

Catch-and-release Behavior of Anglers in Tasik Muda, Kedah

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ABSTRACT

This study aimed to identify the basic sociodemographic background, catch-and-release behavior, and preferred fish species of anglers in Tasik Muda, Kedah, Malaysia. During the study period, anglers who fished in Tasik Muda were requested to answer a survey questionnaire through a face-to-face on-site sampling technique. Based on the theory of planned behavior (TPB), the questionnaire measured four variables, namely, attitude, subjective norm, perceived behavioral control, and intention. Eight types of fish species were included as choices. The results show that most of the respondents were male (90.5%) with a mean age of 36.59 ± 8.80 years old. Furthermore, most of the respondents were married (77.1%), self-employed (45.8%), and obtained an education of up to Sijil Pelajaran Malaysia level (40.3%). Scores for perceived behavioral control were above average (3.94 ± 0.78), thereby indicating that this variable may have a bigger impact in performing catch-and-release fishing. The anglers also demonstrated their subjective norm (3.58 ± 0.75), intention (3.56 ± 0.89), and attitude (3.39 ± 1.07) toward catch-and-release fishing. In terms of fish species, most of the anglers preferred Malaysian mahseer (*Tor tambroides*) (4.65 ± 0.66), snakehead (*Channa striata*) (4.54 ± 0.82), copper mahseer (*Neolissochilus soroides*) (4.51 ± 0.83), and hampala barb (*Hampala macrolepidota*) (4.47 ± 0.80). However, the TPB variables and fish preferences differed when analyzed against the basic sociodemographic background of the anglers. This study provides the basic

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data and information on anglers engaged in recreational fishing in Tasik Muda, Kedah.

Keywords: Catch-and-release fishing, fishing behavior, recreational anglers, Tasik Muda, theory of planned behavior

INTRODUCTION

Tasik Muda, also known as Muda Dam, can be categorized as a remote fishing site due to its location away from cities in Malaysia. Tasik Muda is approximately 40 km from Sik town, the nearest urban center. To reach the best fishing spots in the lake, anglers travel by boat for approximately 3-4 hours from the main jetty. The anglers target several fish species, such as *Hampala macrolepidota* (hampala barb) and *Tor tambroides* (Malaysian mahseer).

However, a few fish species in Tasik Muda are protected in accordance with the Kaedah-Kaedah Perikanan Sungai 1991 legislation by the State Government of Kedah. Thus, anglers are prohibited to catch the listed species and must release such captured fish back into the water.

Groups of inland fishermen depend on dams for subsistence or commercial purposes. These fishermen supply fish as a protein source of food to the nearby community. Records from the Department of Fisheries (DOF) of Malaysia show approximately 50 registered and licensed commercial fishermen in the country. However, only 16 fishermen actively conduct fishing activities. In addition, approximately six unregistered fishermen

fish solely for subsistence purposes. The DOF records also indicate an annual catch of over 50 tons of freshwater fish species. The major fish species include *Hemibagrus bleekeri* (river catfish), *Oreochromis sp.* (tilapia), *Osteochilus hasseltii* (silver sharkminnow), *Barbonymus schwanenfeldii* (tinfoil barb), and *Cyclocheilichthys apogon* (red-eyed barb).

Fish consumption among recreational anglers is high in Malaysia, especially in Tasik Muda, Kedah. Apart from this fact, the basic sociodemographic backgrounds of anglers are mostly unknown. Most anglers focus on their “satisfaction” and “fun” motives while fishing, and are less concerned about fish stock and conservation status.

Based on the theory of planned behavior (TPB), the catch-and-release concept can be divided into elements of attitude, subjective norm, perceived behavioral control, and intention of the anglers. These four variables can lead to corresponding catch-and-release behavior, which is important in preserving the ecosystem by returning protected fish to their habitat (Arlinghaus et al., 2007). In certain occasions, anglers wish to take home some of these fish, which reflects their “consumptive orientation” (Sutton & Ditton, 2001).

However, few studies have sought to understand how anglers view catch-and-release fishing and support relevant regulations (Arlinghaus et al., 2007). To communicate and promote catch-and-release fishing to anglers, fisheries and local agency managers would need to understand

the perspectives and behaviors of these anglers (Arlinghaus et al., 2007).

