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The Perception and Resilience of Bagang Community on Climate Change in Marine Protected Area, Pitas, Sabah, Malaysia

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Climate change had caused occurrence of more frequent big El Nino and La Nino phenomenon that led to drought and flood disasters onto coastal communities and affecting their quality of life. This study aims to ascertain the perceptions of the coastal community of Kampung Mempakad Laut, Pitas, Sabah, Malaysia which is in the boundary of Tun Mustapha Park on climate change. Data is collected through in-depth interviews with the Bagang community and the data was analysed by descriptive methods. The Bagang community members have knowledge and is aware of the changes in the climate conditions through the happenings of extreme event orchestrated by mother nature that relates to the change in climate phenomena despite not knowing or not familiar with the well-used terms 'climate change'. Examples of those extreme events are major floods, changes in dry and wet seasons, as well as long unpredictable dry season. They perceive those events as pressure that ultimately threatens their safety and affects Bagang activities. However, they have come up with their own strategies in adapting to the phenomena including precautionary and preparatory measures for enduring natural disasters, modifications of dwelling houses, attempts to increase understanding and cognisance of the changes in environmental surroundings enabling them to come up with better predictions. The experience and resilience of Bagang community that had endured extreme events related to climate change had provided further insights in understanding human's adaptations to climate change and could become useful guidelines to other coastline communities at large.

Keywords: adaptation strategy; Bagang community; climate change; perceptions; Tun Mustapha Park

I. INTRODUCTION

Climate change has become one of the most disastrous environmental challenges in the 21st century (Magesa & Pauline, 2019). This phenomenon does not only merely involve changes in the weather, but it causes dramatic climate change in certain period that gives rise to long term impacts (Maulu *et al.*, 2021). Natural disasters such as the rising sea level, landslides, coastal and land erosion, long spell of drought, forest fire and haze are among the extreme climate change impacts that have in turn lead to threat to human security and health, affects nation's economic development,

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and alter the natural landscape and infrastructure (Ehsan *et al.*, 2019).

Climate change is undoubtedly a worldwide phenomena which the mankind must face and manage globally. The effect of climate change on human's wellbeing has become of a formidable challenge in maintaining the state's sustainability. This is because climate change has not only affected nature and physical surrounding but has also becomes a threat to living things (Wabnitz *et al.*, 2018). Climate change is affecting the distribution of flora and fauna habitat due to changes of environment conditions such as ocean acidification and rising sea temperatures (Freitas *et. al.*, 2021; Wilson *et al.*, 2020). The coastal communities socioeconomic activities is one of the most affected by climate change as their daily activities is restricted by day to day weather conditions and seasonality (Dunstan *et al.*, 2019).

Coastal communities in Marine Protected Areas like Tun Mustapha Park located in the Marudu Bay of Pitas district, Sabah, Malaysia relies on marine natural resources for their earnings (Hamdan *et. al.*, 2019; Lim *et al.*, 2021). One of the socioeconomic activity in this area is known as the *Bagang* activity. The knowledge and skills of *Bagang* system is brought in by the Bugis ethnic group community that migrate into Northern part of Sabah particularly in Marudu Bay as early as the 1990s. Later, the knowledge and skills of Bagang system became widespread among the communities through social interaction via family relations, marriages and neighbourhood (Ariff & Raduan, 2008; Rahmawati, 2020).

The term '*Bagang*' comes from a word in Bugis language which means cage. The *Bagang* system is a traditional method of fishing anchovies that has been adapted by the *Bagang* community that come from Bugis hereditary in Indonesia. This system is widely practised in East coast of Sabah particularly in Tawau and in several locations in Beaufort and Kuala Penyu. The *Bagang* community on the other hand refers to those who are involve in *Bagang* activity that starts from the process of setting up the cage, managing and catching as well as processing the anchovies. The *Bagang* system has become their main source of income as well as the main employment amongst the villagers that has provide them important economic opportunities to the villagers. In Marudu Bay , 30 out of 200 Bagangs belongs to the *Bagang* community from *Kampung Mempakad Laut*. The aim of this study is to discuss the perception of the *Bagang* community in this village towards climate change and its effect on their everyday lives.

II. MATERIALS AND METHOD

This research was carried out in *Kampung Mempakad Laut*, Pitas, Sabah which is located in Marudu Bay and the second largest marine protected area (MPA) in Malaysia, Tun Mustapha Marine Park (Figure 1). This area is particularly known for activities relating to anchovies fishing and processing through *Bagang* method by using fishing net or cage and light source on a constructed platform above the sea (Ariff & Raduan, 2008). Most of the villagers are descendant of the ethnic group of Bajau and Suluk whereby 90% of the households are involved in *Bagang* activity.

