#); [Dwyer et al., 2004](#)). Second, the current study attempts to measure the adaptation abilities based on the provided definition that is further categorised into three main aspects which are cognitive (i.e., their awareness and sensitivity towards climate change impacts), structure (i.e., supports received from related organisations), and practice (i.e., adaptation practices to climate change impacts). Third, it should be noted that a number of local studies ([Ramli et al., 2018](#); [D'Silva et al., 2012](#)) have looked at the same issue. However, the studies are deemed inadequate because research by [D'Silva et al. \(2012\)](#) only focused on East Coast fishermen (e.g. East Johor, Terengganu, Pahang, and Kelantan) in Peninsular Malaysia, while the work by [Ramli et al. \(2018\)](#) was only concerned about two Peninsular states, namely Pulau Pinang and Kelantan. Therefore, the findings of the present study will be extremely valuable because its data can be generalised to the fishermen's population in Peninsular Malaysia. More importantly, the sampling technique of the present study allows the respondents to be randomly selected from two fisheries zones in Peninsular Malaysia, namely east coast zone and west coast zone.

## 2. The Malaysian fishermen

The fisheries industry within the Malaysia scope plays an important role in ensuring an adequate food supply for the community. According to the Third National Agricultural Policy or DPN3 (1998–2010), the government has strategically focused on fisheries industry as one of the sources to improve local food output and food resources in adhering to the industry ability ([Mazuki and Man, 2014](#)). Generally, marine areas of Malaysia are divided into three sub-areas as follows: (1) west coasts of Peninsular Malaysia, (2) east coasts of Peninsular Malaysia, and (3) the coasts of Sarawak and Sabah.

Specifically, it is important to note that the small-scale fishermen in Malaysia share several common characteristics. First, small-scale fishermen are in the Zone A fishing areas whereby they are allowed to operate in their fishing areas within 5 miles nautical or less. Second, small-scale fishermen are provided with RM300 (roughly USD70) allowance per month, followed by subsidised petrol which is 63 cents cheaper than the current market price. Furthermore, they are provided with 'landing allowance' which allows them to claim 10 cents per kg of fishes that they manage to land. On a similar note, a number of studies have consistently confirmed that the average age of fishermen is 40 years and above with a huge majority (> 95%) of male that possess at least a primary school level of education ([Shaffril et al., 2017b](#); [Hamdan et al., 2017](#); [Abu Samah et al., 2016](#); [Mazuki and Man, 2014](#); [Omar et al., 2012](#)). In addition, [Shaffril et al. \(2017b\)](#) stated that most of them have four or more household members. Meanwhile, majority of the

fishermen (not including their monthly allowance) receive a monthly income of more than RM700 (Hamdan et al., 2017; Abu Samah et al., 2016; Zaremohzzabieh et al., 2014; Osman et al., 2014). Finally, it is also important to note that Malaysian fishermen are commonly headed by their village leaders, jetty leaders, or the skippers (Shaffril et al., 2013).

On average, most of the Malaysian fishermen have >20 years of experience fishing at sea (Muhammad et al., 2018; Hamdan et al., 2017; Zaremohzzabieh et al., 2014; Abu Samah et al., 2016). In addition, majority of them are highly dependent on fishing activities as the sole income generating activity which causes them to spend around 16 to 20 days a month on fishing (Hamdan et al., 2017; Abu Samah et al., 2016; Omar et al., 2012; Osman et al., 2014). Moreover, other characteristics of fishermen in Malaysia include navigating small vessels (24 ft and smaller), using lower engine power (usually 40 hp and below), adopting simple fisheries technology (GPS, echosounder), and fully utilising mobile phone as their basic communication tool (Muhammad et al., 2018; Hamdan et al., 2017; Abu Samah et al., 2016)

### 3. Climate change in Malaysia

On a more important note, several climate change impacts have been detected in Malaysia. Kwan et al. (2013) in their study concluded that areas such as Bayan Lepas, Kota Bharu, and Kuala Terengganu tend to experience warmer days, while areas such as Sitiawan, Miri, and Alor Star often encounter warmer nights. In addition, Shahid et al. (2017) supported the finding by stating that temperature in Peninsular Malaysia is expected to increase from 1.1 to 3.6 °C with the emphasis that rainfall in Malaysia will be more variable. Meanwhile, Mayowa et al. (2015) noted a significant increase in annual rainfall and northeast monsoon rainfall respectively at 95% and 90% confidence levels at the east coast of Peninsular Malaysia over the period of 30 years (1971–2010). Apart from that, it was also concluded that there will be an increasing number of days with >20 mm rainfall by 1.5 per decade in the same period.