Other issues are observed in Tasik Muda. First and foremost is the noted that there is a decline in the population of several fish species. Coincidentally, for unknown reasons, few people have visited Tasik Muda in recent years. Therefore, this study can help fisheries managers and management agencies in Tasik Muda to improve their understanding of the situation by providing basic information about the anglers who fish in the lake. Understanding the anglers engaged in catch-and-release fishing is crucial to implement appropriate management (Arlinghaus et al., 2007). In addition, this study could highlight the importance of educating anglers to appreciate the natural environment, maintain its aesthetic qualities and attractiveness through catch-and-release fishing, and ensure their continued visits to Tasik Muda in the future.

Therefore, the objectives of this study were to determine the basic socio-demographic backgrounds, catch-and-release behavior, and preferred fish species of anglers in Tasik Muda, Kedah. The null hypotheses of the research are as follows:

H₁: Groups of anglers with different basic socio-demographic backgrounds have similar behaviors toward catch-and-release fishing.

H₂: Groups of anglers with different basic socio-demographic backgrounds have similar preferences of fish species.

Catch-and-Release Behavior of Anglers

Sutton (2003) defined catch-and-release fishing as returning the captured fish alive and without injury back to the water to conserve resources and increase future fishing opportunities. Anglers who disagree with elements of “catching fish,” that is, their satisfaction is not entirely focused on catching fish, probably practice catch-and-release fishing (Sutton, 2003).

According to Arlinghaus et al. (2007), from the angler’s perspective, catch-and-release behavior should be applied for conservation and other non-consumptive reasons, such as maintaining opportunities to recapture the fish later on. On the other hand, Sutton and Ditton (2001) stated that catch-and-release was an investment in conserving fisheries resources by controlling the amount of harvested prohibited species or stopping when the bag limits for the day had been reached. Catch-and-release behavior could control excess harvest from fishing activity and simultaneously increase fishing opportunities for other groups of anglers (Sutton, 2003).

Theory of Planned Behavior

The TPB consists of three main ideas used to predict the intention and behavior of an angler (Ajzen, 1991). First, attitude refers to the level of preference or non-preference of an angler toward catch-and-release behavior. Second, subjective norm (or social subjective norm) refers to the social pressure to conduct or not conduct catch-and-release fishing. Third, perceived behavioral control refers to the level of ease in conducting

catch-and-release behavior, which may be influenced by the angler's previous experiences (Figure 1).

Greater preferences placed by anglers on the attitude, subjective norm, and perceived behavioral control toward catch-and-release increases their intention to perform such behavior. Significant results obtained for attitude, subjective norm, and perceived behavioral control toward intention

depend on different behaviors in various situations. Therefore, in certain cases, the results show that attitude significantly influences intention, while a combination of attitude and perceived behavioral control sufficiently explains the intention to perform the behavior. In other cases, all the three predictors contribute independently toward the intention to behave (Ajzen, 1991).

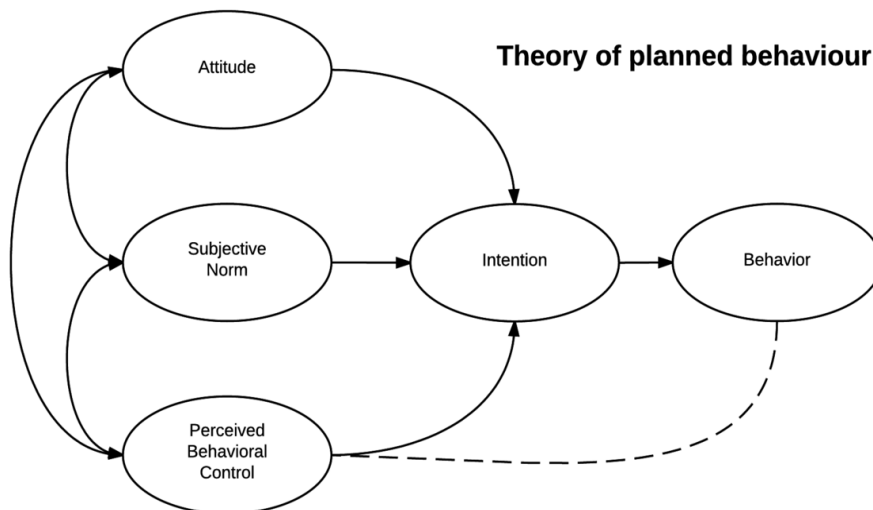


Figure 1. Theory of planned behavior (Ajzen 1991)

MATERIALS AND METHODS

Study Location

This study was conducted in Tasik Muda, located approximately 40 km from Sik town in Sik District, Kedah. Figure 2 shows the map where the sample and data were collected. The dam was built in 1969 by the Muda Agriculture Development Authority (MADA) to provide higher paddy cultivation (twice a year) along the Muda

areas. The MADA administration manages the dam, and the Sik District Council manages the tourism and fishing amenities and facilities on the jetties. Apart from catchment areas and precipitation, two main streams (Sungai Besar and Sungai Kecil) serve as water sources for Tasik Muda. The dam has a large catchment area of 984 km² but a low storage capacity of only 160 million m³ of water.