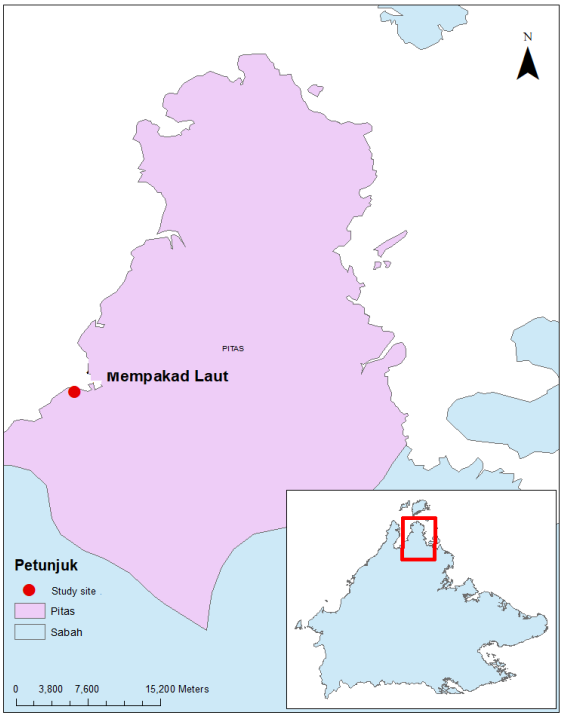

Figure 1. Research location

Data were collected from Focus Group Discussion (FGD) that had involved women in anchovy's business and other dried products, a group of *Bagang* entrepreneurs and part time workers who are the backbone of anchovies' marketing and distribution. In addition, data were also obtained from key informant who is knowledgeable on the background of overall *Bagang* activities at the study site. Information and data that were collected were then analysed thematically to

describe the prevailing perceptions of the *Bagang* community on climate change and the extent to which the former had impacted *Bagang* activities.

III. RESULT AND DISCUSSION

Knowledge is acquired through experience and learning process both via informal and formal medium. Knowledge is the key for resources to be fully utilised and optimised (Sakawi & Awang, 2017). The process of knowledge transfer usually takes place through oral communication particularly for the indigenous people which in turn become cultural tradition that is being passed through generations (Hamdan *et al.*, 2020). The knowledge transfer also influences the perceptions and awareness on conservation which consequently affects the understanding, awareness and knowledge on the importance of an effective environmental management (Hosen *et al.*, 2020). Coastal communities need to understand nature (nature's characteristics and functions) to comprehend and be aware of the extent to which actions taken by humans would benefit both the environment and human (Choy, 2015).

Knowledge on the impacts of climate change is crucial in managing disasters which is due to the changes in climate (Nanlohy *et al.*, 2015). Ultimately, this knowledge will aid the community to adapt to their environment surroundings (Sakawi & Awang, 2017). Knowledge is a fundamental cognitive aspect that is crucial in the process of identifying and recalling an object, idea, procedure, concept, definition, names, events, year, register, summarisation, theories, and conclusion whereby in the aspect of knowledge on climate change becomes the key in enhancing ability to mitigate disaster and to face ensuing risks (Abas *et al.*, 2017).

The research findings reveal that the *Bagang* community of *Kg. Mempakad Laut* has never heard of the well-used term "climate change". Nevertheless, they are in the know and are aware of the changes in the local climate conditions through the happenings of extraordinary events involving nature that relates to the change in climate phenomena. Extreme events associated with climate change that the *Bagang* community of *Kampung Mempakad Laut* is well versed of are major floods, drought, changes in dry and wet seasons, as well as long unpredictable dry season.

The personal experiences of climate phenomena that they had to endure in these recent past five years had provided them the crucial learning opportunities. The perception of *Bagang* community in *Kg Mempakad Laut* on climate change can be described in two phases in the beginning with the Initial Phase and the ability to adapt the Resilience Phase (Table 1). During the initial phase, the *Bagang* community was under immense pressure when their daily activities were badly disrupted due to the change in climate which had raised feelings of insecurity in them (Table 2). However, having to endure series of natural disaster for the past five years, the *Bagang* community had begun to acclimatise to the situation. Subsequently, they had begun to take preparatory actions in the event of unthwarted climate disasters (Table 3). These kinds of reaction and responses on the part of the community can be referred to as the ability to adapt to changes, particularly in terms of their resilience (Table 1).