In research conducted by Tanggang et al. (2012), Malaysia was forecasted to experience frequent extreme events related to flood and drought. On the other hand, Feng et al. (2010) highlighted that frequent occurrence of Modoki types of El Nino (probable influence of anthropogenic warming in the El Nino characteristic) will take place in the 21st century, which is likely to exert more droughts and heat waves over Peninsular Malaysia during the period of December – March. Moreover, a past study by Tang (2019) confirmed that Malaysia has been experiencing the frequent occurrence of extreme events related to dry spell, thunderstorm, and strong winds in the past decade. For example, the worst flood was recorded in southern Peninsular Malaysia during the 2006/2007 monsoon, while days with extreme rainfall events have been on the rise since the 1980s.

In the case of rising sea levels, Kamaruddin et al. (2016) confirmed that Malaysia has been experiencing a rising sea level at  $3.67 \pm 0.15$  mm/year centred on the analysis of tidal data from 1984 to 2013. Hence, it is understandable when the rising level is higher than the projected global sea level rise of 1.7–3.1 mm/year due to the local climate and topographical conditions. The findings of a study carried out by Jeofry and Rozainah (2013) revealed several areas that will be affected as a result of the rising sea level by the year of 2050 which are described as follows: (1) Tanjung Gelang with 14.42 cm rising sea level, (2) Kukup will experience 11.95 cm rising sea level, and (3) Cendering will encounter 11.77 cm rising sea level. Overall, it can be clearly observed that climate change impacts significantly influence the monsoon pattern in Peninsular Malaysia. In a study carried out by Yi et al. (2015), it was noted that the increasing intensities of rainfall during monsoons do not only cause a major flood but also acts as a triggering cause of major landslide event.

### 4. The climate change impacts on the fishermen

Generally, climate change provides consequence effects on the quality and quantity of certain marine species including increased temperature and sea level, unstable rainfall and monsoon pattern, and frequent occurrence of extreme events. For example, unexpected and non-linear effects of climate change have the potential to be exacerbated by fishing pressure which results in the shifts that favour lower-trophic species such as jellyfish at the expense of high-valued species such as cod (Brander, 2009; Kirby et al., 2009). On the other hand, Chaijaroen (2019) noted that warmer temperature leads to coral bleaching, destroys certain fish habitat, and forces certain species to move to new areas. Hence, it is undeniable that these scenarios will negatively affect the fishermen income, which in turn causes them to spend more time and invest more money to search for new catching areas. Moreover, small-scale fishermen are highly vulnerable because they are affected by extreme weather such as strong winds and extreme waves due to their common characteristics such as smaller vessels and smaller boat engine capacity. Accordingly, this increases the risks associated with their fishing routines and forces them to delay or even worse, cancel their fishing trips. Consequently, reduced fishing trips imply less income for them.

On a more important note, extreme weather can damage the infrastructure of either the fishermen or the public. A study by Toriman (2006) stated that the majority of the fishermen's house in the coastal areas were entirely built using wood or semi-wood. Hence, it is expected that coastal erosion and extreme weather such as storm surges and extreme waves will result in the highest degree of damage. Apart from that, climate change impacts also involve potential damage to fishing-related assets (e.g. vessels and catching tools). For instance, Typhoon Haiyan in the Philippines resulted in storm surges and floods which was proven to be highly damaging to fishing gears. Monteclaro et al. (2018) pointed out that only 6% suffered slight damage, >1200 fishing gears were moderately or severely damaged, and >30% gears were completely damaged or washed off out of the total of 2400 fishing gears. Overall, it is crucial to understand that damage to personal and public infrastructure as a result of poor housing condition, loss of dwellings, and community infrastructure will lead to resettlement and displacement, and more broadly, the disruption of livelihoods.

Furthermore, McMichael (2015) stated that climate change has been affecting the community health for a long time and will continue over the coming decades. In this case, it is important to note that the severity of the impacts on human health is mainly determined by where individual lives and works (Austin et al., 2019). Moreover, a considerable amount of studies has proven that small-scale fishermen are exposed to several health problems resulted by the climate change considering that most of them reside at the coastal areas and 'interact' daily with the environment. For example, a study conducted by Samah et al. (2016) claimed that present-day fishermen are frequently infected by fever, flu, and cough. Furthermore, the fishermen can be diagnosed with more serious health problems as a result of climate change impacts which include respiratory related problems (Schweitzer et al., 2018), dengue (Li et al., 2018), cardiovascular, stroke, ischemic heart disease (IHD), and chronic obstructive pulmonary disease (COPD) (Chen et al., 2017). Meanwhile, a number of studies related to climate change have revealed a few mental health problems found in fishermen. Searle and Gow (2010) stated that individuals who overthink on the severe effects of climate change will suffer from stress. In addition, Kucera and McDonald (2010) concluded that bad environmental conditions which cause the fishermen to be transferred to a safer place as a result of climate change impacts may lead to stress and frustration.

Apart from that, several other impacts that are associated with climate change have also been discovered. For example, Ho et al. (2016) mentioned that food shortage caused by nature instability leads to fierce competition in obtaining food supply, which consequently creates chaos and conflicts in society. Additionally, climate change can result

in the risk of malnutrition and under-nutrition among communities that are heavily dependent on fish as a source of protein which leads to changes in their diet (reduction of protein from a fisheries source) (Allison et al., 2009). On another note, safety at sea and injuries are related to natural disasters caused by climatic changes such as typhoon and extreme waves. As suggested by Badjeck et al. (2010), such extreme events pose significant operational challenges for fishermen considering that they might be exposed to injury that may affect their physical ability to pursue their livelihoods.