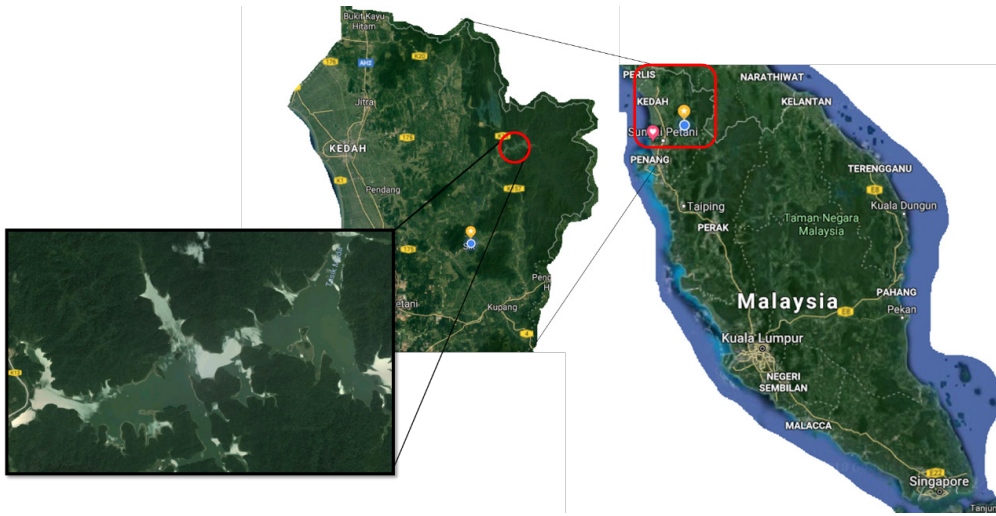


Figure 2. Map of Tasik Muda in Kedah (Source: Google Maps)

Study Duration and Sample Collection

Sampling was conducted over 16 days, during the weekends of March and April 2018. Face-to-face technique was used to approach the anglers between 6:00 p.m. and 9:00 p.m. at the jetties after they had returned from fishing. The time range was selected based on earlier observations on the availability of the anglers at the jetties.

All anglers encountered at the fishing sites were approached and those who agreed to answer the survey questionnaire were included in the sample. A total of 201 anglers completed the survey questionnaire.

Sampling Tools and Techniques

This study used a face-to-face on-site survey technique as the sampling method and a survey questionnaire as the sampling tool. The survey included categorical questions about the anglers' basic socio-demographic backgrounds. Variables for catch-and-

release behavior and anglers' preference of fish species were measured using a 5-point Likert scale ranging from 1 (extremely dislike) to 3 (neutral) to 5 (extremely like).

Variable Measurement

Three variables were measured in this study. First, the basic socio-demographic backgrounds of the anglers were determined in terms of gender, marital status, state of origin, age, income, employment status, and education level. Second, TPB variables of attitude, subjective norm, perceived behavioral control, and intention measured the catch-and-release behavior. Finally, fish preferences among anglers were identified by listing various types of fish species commonly caught in Malaysia.

Statistical Data Analysis

All data obtained from the anglers were analyzed using SPSS software version 20.

The sociodemographic data were examined using descriptive statistics (frequency, percentage, mean, and standard deviation). Responses to the Likert scale were analyzed using one-way ANOVA. In addition, Tukey test was used as post-hoc test, with a p-value of 0.05, to detect any significant difference between the means.

RESULTS AND DISCUSSIONS

Basic Sociodemographic Backgrounds of Anglers

A total of 201 anglers completed the survey questionnaire during the study period. Among the anglers, 90.5% were male and 77.1% were married (Table 1).

Most of the anglers reside in the state of Kedah (53.7%), followed by those from neighboring states Perak (14.4%) and Pulau Pinang (11.4%). The findings show that most of the anglers were locals who spent their time fishing in Tasik Muda. These local anglers could provide greater economic benefits to the fishing sites if they know the best fishing spots, while continuing to protect the wildlife and other aquatic organisms (Cooke et al., 2006). Interestingly, foreign anglers (2.5%) came to fish in Tasik Muda during the study period. These anglers originated from the United States (1.5%), Switzerland (0.5%), and Japan (0.5%).

