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**ETHNOASTRONOMY IN MARITIME ACTIVITIES:  
AN ANALYSIS**

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*Abstract*

This paper aims to examine the relationship between ethnoastronomy with maritime activities. Ethnoastronomy here refers to phenomenon like solar eclipses, lunar eclipses, and the lunar cycles, while maritime activity refers to the phenomenon of the tides, the waves, the wind, a bright and a dark moon, and so on. The question is, is it true that astronomical phenomenon causes changes to maritime activities? Does it also affect ocean life which should be taken into account by fishermen? To answer both of these questions, this study will only highlight studies and previous works related to the connection between astronomical phenomenon with maritime activity. Finally, this paper will conclude that astronomical phenomenon like solar eclipses, lunar eclipses and lunar cycles do cause changes to maritime activities such as tides, wave conditions, the wind, the light and dark moon and so on. Indirectly, all these factors affect ocean life and should be considered by fishermen, especially in order to firstly, determine their revenue and secondly, to ensure their own safety.

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**Keywords:** Ethnoastronomy, astronomical phenomenon, astronomy, activity, maritime.



## 1. Introduction

Studies on astronomy and ethnography are mostly conducted separately. This results in astronomy being seen as not having any relation to life, when in fact, astronomy is one area that directly connects with society (Ashrafoalsadat, 2016). Until now, there are studies that try to unite astronomy with ethnography, but they are only limited to the astronomical phenomenon and its impact on life. For example, Othman (2016) had studied the effect of a partial solar eclipse phenomenon on the behaviour of animals; Yonvitner, Aziz, Butet, and Pujiastuti (2009) had proved that fishermen catch less fish during a full moon; Kumar and Rengaiyan (2011) had proved that a total solar eclipse affects the decrease in the pH of sea water as the content of hydrogen ions ( $H^+$ ) contained in seawater would increase; and Sarah, Rusli, Othman, and Saupi (2016) had conducted a study on the impact of the phenomenon of the full moon on the tides along Malaysian coasts. The question is, to what extent is the relationship between astronomical phenomena with the maritime activities of fishermen? How does knowledge of the relationship between astronomical phenomenon with maritime activities benefit life?

## 2. Problem Statement

It cannot be denied that a part of what was discussed earlier can be aided by advances in technology. A study was conducted to show that fishermen need tools such as echo sounder, sonar, wireless sets, and radar to increase their productivity, enhance their safety and security, conserve energy and save operation time (Aisyah, Zobidah, Jusang, Jeffrey, & Hayrol, 2013). Notwithstanding the tools, human expertise is still required. The human expertise element, particularly in ethnoastronomy is becoming increasingly limited or have entirely disappeared. According to Datuk Setia Mohd. Tamyeh Abd. Wahid, the Mufti of Selangor, when interviewed by Shah (2012), once sailors and fishermen were guided by stars to indicate the direction of the intended destination while at sea. Not only that, they were also guided by the moon and the sun to determine the state of the ocean and suitable times for maritime activities such as fishing.

Such knowledge is now increasingly disappearing with the existence of a variety of advanced technology equipment that has replaced the methods adopted by fishermen in the past. This change will make people, especially the new generation of fishermen, forget the relationship between ethnoastronomy with their maritime activities. Despite a variety of advanced technology equipment to find out the state of the ocean, it must be realised that these technological equipment are only tools to assist men. Sometimes it functions well and other times it may fail. In this case, knowledge of ethnoastronomy for fishermen is very important because it is a natural guide that Allah gifted to His servants.

## 3. Research Questions

This research has several research questions. Firstly, is it true that astronomical phenomenon causes changes to maritime activities?; and secondly, does it also affect ocean life which should be taken into account by fishermen?

## 4. Purpose of the Study

Based on the problem statement discussed earlier, generally, this study intends to examine the relationship between ethnoastronomy with maritime activities. Specifically, this study will only highlight studies and previous works related to the connection between astronomical phenomenon with maritime activity

## 5. Research Methods

Discussions on the research method are divided into parts. First is the data collection method and second is the data analysis method.