### 5. The fishermen adaptation towards climate change impacts: the perspective of cognitive, structure, and practice

The current research focuses on three main climate change adaptation aspects, namely, cognitive, structure, and practice. The cognitive aspect refers to the awareness and sensitivity of small-scale fishermen towards climate change impacts. In this case, it is very important for the fishermen to be extremely aware and sensitive to the worsening climate change because it may cause formidable impacts on their socio-economic routines. For instance, Audefroy and Cabrera Sanchez (2017) have coined a term known as “ethno-meteorological” which refers to the fishermen’s awareness regarding changes in the sky, clouds, and winds, and most importantly, this knowledge increases their resilience to climate change impacts. Meanwhile, Graziano et al. (2018) concluded that a fisherman’s awareness on the negative impacts of climate change encourages them to value the environment, which subsequently motivates them to become the main supporters of resource-protection. Understandably, it is crucial for scholars to examine fishermen’s awareness and sensitivity based on the notion that climate change risks can only be accessed by human perceptions including their awareness towards climate change (Shaffril et al., 2015; Marshall et al., 2009). Hence, this underlines an important facet of risk that accentuates the role of social structures or conditions in establishing a system that provides further exposure regarding the impacts of climate change. Marshall et al. (2009) further postulated that the awareness of fishermen towards climate change is largely determined by the extent of dependency on nature stability as well as its resources for their socio-economic activities.

On a more important note, it should be understood that fishermen cannot stand alone within the context of climate change adaptation due to the importance of the element of structure. Regarding this matter, the structure is described as supports received from the related organisation. Hence, there is an increasing amount of need within the scope of climate change impacts to obtain help from several parties which include government agencies, NGOs, insurance companies, and businesses for the purpose of securing the resources needed by each community in strengthening their adaptive abilities, and at the same time, accelerating their recovery process (Man et al., 2017; Marshall et al., 2009). Relevant to this, Andriessse (2018) highlighted on the success of Pantawid Pamilya Programme - a conditional cash transfer programme in the Philippines to offer fishermen with the opportunities to increase their income and escape the poverty trap. Furthermore, it is believed that these organisations can offer resources which will directly or indirectly help to reduce the risks associated with fishing routine, strengthen social relationship, manage fishermen’s climate change knowledge, facilitate community’s learning of alternative skills, encourage the involvement of fishermen in climate change adaptation planning as well as financial assistance as a method to reinforce the adaptation ability of fishermen (Shaffril et al., 2017a). Accordingly, those who are equipped with these structures are expected to have stronger adaptation ability, while those without it are believed to have very poor adaptation ability towards climate change impacts. Nevertheless, Shaffril et al. (2017a) highlighted that the success of the community-organisation relationship is dependent on the ability to provide the help that is in line with the abilities, needs, and interests of fishermen. According to Vázquez (2017), the failure to consider this

will result in a relationship conflict between the fishermen, thus delaying any planned climate change adaptation initiatives by concerned parties. On the other hand, Paton et al. (2015) accentuate on the elements of trust, critical awareness, and positive outcome expectancy in ensuring the success of the community-organisation relationship.

On a similar note, practice is another element that needs to be measured. In the case of the present study, practice is described as the practice of adaptation towards climate change impact. Moreover, adaptation practices involve several efforts in strengthening societal resilience towards climatic change, utilising available opportunities and regenerating eco-systems, permitting the emergence of a just and sustainable societal support system, and appropriately mitigating the carbon emissions of humanity. For example, Malakar et al. (2018) and Ramachandran et al. (2016) acknowledged that some fishermen have managed to strengthen their resilience towards climate change by practising external and internal income diversification. External diversification refers to engagement in alternative jobs impertinent to the environment (e.g. labour, driver, shopkeeper), while internal diversification refers to engagement in alternative jobs related to the environment (e.g. fish retailers, seaweed farming, milkfish pond, and cage culture) (Hossain et al., 2018; Andriessse, 2018). On the other hand, Hossain et al. (2018) found that some fishermen practice seasonal migration as one of the adaptation strategies in order to utilise any available opportunities in fishing areas which helps them to sustain their livelihood. Meanwhile, Hasan and Nursey-Bray (2018) also stated that fishermen should migrate to better places where there are civic facilities and job opportunities that can increase their livelihood. Apart from that, it is crucial to evade catastrophic harm to the fishermen by selecting the right adaptation practices that are in line with their ability, need, and interests because it is believed to be beneficial in either accelerating or delaying the worsening impacts (Marshall et al., 2009). For instance, Mulyasari et al. (2018) demonstrated the success of fishermen who combine their current fishing gears of portable traps with shrimp/lobster nets that are specifically tailored to their interests. On another note, there is a need to measure the unique adaptation practices of specific groups considering the fact that every group has different needs. For instance, the technique adopted by highland farmers in responding to climate change is completely different from the method employed by small scale fishermen and low land farmers due to their nature of routines (Idris et al., 2018). Therefore, this uniqueness has driven scholars to further examine the unique adaptation practice of these groups.