Table 1
Basic sociodemographic backgrounds of anglers who fished in Tasik Muda, Kedah during the study period

Angler's group	Frequency	Percentage (%)
Gender		
Male	181	90.5
Female	19	9.5
Marital status		
Single	41	20.4
Married	155	77.1
Others	5	2.5
State of origin		
Kedah	108	53.7
Kelantan	6	3.0
Kuala Lumpur	4	2.0
Melaka	3	1.5
Pahang	6	3.0
Pulau Pinang	23	11.4
Perak	29	14.4

Table 1 (Continued)

Angler's group	Frequency	Percentage (%)
State of origin		
Perlis	13	6.5
Sarawak	1	0.5
Selangor	1	0.5
Terengganu	2	1.0
Foreign country	5	2.5
Age group		
17 to 29	42	20.9
30 to 39	91	45.3
40 to 49	47	23.4
50 and above	21	10.4
Income group		
below RM1,000	33	16.4
RM1,000 to RM1,999	72	35.8
RM2,000 to RM2,999	59	29.4
RM3,000 to RM3,999	17	8.5
RM4,000 and above	20	10.0
Employment		
Government	34	16.9
Private sector	68	33.8
Self-employed	92	45.8
Others	7	3.5
Level of education		
Up to SPM	81	40.3
Diploma	54	26.9
Bachelor's degree	50	24.9
Master's or Ph.D.	3	1.5
Others	12	6.0

The age range of the anglers was 17-62 years. Most of them were in the 30-39 age group (45.3%), and a few were aged 50 years and above (10.4%). In terms of income,

the range was from RM0 (no income) to RM12,000; 81.6% of the anglers earned less than RM2,999. In general, anglers in low-income groups were mainly locals

who depend solely on the lake resources, whereas anglers in the high-income groups were mainly tourists who visit the lake for recreational fishing. Crouch (1992) found that high income levels enabled tourists to travel to other countries, and generally, international tourism was considered as a luxury rather than a necessity.

Results also revealed that most of the anglers were self-employed (45.8%), followed by those who work in the private sector (33.8%), government sector (16.9%), and other groups (3.5%). In terms of education, most anglers obtained education up to the Sijil Pelajaran Malaysia (SPM) level (40.3%) or a national certificate of education obtained prior to graduation from secondary school. The rest of the anglers obtained a diploma (26.9%), bachelor's degree (24.9%), graduate degree (1.5%), and other forms of education (6.0%). The findings on the sociodemographic backgrounds of the anglers in Tasik Muda could help fisheries and local agency managers to identify different angler groups and their purposes. Some of the anglers engage in recreational fishing, whereas others may fish for consumption, particularly those with a lower income and a lower level of education compared with the overall population of anglers (Burger, 2002; Burger et al., 1999).

Analysis of Items and Variables in Theory of Planned Behavior

The behavior of anglers towards catch-and-release fishing was determined by using four TPB variables, namely, attitude, subjective

norm, perceived behavioral control, and intention. Each variable consists of at least three items following the study of Ajzen (1991). Table 2 shows the mean values of the items under each variable.

The item analysis indicated that the response "catch-and-release practice is up to me" showed the highest mean value of 4.52 ± 0.70 . This was the only item that recorded a value above 4.00, indicating that the anglers in Tasik Muda believed that they could control or conduct the catch-and-release behavior themselves. Most of the anglers claimed that they released the fish back to the water alive, and the fish usually survived (Arlinghaus et al., 2007). The rest of the items ranged from 3.00 to 4.00. Meanwhile, the least mean value was recorded for "most anglers practice catch-and-release every time they go fishing" (3.13 ± 0.99). This result indicates the uncertainty of anglers if others practice catch-and-release fishing in Tasik Muda. Anglers who fish in a group (social norm) may feel the need to keep or release the fish caught, depending on the behavior of other group members (Wallmo & Gentner, 2008).