### 5.1. Data Collection Method

Data collection in a qualitative study involves only one source of data, namely secondary source. The secondary source in this research refers to thesis, books, journal articles etc. that discussed the relationship between ethnoastronomy with maritime activities.

### 5.2. Data Analysis Method

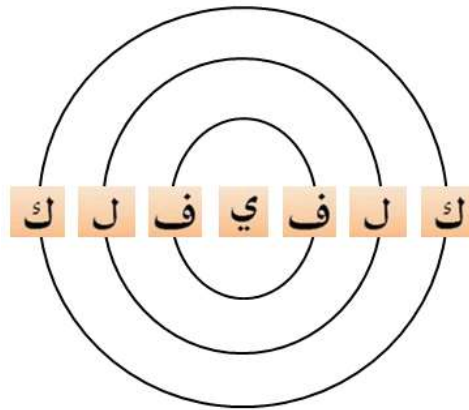
In order to analyse the collected data, the qualitative content analysis method was used. For this purpose, the researcher had read texts and interpreted it according to the theme of the research. The qualitative content analysis method was suitable for this research because the researcher had investigated literature related to the relationship between ethnoastronomy with maritime activities.

## 6. Findings

Based on the earlier discussions, this study made several findings such as:

### 6.1. Definition of Astronomical Concept

Etymologically, the word “astronomy” comes from the Arabic word “falaka”. It has the same meaning as “madar”, which often is interpreted as orbit and celestial (The Encyclopaedia of Islam, 1983 p. 761). In the Qur'an, the word astronomy is mentioned twice in verse 40 of Surah Yassin and verse 33 of Surah al-Anbiya'. Both these verses have the same phrase which is *kullun fi falaki yasbahun* (both of them, the moon and the sun moves in its own orbit). In interpreting this expression, al-Tabariy (1992, p.24) and Ibn Kathir (1992, p. 580) described the movement of the moon and sun on the orbit. This movement is a quick spin round the spinning wheel or grinder. The circular shape will be formed when the letters of the expression *kullun fi falaki yasbahun* are separated, and then each letter is then paired with a circular line in Figure 1 below.



**Figure 01.** Illustration of the circle formed with the pairing of letters in the phrase *kullu fi falaki*

It is clear that the word “astronomy” when used in the Qur'an is used to describe something that is related to the systematic movement of heavenly bodies, that move on its orbit.

Terminologically, al-Biruni (1029) in the *Kitab al-Tafhim Wa'il Sina'at li al-Tanjim* explained that astronomy is a celestial sphere containing the heavenly objects orbiting around the sun respectively. These objects move with their respective spheres rotating around the earth which is in their centre. According to Ibn Khaldun in the Abridged (1987), astronomy is the study of the movement of the permanent stars and planets. Observing how the movement occurs will allow the knowledge of the characteristics of the movement and its position to be known geometrically. Hartmann (1987), defined astronomy as a science which observes objects in space.

For philosophers, astronomy is seen as a subset of mathematics. It contains the study of astronomy schedules (*zij*), knowledge about the composition of the orbit, number of stars, constellations, distance, size and other related issues (*hai'ah*), the rules of celestial paths (*ahkam*), and knowledge relating to the studies of stars (*al-munajjimin* tools) (Baharudin, 2009). Based on the above understanding, it can be concluded that astronomy is the science of movements of heavenly objects like the moon, the sun and stars on their orbit circles. Its functional aim is to support the worship of Allah the Almighty.

Based on the field of astronomy studies, astronomy is very important in Islam. Aside from showing how majestic Allah the Almighty is as the Creator of this universe, astronomy is used to determine the direction of kiblah, prayer times, and imsak, forming of the Hijra calendar and agricultural calendars and to determine the start of Ramadhan and eid. Actually, the importance of astronomy is not only limited to the extent which had been described, but it also is related to nature and human life. An example is the effect of the partial solar eclipse phenomenon on the behaviour of animals (Othman, 2016); and the effects of the phenomenon of the full moon on the tides along the Malaysian coasts (Sarah et al., 2016). Studies which discuss the relationship between astronomical phenomena with nature and life is called ethnoastronomy.