### 6. The climate change adaptation among youth and older fishermen

In line with the definition of youth in Malaysia, the present study categorises youth fishermen as those in the age of 40 years and below, while older fishermen refer to those in the age range of 41 years and above. In addition, the general perception with regard to the adaptation towards climate change prefers the older group based on the justification that they possess more experience. Hence, this also indicates that they are equipped with the knowledge needed to successfully respond to the worsening climate change impacts. Nevertheless, it seems that the existing literature is against this general perception based on the inconsistent findings that have been reported. For example, Saroar and Routray (2012) concluded that older fishermen have better adaptation ability because they have an extensive adaptation of experience which allows them to be aware, sensitive, and responds proactively towards severe weather conditions. This finding is consistent with D’Silva et al. (2012) who stated that older fishermen have a better adaptation strength because they are equipped with adequate knowledge and skills compared to the youth who may face anxiety and uncertainties to adapt to the climate change due to their inadequate knowledge and experience.

Nevertheless, a recent study by Ramli et al. (2018) expressed their disagreement towards the finding provided by Saroar and Routray



(2012) by postulating that that older fishermen have weaker adaptive capacity due to their declined physical abilities as a result of their age. Moreover, the findings of Ramli et al. (2018) is supported by Bukvic et al. (2018) who claimed that the unique physical and psychosocial challenges faced by older fishermen may affect their adaptation ability, level of preparedness, capacity to cope, and ability to respond and recover from a climate change impact. Meanwhile, another study by Bukvic et al. (2015) also found that older people are faced with several issues regarding their adaptation ability, particularly when they are required to relocate to other areas. Apart from that, it was further stated that age has a buffering or protective effect on the level of experienced stress as well as the consideration of relocation based on the notion that older individuals tend to perceive lower stress and less interest in relocation (Bukvic et al., 2015).

A study by Tapsell et al. (2010) revealed several adaptation difficulties faced by older fishermen. The results of the study stated that older group may have health problems due to their advanced age (e.g. reduced mobility or sensory impairment), thus making it difficult for them to receive, understand, and respond to warnings. Moreover, the older group often have limited financial which tend to interfere with their preparation and response towards climate change impacts (Dwyer et al., 2004). On the other hand, Andrey and Jones (2008) stated that older group community may not have the most immediate support network in a disaster as well as limited access to information regarding evacuations or shelters due to their insufficient knowledge in the use of technology.

## 7. Methodology

### 7.1. Participants

In the case of the present study, 29.3% respondents were selected from Pulau Pinang, followed by those in Kedah (27.0%), Johor (24.7%), and Terengganu (18.9%) with a huge majority of the respondents who are male (97.3%). Meanwhile, in terms of educational achievement, the majority of them hold upper secondary school certificate (39.4%), while only 5.8% received tertiary level education. Apart from that, it should be noted that a total of 41.7% of respondents have more than six household members, while another 39.0% have between 4 and 5 household members. In addition, most of the respondent are full-time fishermen (67.2%), while 32.8% of the fishermen were found to have a part-time job considering that the selected areas are known to be rich with tourism activities. On average, the respondent managed to earn RM950.39 per month which contradicts the findings of previous studies (e.g. Hamdan et al., 2017; Abu Samah et al., 2016; Zaremohzabieh et al., 2014; and Osman et al., 2014) which indicate that all the studied areas still have a lot of marine resources that offer financial benefits to fishermen. On another note, majority of the respondents (66.8%) have >10 years' experience as a fisherman. The analysis concluded that most of them (64.9%) spend about 16 to 25 days for fishing operation monthly, while 96.9% of them use fibre type vessels. Apart from that, more than two third of the respondents (69.9%) use seines as the main catching tools, whereas more than two-fifths of them (45.2%) use boat engine with 23–40 hp. Furthermore, it was found that majority of the respondents (64.5%) continue operating their fisheries activities in conventional ways and do not utilise any fisheries technologies such as sonar, echo-sounder, and Global Positioning System (GPS).