Meanwhile, the variable analysis indicates that perceived behavioral control had the highest mean value (3.94 ± 0.78) (Table 2). It was followed by subjective norm and intention, with mean values of 3.58 ± 0.75 and 3.56 ± 0.89 , respectively. The lowest mean value was 3.39 ± 1.07 for attitude. Situational factors may play a significant role in the practice of catch-and-release behavior (Sutton, 2001). These results could highlight some important

Table 2

Mean values for items under TPB variables of catch-and-release fishing among anglers in Tasik Muda, Kedah

Items	Mean \pm SD
Attitude	3.39 \pm 1.07
My catch-and-release behavior is good so far.	3.43 \pm 1.12
My catch-and-release behavior will increase my fishing satisfaction.	3.38 \pm 1.17
My catch-and-release behaviour makes me happy.	3.35 \pm 1.25
Subjective norm	3.58 \pm 0.75
Most of my angler friends support the catch-and-release behaviour.	3.72 \pm 0.94
Most anglers practice catch-and-release every time they go fishing.	3.13 \pm 0.99
My friends think that I should practice catch-and-release fishing.	3.91 \pm 0.79
Perceived behavioral control	3.94 \pm 0.78
I am confident that I can practice catch-and-release every time I go fishing.	3.58 \pm 1.06
Catch-and-release practice is up to me.	4.52 \pm 0.70
I expect that I will practice catch-and-release in my next fishing trip.	3.72 \pm 1.03
Intention	3.56 \pm 0.89
I intend to practice catch-and-release each time I go fishing.	3.69 \pm 0.97
I intend to release the fish after catching them.	3.65 \pm 0.99
I intend to ask my friends to practice catch-and-release behavior.	3.86 \pm 0.87
In the past 6 months, I practiced catch-and-release every time I went fishing.	3.18 \pm 1.14
In the past 6 months, I asked my friends to practice catch-and-release fishing.	3.44 \pm 1.09

factors that reflect the catch-and-release behavior among anglers in Tasik Muda, Kedah.

From the management perspective, fisheries managers should exert further effort in increasing the anglers' attitude toward the behavior of catch-and-release fishing. With attitude having the lowest mean value, educational efforts and promotions should

include extensive messages and attractive slogans to encourage anglers to perform catch-and-release fishing (Arlinghaus et al., 2007).

Basic sociodemographic backgrounds in determining anglers' behavior of catch-and-release fishing

Detailed analysis of the TPB variables revealed various results, especially when

compared with the sociodemographic data of the anglers (Table 3). This analysis includes comparisons of age, income, employment, and education level.

No significant difference was found between the anglers' age groups ($p>0.05$). This result indicates that the variables of attitude, subjective norm, perceived behavioral control, and intention toward catch-and-release behavior did not differ based on the anglers' age.

However, the results based on income levels were significantly different among the anglers. The variables of attitude, perceived behavioral control, and intention of catch-and-release fishing varied for the anglers in the income group below RM1,000 compared with those in the RM3,000 to RM3,999 and RM4,000 and above income

groups. This finding supports previous studies stating that the catch-and-release behavior among anglers could differ based on different income groups (Graefe & Ditton, 1997; Grambsch & Fisher, 1991). Among black bass and trout anglers in the United States, the lower income group showed a higher level of catch-and-release behavior compared with that of the higher income group (Grambsch & Fisher, 1991). By contrast, other lower income groups of anglers tend to keep the fish they caught, either for their own consumption or for subsistence fishing purposes (Burger, 2002). This could probably relate to the anglers' strong reliance on fish for food compared with the attitude of catch-and-release fishing (Wallmo & Gentner, 2008).

Table 3

Comparisons between angler's groups based on basic sociodemographic background toward the TPB variables

Angler's group	Attitude	Subjective norm	Perceived behavioral control	Intention
Age group				
17 to 29	3.58	3.49	4.02	3.69
30 to 39	3.36	3.56	3.86	3.47
40 to 49	3.35	3.64	3.94	3.62
50 and above	3.21	3.75	4.10	3.61
Income group				
below RM1,000	2.96 ^b	3.65 ^{ab}	3.85 ^b	3.30 ^b
RM1,000 to RM1,999	3.11 ^b	3.41 ^b	3.62 ^b	3.26 ^b
RM2,000 to RM2,999	3.57 ^{ab}	3.51 ^b	4.07 ^{ab}	3.68 ^{ab}

Table 3 (Continued)

Angler's group	Attitude	Subjective norm	Perceived behavioral control	Intention
RM3,000 to RM3,999	3.90 ^a	4.10 ^a	4.45 ^a	4.21 ^a
RM4,000 and above	4.12 ^a	3.85 ^{ab}	4.43 ^a	4.22 ^a
Employment				
Self-employed	3.13 ^b	3.50 ^{ab}	3.81	3.38
Private sector	3.58 ^{ab}	3.77 ^a	4.08	3.75
Government	3.72 ^a	3.39 ^b	4.03	3.67
Level of education				
Up to SPM	2.94 ^c	3.46 ^c	3.71 ^b	3.19 ^c
Diploma	3.47 ^b	3.56 ^{ab}	3.91 ^b	3.61 ^b
Bachelor's degree	3.97 ^a	3.83 ^a	4.31 ^a	4.04 ^a

*Various superscripts in a column indicate a significant difference between groups at alpha level of $p < 0.05$.