Table 1. Phases of perceptions towards climate change

Phase	The effects of climate change	Factor
Initial	Under pressure	Drastic changes
Resilience	Manageable	Ability to adapt to changes

Although the *Bagang* community may have attained resilence, they had concurred that the climate change phenomena are the overall threat to their survival and well-being.

A. Initial Phase Perception

Pressure and security threat are the initial perceptions of the villagers towards climate changes as their responses are divided into three themes namely life threat, food security threat and threat to water resource (Table 2). Among other responses include fear and worries over unpredictable threats that may occur at any time which in turn lead to life threatening situation, damages to property, and interruption of *Bagang* activities ultimately affecting their source of income. Besides that, incidents of major floods and long spell of dry season also adds to tremendous pressure in their well-being as those disasters give rise to food security threats and water resources scarcity (Table 2).

Table 2. Responses during initial phase

Initial Phase	
Theme	**Responses**
(a) Life threat	"*Bahaya bah itu kalau ombak kuat*" – it is scary if the waves are huge. "*Takutlah bah*" – I am constantly in fear/I am scared. "*Bahaya tu kalau angin sama ombak kuat, goyang tu Bagang, boleh runtuh. Kalau ngam-ngam kita di sana, nah macam mana*" – It would be dangerous if the waves are huge as the Bagang will shake uncontrollably and might collapse. What if we were on the Bagang at that time?
(b) Food Security Threat	"*Susah kalau kemarau datang, terpaksa beli air dari luar. Mau makan, mau mandi pun susah*"; " *Mau satu bulan sudah tiada air di sini. Ada tangki pun tiada guna, bukan ada hujan*" – It would be extremely difficult if we have long dry season. We must buy water from outside our area; To eat and to shower is also difficult. It has been a month that we must endure water shortage here. Even if we have water tank, it is pointless as there is no rain.

1. Life threat

Life threat refers to events of disruption that may pose life threatening situations. Several occurrences of huge waves, floods and hurricanes had become a threat to human life as well as damages to property. Among natural disasters that had occurred in Pitas was the unfortunate event that took place in the year 2014 are strong wind had caused damage and destruction on dwelling houses to the extent where some of the villagers fell into the sea. Moreover, the occurrence of huge waves had caused houses to collapse and submerged into the sea in 2018. The respondents also mentioned series of floods and strong winds that had damaged the bagang and boats.

2. Food security threat

Climate change can significantly affected crops and food productions in a food supply chain by influencing the food source availability or quantity (Tan *et al.*, 2021). Environmental phenomenon that severely affects natural surroundings can caused disruption to food supply and jeopardise food security (Firdaus *et al.*, 2019). In the time of flood, the community does not have access to road transportation to obtain food resources. Such inaccessibility also affects fishing activities and clean water resources supply which is vital fod domestic's usages, food and beverages preparation. On the other hand, a long dry spell up to a month significantly affect water supply (Table 2). This situation will be worsened when rain seeding could not be carried out which leave the community no other choice but to purchase water from the nearby villages. In addition, the procured water needs to be treated in ensuring the water quality is safe for consumption.

B. Initial Phase Perception

Resilience refers to the capacity of the ecosystem to regain full potential after disturbance or disruptions to its function had occurred. In contrast, resistance refers to the capacity to maintain the function of the ecosystem despite being subjected to pressure. Nevertheless, resistance has been an indicator to assess the ecosystem's performance (Lu *et al.*, 2015). During resilience phase, the *Bagang* community perceives the climate change phenomenon as something that has become common to them (Table 3). In other words, the changes in climate are normal and within their knowledge as well as expectation. They also believe that they have the capacity to handle and adapt to the changes. This is because they have become accustomed to the threat and has acclimatised to it such that they manage to adapt.

1. Common

During this common phase, the perception of the community has become optimistic and more positive towards managing the threats. In other words, the community believes and have the confidence that the challenges can be overcome despite the accompanying risks. The *Bagang* community at *Kg. Mempakad Laut* perceives the environmental disaster that had taken place due to climate change as common events in their areas after a series of the same catastrophes recurs. Due to their acceptance, beliefs and positive outlooks, the member of the *Bagang* community have decided to stay put as they do not see any need to migrate to other areas.