### 7.2. Procedures

The duration of this cross-sectional survey lasted for two and a half years (2015 to 2017). In the case of the present study, a total of 259 respondents were selected based on a multi-sampling with 118 youth respondents (aged 40 years and below) and 141 elderly respondents (aged 41 years and above). Furthermore, a cluster sampling was adopted at the first stage of sampling whereby four (Kelantan, Perak,

Pahang, and Pulau Pinang) out of possible 11 states from two fisheries zones in Peninsular Malaysia were randomly selected. Accordingly, the present study listed all of the areas that are affected by at least one climate change impacts which include rising temperature, rising sea levels, unstable rain patterns, unstable monsoon pattern, strong winds and waves. Subsequently, one area was randomly selected to represent each chosen state which includes Pantai Sabak (Kelantan), Cherating (Pahang), Sitiawan (Perak), and Bayan Lepas (Pulau Pinang) (Fig. 1). Originally, the present study aimed to randomly select 100 respondents to represent each of the selected areas. Nevertheless, the present study finally managed to gather information from a total of 259 respondents despite a few obstacles faced during the data collection process (e.g. the fishermen refuse to be selected as the respondents, difficulties in locating the fishermen, and congested schedule of their fisheries activities).

The research team visited the selected areas prior to the conduct of actual research with the aim of developing good networking with the locals. In this case, permission from the local leaders was first obtained. Furthermore, a few enumerators were hired and trained for the purpose of enhancing their understanding of the instruments that will be utilised in the field. The data collection process started in December 2015 and ended in March 2016 which was conducted at the places of interests of fishermen such as the Waqf (a small wooden hut), jetties, and coffee stalls. The main data collection technique adopted in the present study was the survey method. A survey is a data collection technique that allows the researcher to gain information and insights on various topics of interest from a pre-defined group of respondents. More specifically, the questions and several response options were read to the respondents in the Malay language by the enumerators. On average, the enumerators took between 10 and 15 min to complete each survey session.

### 7.3. Measures

The questionnaire developed for the purpose of the present study consisted of four parts, namely demographic (11 items), cognitive (31 items), structure (12 items), and practice (15 items). The items for the questionnaire were established based on the operational definition of each variable. Nevertheless, items from previous studies that are indirectly appropriate with the operational definition of each variable were considered where applicable as long as they are consistent with the objectives of the present study. The questionnaire was validated via a series of meetings among the researchers and then presented to two experts in community development for expert validity purposes. Accordingly, several efforts were taken after the questionnaire was returned to further rephrase certain items in the structure and cognitive parts as well as the need to consider the suitability of the Likert scale used in the questionnaire.

A pilot study to examine the reliability of the questionnaire was conducted at Pekan, Pahang among 30 fishermen. The Cronbach alpha values that were obtained are as follows: 0.725 for cognitive, 0.833 for structure, and 0.627 for practice. However, it is clear that the Cronbach alpha for practice did not exceed the recommended value of 0.700 as suggested by Nunnally (1978). Therefore, the researchers decided to rely on 'if item deleted' analysis to overcome this issue. The analysis suggested that two items [number 11 (related to the number of fishing trips) and number 12 (related to the duration of fishing trips)] had to be deleted; hence, the reliability value was increased to 0.729.

Demographic data – This part consisted of 11 items related to the background information of respondents which covers information such as gender, age, educational background, SSFM category, income per month, number of household members, experience as a fisherman, and others. The respondents were given the option to choose either open-ended or closed-ended questionnaire.

In the case of this survey, the practice was measured based on 15 developed items. The development of the items was based on the idea of

