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IMPACT OF FUEL SUBSIDIES ON FISHERMEN INCOME: AN EMPIRICAL STUDY OF SMALL-SCALE FISHERMEN IN KEDAH AND PERLIS

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Abstract
Even though fuel subsidy can give more profit to the fisheries sector, it also has drawbacks to the ecosystem that tends to lead to overcapacity. This study investigated the impact of fuel subsidies on the income of fishermen operating in Zone A and Zone B in Kedah and Perlis. Focus group discussions with fisherman association committees were conducted to understand the issues related to fuel subsidy. The regression analysis method was used to examine the relationship between the fishermen's monthly income and various explanatory variables, such as oil subsidy received by the fishermen, the incentive value of catch received, the monthly allowance, the location of fishing activity, and the socioeconomic background of fishermen. The result of the study revealed that Boat B fishermen gained more benefits from the implementation of fuel subsidized policy than Boat A fishermen because the former used larger boat sizes and better fishing gear. In addition, variables, such as fuel subsidy, operating costs, and duration of fishing hours, influenced fishermen's income. Although fuel subsidies may contribute toward overfishing, fuel subsidy is still needed by small-scale fishermen since it can reduce the cost of fishing activities and thus increase their monthly income. This research indicates that it is important to understand the contribution of fuel as the total cost of fishing activities and how fuel subsidies can reduce these costs to improve the income of fishermen in the study area.

Keywords: *fishermen; fishing gear; fuel subsidy; income*
JEL Codes: *Q22; Q27*

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Introduction

Fishery subsidies is a "financial contribution from the government that grants private benefits to the fishery sector" (World Bank, 2008). Subsidies have the advantage of increasing revenues and reducing the cost of fishing operations that make the fishing sector more profitable. However, it is widely said that global subsidies have contributed to overfishing, resulting in an annual loss of USD55 billion in potential benefits if fisheries operated at an economically-optimal level (World Bank, 2017). In Malaysia, fishery subsidies include fuel price, monthly allowance, catch incentives, fishing vessels, fishing equipment, and other investments in infrastructure for fisheries development, such as building a jetty for fish landing (Lembaga Kemajuan Ikan Malaysia, 2016). The Malaysian government in the year 2016 spent about RM596.1 million for fuel subsidy, RM121.23 million for catch incentives,, and RM11.85 million for livelihood allowances (Lembaga Kemajuan Ikan Malaysia, 2016).

Fishing efforts in terms of time spent on fishing by small-scale fishermen are substantially less than that of fishermen using commercial boats. The time used to catch fish by small fishermen is shorter (an average of five hours a day) compared to commercial fishermen (an average of ten hours a day) based on the size of the boat, capture equipment, and fishing operation zones (WWF, 2013). Larger boat owners are able to invest in modern fishing equipment that significantly increases catch and income, while small-scale fishermen fail to increase

substantial income from fishery subsidies (Ali et al., 2017). This suggests that a fuel subsidy has encouraged more fishing, especially the large vessels with increased catch through excessive fishing. It is expected that there is an inequitable distribution of the benefits from the subsidy policy for different types of fishermen. This is the case because the amount of fuel subsidy given depends on the number of previous catches that have been made (Lindebjerg, Peng & Yeboah, 2015).

Even though subsidy can give more profit to the fisheries sector, it also has drawbacks to the ecosystem that tends to lead to overcapacity (Sumaila et al., 2012). Srinivasan, Cheung, Watson and Sumaila (2010) pointed out that the sustainability of marine resources, particularly the fish stock, will decline due to overexploitation that leads to resource depletion of fishery resources. Teh, Teh and Sumaila (2011) and Sumaila et al. (2015) found that capacity-enhancing subsidies, such as fuel subsidy, reduced operational costs and enhanced revenue. This situation will encourage fishermen to increase their fishing activities. For that reason, it is crucial for the government to ensure that the fishery sector is effectively managed, and the control in subsidies should be given priority. Boat B that operates in Zone B is bigger than Boat A that do fishing activities in Zone A. At the same time, Boat B normally uses better fishing technologies, such as a detecting device and faster boats to increase speed. Using a better quality boat and fishing technologies can influence the quantity of the catches.

The zone A and B fishermen receive both petrol and diesel subsidy at RM1.45 per liter with the maximum petrol limit of 1,590 liters (RM1,110) and a maximum diesel limit of 16,000 liters (RM8,450) for zone A and 22,000 liters (RM13,500) for zone B. The types of fishing subsidy and incentive programs in Malaysia, are summarized in Table 1.