Table 3. Responses during resistance phase

Resilience Phase	
Theme	**Responses**
(a) Common	"*Kalau setakat kuat hujan tiada apa-apa itu, tetap turun juga ke laut*" – If this is only heavy rains, we still go out to the sea. "*Kecuali banjir dan ombak, kami tetap pigi Bagang*" – Unless there are floods and huge waves, we still go to the Bagang.
(b) Able to adapt	"*Sekarang saya tahu sudah, selalu saya siap-siap beli makanan banyak-banyak*" – Now, I can contemplate, and I make preparation to stock up food. "Kami tukar tiang rumah dari kayu bakau supaya tahan sikit" – We changed our house stilt to mangrove woods so that the house becomes more resilient.

2. Ability to adapt (adaptability)

Optimum phase of adaptability is achieved when the community can confront and manage event that was previously perceived as threat (Samah *et al.*, 2019). Various adaptability strategies were undertakan to enable them to continue living at the same settlement area. They are better able to gauge the intensity of the rain that can be categorised as heavy, mediocre and low to ascertain whether they should go to their *Bagang* or otherwise through experience (Table 3). They are convinced that rains are not going to become a hindrance for them to carry out *Bagang* activity and other activities at sea.

At the same time, they had undertaken precautionary measures and carried out ample preparation in making sure they have adequate stock of clean water and food in the event of flood (Table 3). Meanwhile, in terms of facility, they have also carried out suitable modifications in term of the design of their dwelling houses and material to build the house. For *Bagang* activity, the community took the initiative to come up creatively with an innovation called 'floating Bagang" (Figure 2(b)). The new floating feature enable the community to carry on with their activities within the permissible safety limit in time of bad weather and huge waves occurs. This feature also prevents damage to the *Bagang* and hinders it from collapsing into the sea during strong win.

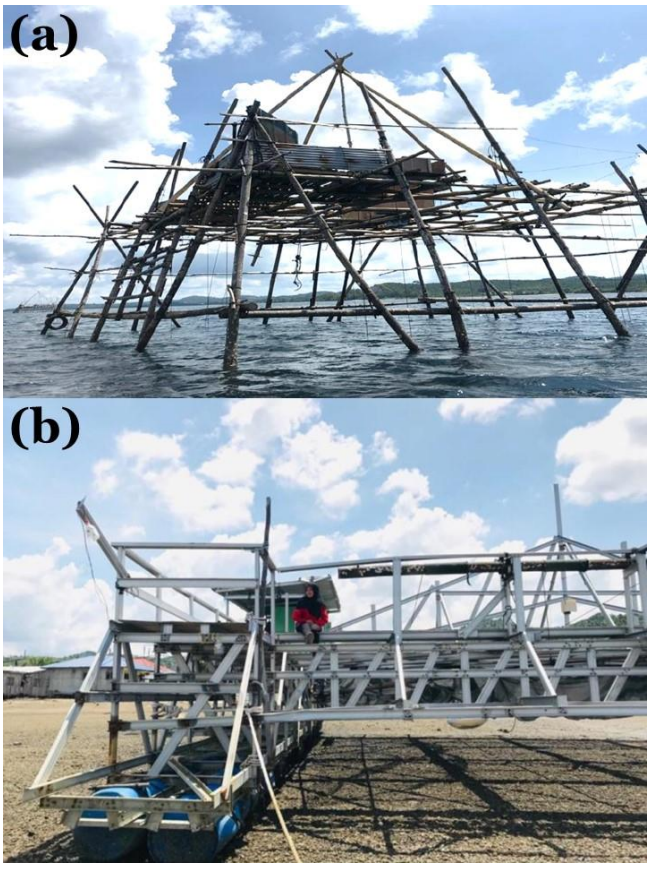

Figure 2. (a) The old Bagang design is generally constructed with wood materials and erected on the ground, and (b) Floating Bagang can be brought to land and easily move to different sites

IV. CONCLUSION

Extreme events related to climate change such as more frequent big El Nino and La Nino phenomenon that led to drought and flooding disasters had affected the *Kg*. *Mempakad Laut*'s *Bagang* community's quality of life, lifestyles and well-being advertently. Nevertheless, the experiences gained through past natural disasters had enabled the *Bagang* community to come up with better plans and strategies in managing climate change related incidents. The *Kg*. *Mempakad Laut*'s *Bagang* community had initiated their own strategies in adapting to climate change phenomenon. Among the efforts taken by the *Bagang* community to enable them to come up with better prediction are enhancing preparation to endure disaster; modification of dwelling houses; attempts to increase understanding and cognisance of the changes in environmental surroundings. The experience of the *Kg*. *Mempakad Laut*'s *Bagang* provide further insights in understanding human's adaptation to climate change which in turn could become useful guidelines to other coastline communities at large.

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