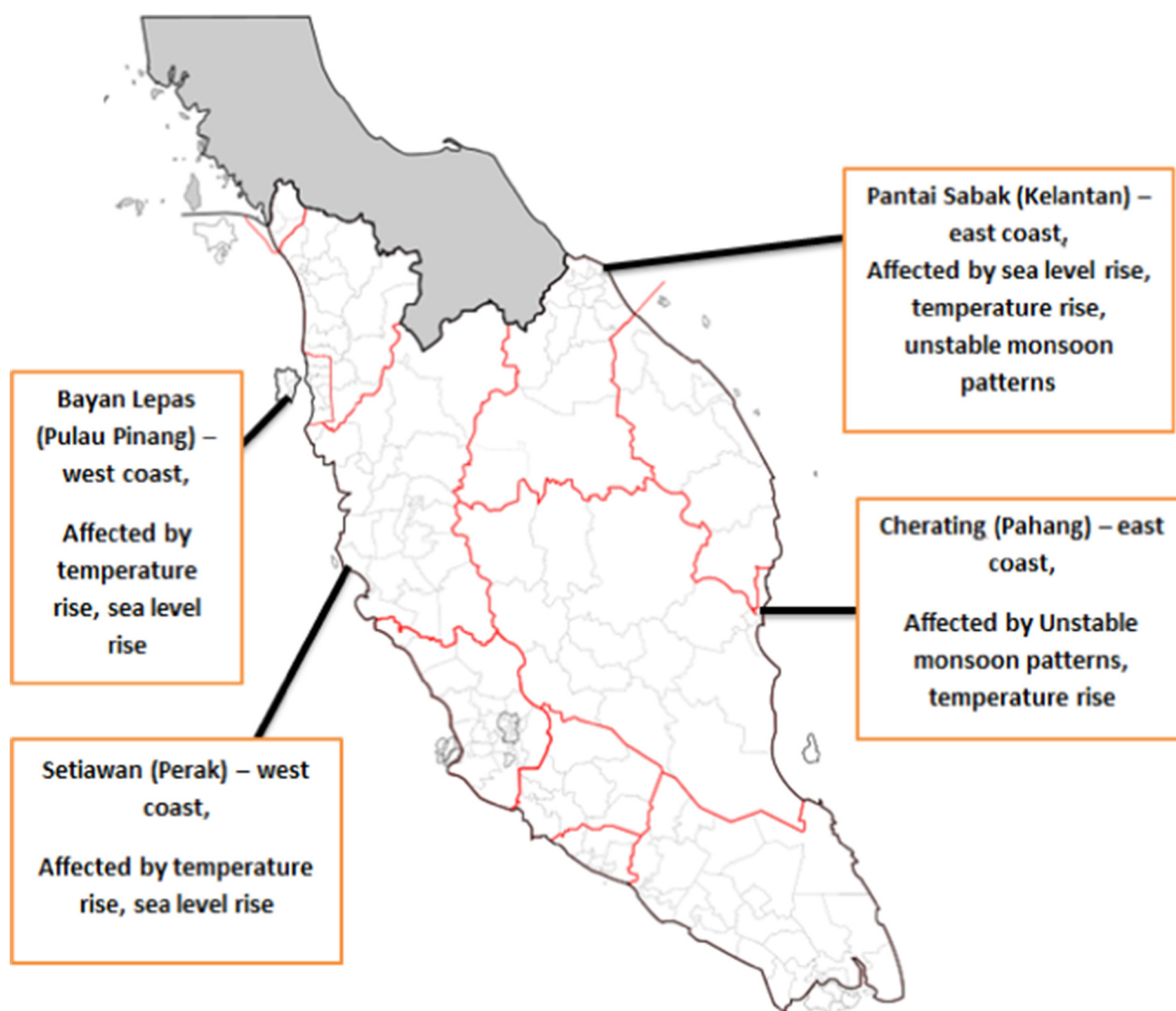


Fig. 1. Areas of study.

social adaptation framework developed by the Marshall et al. (2009). The examples of items that were included are as follows: (1) 'I like to learn new skills which are related to the fisheries activities', (2) 'I can use other fishing tools than the one that I use now', and (3) 'I have no problems to use technology to face weather instability nowadays'. Moreover, the respondents were given an option of five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) for each of the item asked.

Next, the structure aspect was examined using 12 items developed based on the social adaptation framework established by the Marshall et al. (2009). The examples of items included are as follows: (1) "Related agencies (LKIM, PNK, DOF) provide insurance for fishermen face any disaster", (2) "Related agencies (LKIM, PNK, DOF) supply security equipment (example: float, life jacket) to fishermen", and (3) "Fishermen called to participate in the discussion that touched their preparation for facing climate change". The respondents were given an option of five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Finally, the cognitive aspect was measured based on 31 developed items. Similar to practice and structure aspects, items under this variable were developed based on the idea of social adaptation framework provided by the Marshall et al. (2009). In this section, some examples of the items are as follows: (1) "The temperature at the land is getting hotter", (2) "The coastal areas are eroded", and (3) "The quantity of the landed fishes is reduced". The respondents were given an option

of five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

#### 7.4. Data analysis

The collected data was analysed using SPSS whereby the descriptive analyses such as mean score, frequency, and the percentage will be utilised to describe the demographic background of the respondents. Accordingly, an inferential analysis – independent *t*-test was performed to fulfil the main objective of the present study which is to compare the adaptation ability (practice, structure, and cognitive) between two age groups.

## 8. Result

The discussion in this section focuses on the main objective of the present study which is to compare the adaptation ability (practice, structure, and cognitive) between older and youth fishermen. In addition, the assumption of homogeneity of variance was tested using Levene's Test prior to the conduct of the independent *t*-test with the aim of achieving the objective of the present study. The analysis confirmed that the significance value was  $>0.05$  (i.e.,  $p > .05$ ); hence, the group's variances were treated as equal.

Specifically, it can be confirmed that there is no significant difference between the younger and older fishermen with regard to cognitive

**Table 1**  
Comparison of adaptation strategies based on their age groups.

Adaptation aspects	t	p
Cognitive	0.873	0.384
Practice	1.461	0.145
Structure	1.532	0.127

aspect based on the results of [ $t(259) = 0.873, p = .384$ ]. These two groups demonstrated equal strength of adaptation with regard to practice aspect according to the following result: [ $M = 3.55; t(259) = 1.461, p = .145$ ]. A similar result was found on the structure aspect based on the findings of [ $t(259) = 1.532, p = .127$ ], which indicates an insignificant difference between these two age groups. Although the current study support previous findings of [Salman et al. \(2018\)](#) and [Vulturius et al. \(2018\)](#), however, it is important to note that the findings are not consistent with the previous studies conducted by [Saroar and Routray \(2012\)](#), [D'Silva et al. \(2012\)](#), [Ramli et al. \(2018\)](#), [Bukvic et al. \(2018\)](#), [Bukvic et al. \(2015\)](#), [Tapsell et al. \(2010\)](#), [Andrey and Jones \(2008\)](#) and [Dwyer et al. \(2004\)](#), which claimed that either older or youth fishermen is superior to each other with regard to their adaptation ability towards climate change impacts ([Table 1](#)).