Table 1. Fisheries Subsidy Programs by Fishing Zones, Malaysia (2015)

Subsidy Component	Unit	Zone A	Zone B
Livelihood Incentive	(RM/month)	RM300	RM250
Catch Incentive	(cent/kg)	RM0.10	RM0.10
Maximum Catch Incentive	(RM/month/pax)	RM 350	RM950
Diesel Subsidy	(RM/litre)	RM0.55	RM0.55
Petrol Subsidy	(RM/litre)	RM0.65	RM0.65
Diesel Subsidy Price	(RM/litre)	RM1.65	RM1.65
Petrol Subsidy Price	(RM/litre)	RM1.45	RM1.45
Diesel limit	(liter/month/boat)	16,000	22,000
Petrol limit	(liter/month/boat)	1,590	1,590
Diesel limit	(RM/month/boat)	RM8,450	RM13,500

Source: Annual Report, Lembaga Kemajuan Ikan Malaysia (2016)

Problem Statement

Subsidies to the fisheries sector in Malaysia have existed for many years. Various categories of subsidies have been provided to the fisherman in Malaysia, which include fuel subsidy, fishing equipment, and the construction of fishing boats. However, while subsidies may contribute to the capacity enhancement of the fisheries sectors, the capacity enhancement program can contribute to overcapacity and create a situation of the depletion of fishery stocks. Some people are concerned about the sustainability of fishery resources, especially the impact of these subsidies on the fishery stocks. In their opinion, fishery subsidies, such as fuel subsidy and the construction of fishing boats, can be harmful to sustainable fishery because it will increase fishing efforts. Some groups are against all types of harmful subsidies because of their

concern with the sustainability of fisheries activities. However, the subsidies, such as fuel subsidy, given by the government will reduce the cost of fishing operations and generate more profits for the fishermen. It is reported that fuel consumption is one of the largest costs incurred by fishermen. Subsidy policies that reduce the cost of operations and increase income will benefit small-scale fishermen who have many deficiencies, such as low level of income, relatively smaller boats, and traditional fishing gear, such as drift nets and fishing rod. However, whether subsidy policies increase the income of fishermen is unknown, especially fishermen in Kedah and Perlis. The results of the study would contribute to valuable policy inputs to help rationalize fuel subsidies for the fisheries sector in Malaysia.

Literature Review

A subsidy or government incentive is a form of financial aid or support extended to an economic sector (business or individual) to promote economic and social policy (Myers & Kent, 2001). Barrett, Lee and McPeak (2005) and Béné and Friend (2011) reported that the subsidy provided by the government comes in diverse forms, such as grants, loan guarantee, tax exemption, and price or income support program. In the fisheries sector, various categories of subsidies are provided to the fishermen in Malaysia, which include fuel, monthly allowance, fishing equipment such as vessel, net, and GPS, and other support, such as house building and maintenance. Malaysia has spent more than one-tenth of its operating expenditure on fuel subsidy and has been implementing the fuel subsidy policy for about 25 years now (Teh et al., 2011).

Research has focused on the welfare impact of fishing communities. Sumaila et al. (2012) found that subsidies led to a negative impact of overexploitation of fisheries, adversely affecting the productivity of the fisheries sector and diminishing the sustainability of the sector in the long term. Subsidies offer more benefits to large-scale fishermen rather than small-scale fishermen, giving an advantage to rich people to receive equitable benefits from the subsidies (Ofori-Danson, et al., 2013; Nunoo et al., 2009). Meanwhile, Meliadò (2012) addressed the issues of inequitable distributions of subsidies among small-scale fishermen. He found that a subsidy scheme was not related to socioeconomic needs or poverty eradication strategy. In the fishery sector, fuel cost is the biggest component of the cost of fishing. Ali et al. (2017) and Parker and Tyedmers (2014) reported that fuel costs represent 60-70 percent of the total cost of fishing.

To support fishermen, many developing countries give fuel subsidies to increase the fishermen's income (Rife et al., 2013). Lee and Rahimi (2015) claimed that the majority of fishermen, especially small-scale fishermen would face a serious problem if a fuel subsidy is abolished because it will increase their cost of operations. Sovacool (2009) highlighted that a fuel subsidy has been a decisive factor in the modernization of fishing equipment, motivating fishermen to use more powerful engines, prolong sea trips, and open up new fishing areas. All these factors can increase the catches of fish and keep the price of fish at an affordable rate. The fuel subsidy provided by the Malaysian government serves as a catalyst for the improvement of income for the majority of Malaysian small-scale fishermen because such a subsidy will lower the cost of fishing activities and increase the fishermen's income (Kuperan et al., 2008; Ali et al., 2017).

Improved types of boat and fishing equipment are important inputs in fishing activities and are a key factor in determining the capability of fishermen to increase their catches (Lambert et al., 2012). "Improved" refers to any several desirable characteristics: higher catches, responsiveness to new fishing technology, and modification of gear design that can catch more

fish, greater adaptability to stresses, such as rough sea during a monsoon season (length of the fishing season), better storage capability after harvest with a better frezon facility, and higher fodder quantity or quality (Rijnsdorp, 2000).

Ahasan et al. (2014) studied the profitability effects of subsidies in the Vietnamese fisheries sector. They proposed that the subsidies will increase fishermen's income in the long term. They found that the subsidy schemes had positive effects on vessel profitability in which the largest vessels received relatively more support than the smaller ones and earned most of the super profit and achieved higher economic performance. The most important subsidy in the Vietnam fishery was fuel subsidy. Besides subsidy, they also found that the socioeconomic status of fishermen, boat size and type of fishing gear influenced catches and subsequently the income of the fisherman. Their study confirms the contributions of a subsidy towards the modernization of the fishing industry in Vietnam in developing fishing equipment, facilitating the use of more powerful engines, helping prolong sea trips, and opening up new fishing areas. Increased profit then would encourage the new participation of rural people in the fishery activities.