## **6.2. Ethnoastronomy**

In the Encyclopaedia of Science (1983), ethnoastronomy is described as a field of astronomy that deals with the relationship between the elements of astronomical objects in the form of myth, and ritual and spiritual beliefs. It is different from *archaeoastronomy* which is more focused on the study of artefacts and monuments that correlates with activity in ethnoastronomy. For example, the megalithic monument of Stonehenge, located in Salisbury, England; and the temple of Templo Mayor in East Mexico (Krupp, 1979). Amongst ethnoastronomical practice which was popular among the Mayans was by describing the moon and the sun as a brother and sister as well as husband and wife. Ancient Egyptians also believed in the sun god Ra as a master of divinity (Pannekoek, 1961).

In regards to the view of the ethnoastronomy amongst the communities in Bali, Indonesia, they believe that eclipses occur because the evil spirit Kala Rau is jealous of god who controlled Nirvana. Kala will always chase the moon and the sun gods and try to swallow them. Solar and lunar eclipses are portrayed as this evil spirit who succeeded in swallowing the moon or the sun for a while before spitting them out (Harris, 1994). Winstedt (1981) explained on ethnoastronomy element in the belief of spirits among the Malays. White spirit is said to be from the sun and black spirit from the moon. These interpretations led some researchers like Ammarell (1997) to place ethnoastronomy as part of ethnoecology, as the ethnic group associate their lives with celestial phenomena. This includes using the techniques of astronomical observation to determine the agricultural cycle and their sea travels.

Thus, ethnoastronomy is a combination of ethnographic studies that examine the movements of heavenly bodies like the sun, moon and stars on their orbits, such as the knowledge of the local fishermen about the connection between astronomical phenomenon and maritime activities such as tides, wave conditions, the movement of the wind and fishing activities. However, ethnoastronomy in Islam certainly does not refer to myth, ritual and spiritual beliefs held by the ancient communities. Instead it refers to a general understanding of ethnoastronomy that is to discuss the relationship between ethnoastronomy with maritime activities based on the knowledge of local fishermen registered with the Malaysian Fisheries Development Board (LKIM).

## **6.3. Astronomical Phenomenon in Maritime Activities**

Based on observations on existing studies and manuscripts, at the very least this can be divided into two themes, which are the effect of astronomical phenomenon on fauna and maritime lives, and the effect of the science of astronomical phenomenon on fishing activities among the fishermen.

### **6.3.1. The Effect of Astronomical Phenomenon on Fauna and Maritime Lives**

Based on observations on existing studies and manuscripts, Various discussions exist on the effect of astronomical phenomenon on fauna and maritime lives. The astronomical phenomenon discussed include solar eclipse and lunar cycles. This astronomical phenomenon affects the fauna life from the aspects of behaviour as well as the current population. According to Branch and Gust (1986), the solar eclipse that occurred on May 30, 1984 affects the behaviour of fauna such as chimpanzees. Some of the behaviour shown was when a group of chimpanzees who were subjects of experiments showed positive reactions to the sun and the moon and oriented their bodies toward the sun and the moon during a solar

eclipse. The findings of Branch and Gust (1986) were reinforced when Othman (2016) found that partial solar eclipse phenomenon affected the behaviour of a herd of deer who were looking for food. Solar eclipse not only affects fauna on land, but also affects the fauna in the sea. For example, the during the solar eclipse that occurred on March 7, 1970, Fowler and Small (1972) showed that there were movement of zooplankton to the surface of the ocean during the afternoon when the full solar eclipse occurred. The movement of these animals showed a significant difference between the night before and after a solar eclipse. In addition, sea life such as prawns are also affected by lunar cycles. Supardjo, Djumanto, and Septy (2010) proved that the catch of prawns in Cilacap Regency, Indonesia declined during the beginning of the month. Although prawns are living in water, the movements of the moon still affect the catch in that area. In actual fact, astronomical phenomena such as the passage of the moon also affect populations of wildlife. For example Yonvitner, Aziz, Butet, and Pujiastuti (2009) proved that the catch of mackerel is lower during full moon, and is not the same as the catch made during other phases of the moon. This happened because there is a relationship between the optimum intensity of light with fishing activities. Other astronomical phenomenon such as eclipses of the sun also affects the current state of the ocean. Kumar and Rengaiyan (2011) proved that the total solar eclipse that occurred on July 22, 2009 affected the decrease of the pH of sea water due to the increased content of hydrogen ions (H<sup>+</sup>) contained in seawater. Indirectly, this led to reduced levels of salinity and led to changes to the freezing point of the sea water. In addition, Sarah et al. (2016) found that the phenomenon of the moon affects the tide along Malaysian waters.