## 9. Discussion

The present study has managed to obtain a unique and important result which describes that the youth and older fishermen are equally strong in their adaptation ability. Moreover, the comparison tests confirmed that no difference was found between the ability of both groups to adapt to climate change and this is in line with the studies conducted by [Salman et al. \(2018\)](#) and [Vulturius et al. \(2018\)](#). Nevertheless, it is crucial to note that this finding contradicts a number of previous studies (e.g. [Saroar and Routray, 2012](#); [D'Silva et al., 2012](#); [Ramli et al., 2018](#)) which stated that both age groups are equally stronger in their adaptation ability towards climate change. Therefore, the main focus of this section is to discuss the possible reasons that resulted in this similarity with the aim of providing relevant points that can be considered in the planning process of fishermen's adaptation strategy. In this case, it is believed that active dissemination and sharing of knowledge and experience between the older and youth fishermen is one of the reasons that both parties share equal strength of adaptation ability. The sharing process usually occurs on several occasions. First, sharing session happens during their gathering at waqf which is described as a small tiny shelter that is usually built near the coastal areas. Moreover, waqf is a place where fishermen conduct their social activities (e.g. chatting, net repairing) which usually takes place in the evening. Apart from that, other activities that are conducted at waqf involve knowledge and experience sharing. One of the most shared and disseminated knowledge and experience between the young and older fishermen is related to climate change ([Shaffril et al., 2017a](#)). In addition, it was found that older fishermen act as “environmentalist teachers”. Regarding this matter, one of the occasions that allow the sharing and dissemination of their knowledge and experience related to climate change is during their fishing operation. In most cases, members of a vessel consist of older and youth fishermen; hence, this provides the opportunities for the younger fishermen to learn numerous things from the experienced older fishermen (including climate change-related things) which can occur via conversation and observation.

The rapid development of diverse communication tools and applications allows fishermen to obtain adequate access to information. In particular, the existence of mobile phones, WhatsApp, and social media applications enables weather-related information to be quickly disseminated among fishermen. In this case, [Omar et al. \(2013\)](#) emphasised the effectiveness of traditional media such as television and radio in conveying information on the changes of weather to older fishermen despite their unwillingness to utilise advanced communication devices.

Nevertheless, it should be noted that the traditional methods of disseminating climate-related news such as the use of flags in Chendering to indicate the strength of the wind still enables everyone to gain access to weather information as well as be prepared for any possibility.

Overall, it can be concluded that fishermen gathering at waqf, conversation and observation during their fishing operation, and the existence of several channels of communication allow the sharing and dissemination of active knowledge and experience. This would eventually complement the existing government disaster risk reduction mechanisms, and at the same time, empowers the fishermen for their own safety and wellbeing. [Shaffril et al. \(2017b\)](#) stated that knowledge and experience sharing would benefit the fishermen in the following ways: (1) addition on the knowledge of the risks, (2) ability to monitor, analyse, and forecast the hazards, (3) communication or publication of the alerts, and (4) reinforcement of the communities' abilities to react to the warnings.

On another note, the dependency of fishermen on the sea has been reduced due to the greater access to livelihood diversification which is described as the opportunity to be involved in non-fishing as well as non-environment-related income-producing activities, thus further diversifying their income ([Shaffril et al., 2017a](#)). The areas that were studied include the focal point for tourism attraction; hence, all fishermen regardless their age groups have an equal opportunity to livelihood diversification ([Shaffril et al., 2014](#); [Mazlan and Shukor Juraimi, 2014](#); [Latif, 2019](#)). Moreover, both fishermen groups are provided with the opportunity to diversify their income by getting involved in tourism-related activities such as agro-tourism, diving, sport fishing, recreational fisheries, and small-medium enterprise (SME) that can provide income-generating opportunities for them, which subsequently enables them to strengthen their adaptive ability. Moreover, concerned organisations such as Fisheries Development Authority of Malaysia (LKIM) and Association of Local Fishermen (PNK) have been actively providing economic related programs such as Cluster for Fisherman Association Economic Project and KUNITA (fishermen women group). Nevertheless, these programs are not only available for the fishermen, but also for their family members. Regarding this matter, [Shaffril et al. \(2017a\)](#) postulated that the organisation needs to ensure that the help offered to the fishermen are in line with their needs, ability, and interests. This is important considering that different age groups may require different help from the organisation. For instance, [Shaffril et al. \(2017b\)](#) concluded that the youth fishermen should be offered more vocational based activities to diversify their livelihood, while the older group should have more exposure to entrepreneurial activities. Therefore, the organisations should conduct a need analysis study to realise this for the purpose of examining the actual needs of the locals. Eventually, providing what the community want and not what the ‘organisations want’ will be able to prevent conflict, strengthen the organisation-community relationship, and empower the fishermen by enabling them to posit their own ideas and take the necessary action.