Analysis of the anglers' employment status showed mixed results. Those who worked in the government sector indicate a high attitude ($p < 0.05$) of catch-and-release fishing but low subjective norm ($p < 0.05$). However, the other variables showed no significant results ($p > 0.05$). Thus, these results indicate that the employment status may affect only a few aspects of catch-and-release fishing among anglers.

Significant differences were observed in the results for the education level of anglers. Those who obtained a bachelor's degree rated significantly higher ($p < 0.05$) on all four variables, compared with the "up to SPM" group. This result indicates that a higher level of education could have an effect on higher level of attitude, subjective norm, perceived behavioral control, and

intention toward catch-and-release fishing. Previous studies obtained similar results. For instance, Grambsch and Fisher (1991) reported a positive correlation between educational levels and catch-and-release behavior among black bass and trout anglers. Thus, fisheries managers should categorize promotions based on different educational levels among anglers in Tasik Muda, especially for the larger "up to SPM" group.

Fish Preferences and Differences in Sociodemographic Backgrounds among Anglers

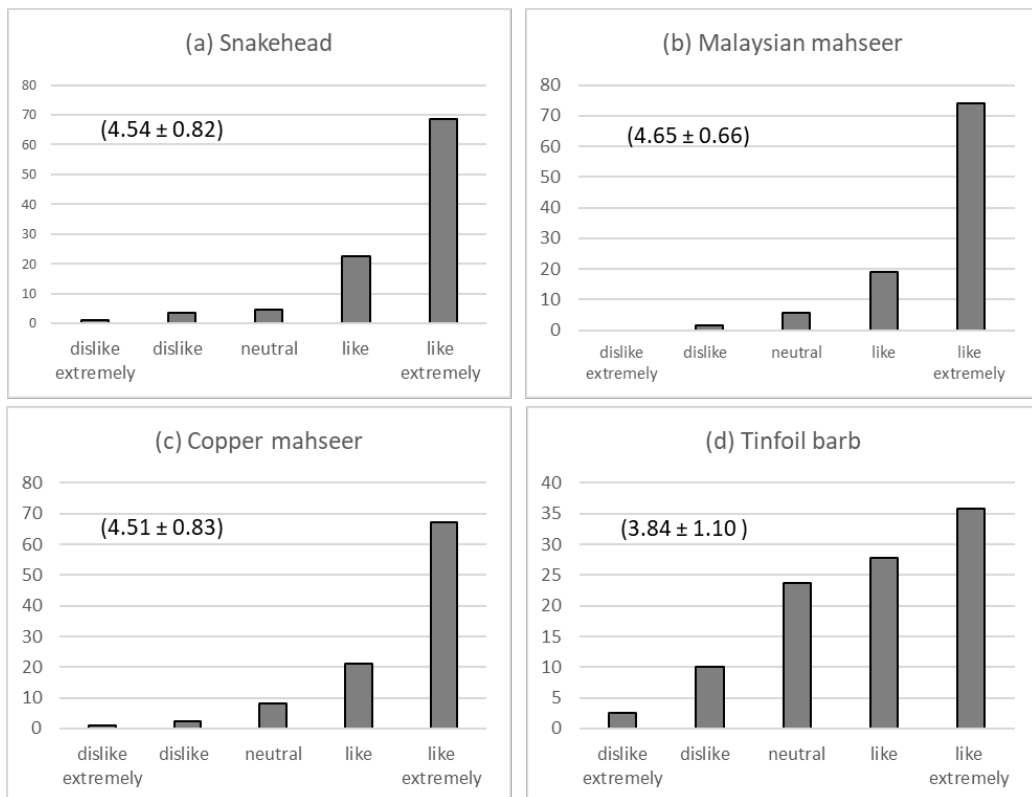
Eight commonly caught species of fish were listed in the survey questionnaire. The anglers rated the Malaysian mahseer with the highest preference, with a mean

value of 4.65 ± 0.66 . This preference was followed by snakehead (4.54 ± 0.82), copper mahseer (4.51 ± 0.83), and hampala barb (4.47 ± 0.80) (Figure 3). These latter species are known as “sport” fish due to their power (Ibrahim et al., 2015). A large snakehead tends to resist being captured. The Malaysian mahseer is difficult to catch because it is available only in habitats that require pristine, serene, and clean running waters, which are generally located in the wilderness (Ingram et al., 2007; Kiat, 2004).