### **6.3.2. The Effect of the Science of Astronomical Phenomenon Fishing Activities Among the Fishermen**

In connection therewith, the fishermen's knowledge on astronomical phenomenon is crucial in their maritime activities especially in the activities of fishing. For example, according to Mahazan et al. (2016), the impact of climate change brought negative implication towards several community groups especially the small-scale fishermen. According to Acheson (1981), the knowledge is important because of the danger of the sea and difficulty in controlling marine resources making fishing a highly risky venture in the eyes of the fishermen. Therefore, the fishermen's knowledge is naturally compatible with the culture of the local fishing community, adapted from the natural conditions of communities living in coastal areas. Based on this knowledge, fishermen have the potential to understand the signs of the sea and skies and on the conditions of the sea and possible obstacles. An example is the fishing communities in Lungkak, Tanjung Luar village in East Lombok who understood stars as an indication of conditions of sea (Fadly, 2011). For example, firstly, the Tanggale star indicating directions (shaped like a wooden rice plow), appeared in the August to December months at the east; second, the Rowot star (akin to young tamarind leaves), appeared during the months of August to December on the east; thirdly, the star of Tegedoq Bute emerged in January to July in the south until late morning. When the star appeared, there will be a breeze coming from the south. The appearance of these stars indicates to the fishermen that there are many fish. In addition, according to Syamsul (2014), the fishing community at Kupa, Barru Regency, South Sulawesi Province also have knowledge about objects in the sky and the sea. This knowledge is essential to the fishermen to guide them to suitable location for fishing and maximising their catch. The fishing communities also believe that during full moon is the best time to catch squids and the results

showed a positive effect. The same applies to the fishermen in the South of Brazil. Kalikoski and Vasconcellos (2007) stated that they have their own fishing calendar to help with their fishing activities. For example, January to May is the time to catch fish and shrimp in the ocean, while July to May is the season to catch catfish. Their knowledge is important to reduce the risk of failure to get a good catch which is their main economic resource.

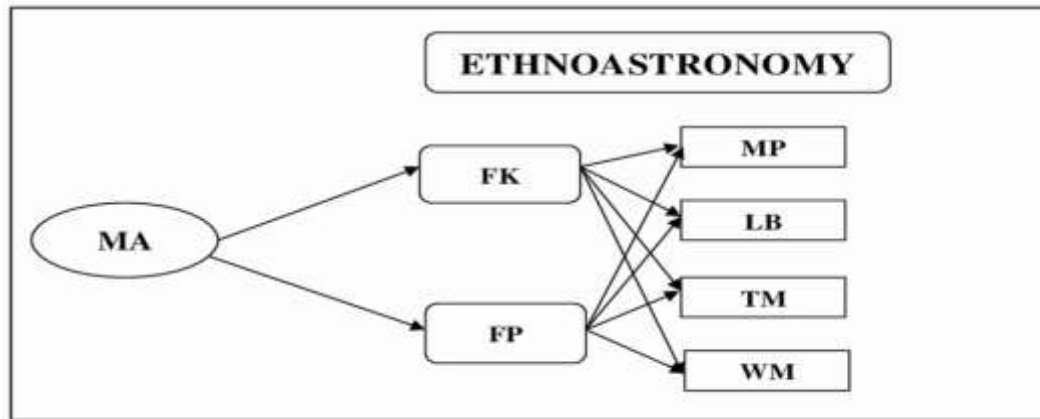
#### **6.4. Analysis on Ethnoastronomy in the Maritime Activities**