A heightened physical infrastructure helps to strengthen the fishermen's climate change adaptation ([Hasan and Nursey-Bray, 2018](#)). In the past, fishermen houses were built from fragile materials like wood. However, their house condition has been improved when some of them have taken the initiative to build their homes with stronger materials such as bricks ([Shaffril et al., 2013](#)). This infrastructure will help the fishermen to have a better chance of protecting themselves against extreme events, reducing their vulnerability to the weather as well as minimising the damage to their houses, loss of life, and valuable assets. Meanwhile protections such as a fortress and early warning systems (e.g. siren) provide more time to the older and the younger fishermen to seek protection from the impacts of extreme weather ([Shaffril et al., 2013](#)).

The impacts of climate change such as rising temperature, rising sea level, and typhoon have significantly affected the quality and quantity of marine species and habitat. Accordingly, [Krishnan et al. \(2016\)](#) stressed on the conservation of natural resources as an effective adaptation



strategy which equally protects these fishermen. Understandably, efforts related to conservation strategy can offer a 'healthy' environment for the future generation. Interestingly, these fishermen are said to have stronger connections to nature regardless of their age, which intensifies their sense of responsibilities in conserving nature through mangrove planting programs (Graziano et al., 2018).

## 10. Limitations and recommendations for future studies

The present study merely focused on the influence of age group (youth and older fishermen) on the climate change adaptation of fishermen despite other influences that should be taken into consideration. Hence, it is recommended for future studies to examine other factors including gender. Past research by Goh (2012) and Graziano et al. (2018) noted that climate change may impact men and women differently. There are many points stated in the report by World Health Organization (2014) to prove that women are more vulnerable towards climate change impacts because they are intrinsically tied to waters, difficult to migrate and have low access to important life skills due to gender norms or expectations around "appropriate" behaviours. Therefore, it is deemed very important to conduct further investigation on these differences because issues related to gender is an ongoing discussion considering its influence on vulnerability, risk exposure, and capacity to respond. However, major problems are expected to rise if future studies are to be conducted quantitatively due to the limited number of women fishermen in Malaysia (Shaffril et al., 2015). Hence, this indicates that the qualitative study is the most suitable option in overcoming such a problem. On another note, it is important to realise that the current research excluded fishermen from Sabah/Sarawak zone; hence, it is recommended for future scholars to include them in their study. Moreover, this addition is expected to enrich the data as the socio-culture of those in Sabah, Sarawak, and Labuan are different from those in Peninsular Malaysia. Apart from that, the present study adopted the five-point Likert scale (interval scale) for the purpose of measuring the respondents' adaptation ability; however, this type of scale is limited because it tends to be skewed and have less variability for the population at large, thus preventing the researchers to obtain nearly as many 1's as 5's (Murphy, 2011). In this case, future studies are urged to consider employing the seven-point Likert scale in their study due to its advantages such as a stronger accuracy with *t*-test results as well as its ability to provide more options for the respondents (Dawes, 2008). Murphy (2011) noted that a broader survey scale is more accurate in terms of capturing the range of honest responses, while Dawes (2008) emphasised that a seven-point Likert scale is able to offer a wider spread of data, which will result in a larger variance, and possibly more negative kurtosis.

## 11. Conclusion

Malaysia has been experiencing a number of climate change 'symptoms' such as rising temperature, sea level rise, unstable rain patterns, and frequent occurrence of extreme events related to dry spell, thunderstorm, and strong winds. Generally, fishermen who tend to rely heavily on nature stability are formidably affected by these changes; hence, strengthening their adaptation ability is seen as the best response. On a more important note, the limited number of local studies that focused on the ability of age in influencing climate change adaptive ability as well as the inconsistent findings from previous works had driven the present study towards achieving its main objective which was to compare the adaptation ability of youth and older fishermen. Moreover, these findings offer several advantages to the authority because it provides facts and figures that would assist in developing sound adaptation measures that are tailored to the fishermen's needs, abilities, and interests. In addition, the current research managed to produce valuable results which revealed that both youth and older fishermen have equally strong adaptive abilities with regard to their

cognitive, practice, and structure. Surprisingly, the findings of the current research contradicted the results of previous studies. Nevertheless, it was revealed that Malaysian fishermen conduct active dissemination of knowledge through their gathering at Waqf that allows them to converse about their fishing operations as well as the use of several channels of communication. Moreover, greater access to livelihood diversification related to tourism and entrepreneurial related activities for the purpose of generating extra income for the family has further strengthened the adaptation ability of fishermen. Finally, several differences were found in the level of vulnerability towards climate change impacts; hence, future scholars are recommended to consider examining the influence of gender on climate change adaptive ability. As previously mentioned, future scholars may want to expand their study to other areas and apply a seven-point Likert scale in their questionnaire in order to enrich the results.

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