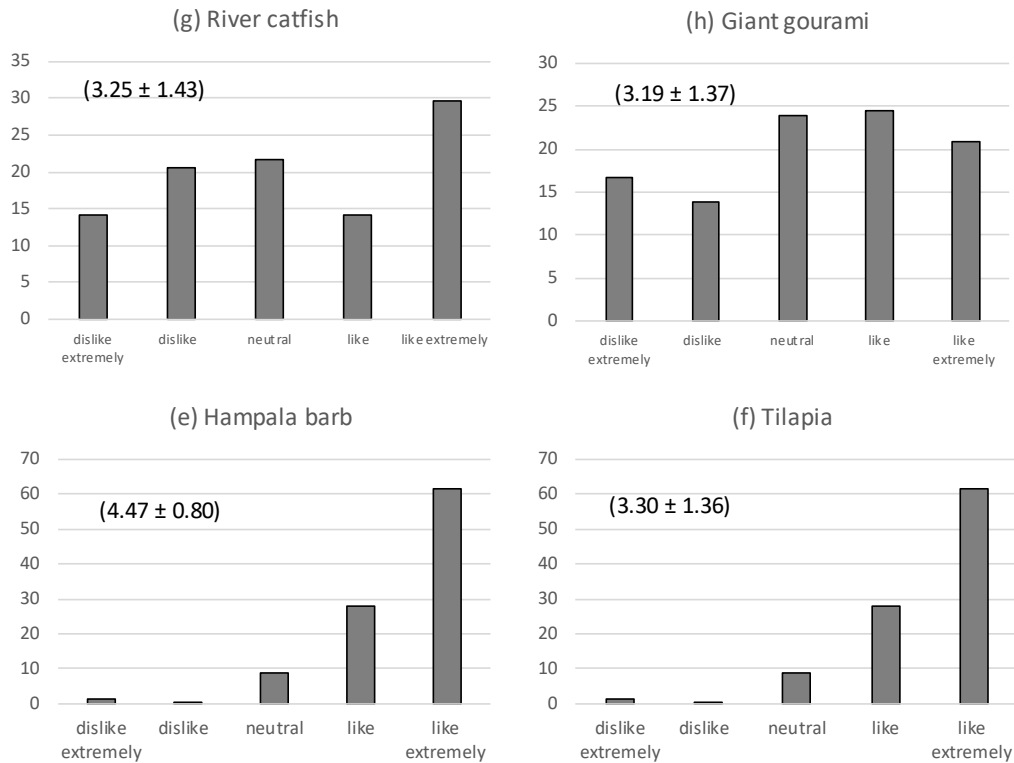
Then, fish preferences were compared among different angler groups. Clear

differences were observed based on income level, employment status, and education level (Table 4).

Compared with the anglers in the RM4,000 and above income group, those in the below RM1,000 income group tend to place significantly higher preferences ($p < 0.05$) on most of the listed fish species. This finding indicates that anglers in the lower income group prefer to catch most of the fish species. Based on employment status, compared with anglers from the government sector, those who were self-employed placed significantly higher preference ($p < 0.05$)



Figures 3(a) to (h). Anglers’ preferences for different fish species in Tasik Muda, Kedah, from a scale of 1 (dislike extremely) to 5 (like extremely). Values in the middle of each graph indicate the mean \pm S.D. of preferences



Figures 3 (Continued)

for snakehead, Malaysian mahseer, copper mahseer, and tinfoil barb. Finally, significant trends were observed among anglers based on their education level. Compared with those who obtained a bachelor’s degree, anglers in the “up to SPM” group tend to place higher ($p < 0.05$) preferences for cooper mahseer, tinfoil barb, hampala barb, tilapia, and river catfish (Table 4).

The results indicate that different angler groups in terms of sociodemographic backgrounds have different fish preferences. The differences were significant among higher-end and lower-end groups. This finding could indicate the importance of fish species to the anglers, such as the

lower income group utilizing almost all fish species listed for their own consumption or subsistence purposes. Similarly, as locals that primarily depend on lake resources, self-employed anglers prefer different types of fish species when compared with tourists who fish in Tasik Muda.