The discussion about the relationship between science and ethnography with this astronomical phenomenon is called ethnoastronomy. It is a field of study that mainly examines the social and cultural of the locals with knowledge of astronomy. Zeilik (1985) discussed the history of the lives of the Pueblos who inhabit the south-western United States. This community has a unique tradition of watching the sun and using it as a guide in their lives. According to Zeilik (1985), the activity of sun watching has two main objectives. First, to produce the religious activities calendar; and second, to determine the appropriate time to carry out the cultivation of crops. The purpose of the first activity shows that religion is the basis of the spiritual life of Pueblos communities. The second activity is to ensure the continuity of life as agricultural activities are main economic resources of the community. The relationship between religious activity and agriculture are interdependent relationships. For example, there are religious activities conducted to get rain to ensure the fertility of crops grown.

In addition, Vaiskunas (2006) said that the ancient Lithuanian community (one of the northern European countries) used the cycles of the moon phases as a guide to their lives. This community believed that every phase of the moon has its own meaning. For example, from the crescent moon to the first quarter of the moon is the best time to begin planting crops as it is believed that the branches and leaves would grow better, while the period of the first quarter to the full moon phase, would be the best time for the crop to grow well. These indications are important to determine the continuity of their agricultural activities. The movement of the moon is not only a calendar for the ancient community of Lithuania but is a guide to getting the best quality of their daily lives.

Based on the above discussion, clearly there is a connection between the ethnoastronomical phenomenon with the areas of life such as agriculture, fishing and maritime activities. For fishermen, their knowledge of these phenomenon is crucial to their fishing activities. As there isn't yet any studies on the local fishermen's knowledge and understanding on ethnoastronomy's relationship with maritime activities, this has led researchers to carry out such research. Studies involving the local wisdom of fishermen on the link between ethnoastronomy and maritime activities is most useful in human lives especially in the lives of fishing community.

In relation thereto, to show the connection between the astronomical phenomenon and maritime activities, it is proposed that a study on ethnoastronomy be carried out. The proposed study is as in figure 02 below:



**Figure 02.** Relationship between Ethnoastronomy and Maritime Activities Reference: MA = Maritime Activities; FK = Fishermen Knowledge; FP= Fishermen Practice; MP= Moon Phases; LB = Lunar Brightness; TM= Tidal Movements; WM = Wind Movements

Figure 02 shows the relationship between ethnoastronomy with maritime activities. This study starts from the activities carried out by the fishermen. The ethnoastronomy components in this study identifies the knowledge of fishermen and their practice in carrying out their maritime activities. The study continues with the analysis of the connection between the knowledge of fishermen, and their practice with the astronomical phenomenon in maritime activities such as lunar phases, lunar brightness, tidal movements and wind movements. The relationship of these two fields creates a perspective of the relationship between ethnoastronomy and maritime activities. Based on the research model, at least three main objectives are achieved. Firstly, to identify ethnoastronomy with maritime activities based on knowledge of fishermen. Secondly to analyse the relationship between ethnoastronomy with maritime activities based on knowledge of fishermen, and thirdly to summarise the ethnoastronomy with maritime activities based on knowledge of fishermen.

## 7. Conclusion

The study of relationship between the astronomical phenomenon with maritime activities is important because even though only the sun and moon elements are involved, the impact it has on maritime activities is great. The astronomical phenomenon is the cause of changes in maritime activities such as tidal movements, wave conditions, breeze/wind conditions, lunar brightness, dark moon, etc. Indirectly, these influence sea life which must be considered by the fishermen for two reasons. Firstly to determine their revenue, and secondly to ensure their own safety. Up to now, fishermen mostly depend only on the skills and experience of the skipper. If the skipper is experienced, the probability of getting a big catch and safely return is higher. However if the opposite is true, the revenue and safety of fishermen would not be guaranteed. According to Acheson (1981), the knowledge of fishermen about the relationship between astronomical phenomenon and maritime activities is critical as the sea is dangerous and ocean resources are hard to manage. This leads to fishing being seen as a highly risky activity in the eyes of the fishermen.



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