In general, the results of this study could provide insights into the importance of various fish species to different angler groups in the lake. The analysis could also provide inputs for management decision processes and approaches, such as fish stocking programs (Lorenzen, 2008). Furthermore, implementation of rules and regulations on catch-and-release fishing requires managers

Table 4
 Comparisons between angler's groups based on basic sociodemographic background toward their preferences for different fish species in Tasik Muda, Kedah

Mean / Angler's group	Snakehead	Malaysian mahseer	Copper mahseer	Tinfoil barb	Hampala barb	Tilapia	River catfish	Giant gourami
Age group								
17 to 29	4.83	4.88	4.88 ^a	3.74	4.52	3.71	3.71	3.67
30 to 39	4.45	4.57	4.39 ^b	3.71	4.44	3.10	2.91	2.98
40 to 49	4.41	4.57	4.39 ^b	4.13	4.43	3.36	3.46	3.23
50 and above	4.62	4.76	4.57 ^{ab}	4.00	4.60	3.24	3.29	3.05
Income group (RM)								
Below 1,000	4.85 ^a	4.77	4.77 ^a	4.43 ^a	4.84	4.48 ^a	4.45 ^a	3.65
1,000 to 1,999	4.58 ^{ab}	4.63	4.46 ^{ab}	3.92 ^{abc}	4.33	3.25 ^b	3.09 ^b	3.23
2,000 to 2,999	4.58 ^{ab}	4.66	4.54 ^a	3.63 ^{bc}	4.31	3.09 ^b	3.19 ^b	3.05
3,000 to 3,999	4.25 ^b	4.82	4.82 ^a	4.00 ^{ab}	4.76	2.65 ^b	2.53 ^b	2.75
4,000 and above	4.15 ^b	4.40	3.95 ^b	3.20 ^c	4.65	2.85 ^b	2.60 ^b	3.10
Employment								
Self-employed	4.59 ^a	4.70 ^a	4.59 ^a	4.01 ^a	4.47	3.40	3.28	3.15
Private sector	4.66 ^a	4.72 ^a	4.65 ^a	3.51 ^b	4.43	3.03	2.94	3.07
Government	4.09 ^b	4.38 ^b	4.06 ^b	3.88 ^{ab}	4.44	3.30	3.47	3.44
Level of education								
Up to SPM	4.60	4.66	4.59 ^a	4.22 ^a	4.65 ^a	3.56 ^a	3.69 ^a	3.36
Diploma	4.41	4.56	4.24 ^b	3.67 ^b	4.17 ^b	3.09 ^{ab}	2.85 ^b	2.87
Bachelor's degree	4.52	4.82	4.70 ^a	3.38 ^b	4.54 ^a	2.84 ^b	2.76 ^b	3.22

*Various superscripts in a column indicate a significant difference between groups at alpha level of p<0.05

to understand the diversity of angler groups in the population (Johnston et al., 2011). All of these efforts are geared toward the sustainable management of the fisheries resources in Tasik Muda, Kedah.

CONCLUSION

This study aimed to improve the current understanding of the basic sociodemographic background, catch-and-release behavior, and fish preferences of anglers in Tasik Muda, Kedah. The results showed that the anglers could be categorized into various groups based on their age, income, employment status, and educational level. Meanwhile, the anglers' catch-and-release behavior was determined by measuring four TPB variables, namely, attitude, subjective norm, perceived behavioral control, and intention.

Analysis of the TPB variables showed that the anglers' perceived behavioral control was the highest (3.94 ± 0.78) contributing factor in catch-and-release fishing behavior. However, the TPB variables exhibited differences when anglers were compared on the basis of their basic sociodemographic backgrounds. Overall, anglers who fish in Tasik Muda have a moderate to high probability of practicing catch-and-release fishing behavior.

Fisheries managers need to bridge the gap in management programs to encourage more anglers to support catch-and-release fishing behavior. Catch-and-release guidelines and strategies (such as catch limit, bag limit, or fishing licenses) from other developed countries could be

adopted and modified to suit the fisheries management system in Malaysia. In the near future, fisheries and agency managers should encourage and educate anglers regarding catch-and-release fishing. Emphasis on the importance of preserving the fisheries resources in Tasik Muda should lead to ideas that contribute toward sustainable recreational fishing practices for the benefit of future generations.

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