Research Methodology

The unit of analysis in this study was individual commercial fishermen in Kedah and Perlis. Fishermen who used any of the three types of fishing gear trawler, purse seine, and drift net were selected as participants. To understand the issue related to fuel subsidy, focus group discussions with the fisherman association committees were also conducted.

The Model

Productivity increases in the fishery sector can have a positive impact on fishermen (Parker & Tyedmers, 2014). From the existing literature, the income of the fishermen in the study areas was modeled as a function of the (a) quantity of fuel subsidy received by the fishermen, (b) value of catch incentives and monthly allowances, (c) locations of fishing activities (Kedah or Perlis), (d) socio-economic background of the fishermen, such as age and household size, and (e) fishing efforts variables, such as fishing hours, number of boat crew, types of fishing gear, and boat size. To empirically measure the fuel subsidy effect on fishermen's income, the model used assumes that the income is influenced by the quantity of fuel subsidy, the value of catch incentives and monthly allowances, locations, economic background of the fishermen, and fishing efforts.

This study assumed that fishermen in Kedah and Perlis do not receive the same benefits from the fuel subsidy program. While all fishermen in the study area receive fuel subsidies, the fishermen's income is influenced by fishing skills, marketing strategies to market their catches, types of boats used, and fishing equipment (drift-nets, fishing rods, traps, or trawlers). Therefore, to estimate the effects of fuel subsidy programs on the fishermen, other factors assumed to affect the income of fishermen should also be taken into account.

The benefits gained from the fuel subsidy were analyzed for two groups of fishermen, fishermen operating in Zone A (Boat A) and fishermen operating in Zone B (Boat B). To achieve the objectives of the study, the following information on cost and benefits was collected:

1. The existing structure of fishing costs—breakdown by operating costs, such as the cost of fuel, ice, and labor, and fixed costs such as monthly boat maintenance.
2. Types of subsidies and incentives received by fishermen in the study areas.

3. Socioeconomic benefits from subsidized receipts, such as total monthly income and asset ownership positions.

Data collection technique

There were 1,489 small-scale fishermen who operated in Zone A and Zone B, of whom 984 were in Kedah and 505 in Perlis. In this research, interview data were gathered from 217 fishermen using a structured questionnaire. The survey was carried out from April 2017 to August 2017 to 217 fishermen randomly selected in the main fishing ports located in Kuala Kedah, Tanjung Dawai, Kuala Kedah, Kuala Perlis, and Kuala Sungai Baru. The questionnaire was distributed using a self-administered method to ensure good returns. The number of participants was proportional to the size of fishermen in a particular area. Areas with more fishermen had more participants (see Table 2).

Table 2. The sampling frame of fishermen in Kedah and Perlis

Fishing Areas	Population of small-scale fishermen	Sample	% Sample from population
Kedah	984	138	14.02 %
Perlis	505	79	15.64%
TOTAL	1,489	217	14.57%

Source: Department of Fishery (DOF) (2014), Malaysia

Research Model

Following Gazi et al. (2013), this study used a simple linear multiple regression analysis to examine the relationship between fishermen's monthly income and various explanatory variables, such as fishing methods (fishing operation cost, number of fishing hours, type of fishing gear), government assistance (fuel subsidy, catch incentives), and demographic characteristics of the fishermen (area, age, household size) (Equation 1).

$$\text{Income (Y)} = \beta 0 + \beta 1\text{FCost} + \beta 2\ \text{Hour} + \beta 3\ \text{Gear} + \beta 4\ \text{Area} + \beta 5\text{Age} + \beta 6\text{HSize} + \beta 7\text{Fuel\_S} + \beta 8\text{Catch\_I} + \beta 9\text{Crew\_N} + \varepsilon \quad (1)$$

Where,

Income	=	Fishermen's monthly income (Ringgit Malaysia)
FCost	=	Fishing Operation Cost (RM/day)
Hour	=	Number of fishing hours (hours)
Gear	=	Types of Fishing Gear (dummy variable, fishermen who used trawlers = 1, and others = 0)
Area	=	Fishing Areas (dummy variable, Kedah = 1, Perlis = 0)
Age	=	Fisherman Age (years)
HSize	=	Household Size (number of household)
Fuel_S	=	Fuel Subsidy (RM/month)
Catch_I	=	Catch Incentives (RM/month)
Crew_N	=	Crew Number (number/fishing boat)

βi ($i = 0,\ldots 9$) are parameters to be estimated and, ε = error term

Socioeconomic indicators of fisheries, such as fishing cost and gross revenue, play an important role in economic analysis and ecosystem modeling, so they are useful information for sustainable fisheries management, planning, and policy-making. These indicators have been used in monitoring and assessing the economic and social performance of fisheries and the impact of fisheries in a broader context. However, in this model, we used fuel cost as one of the factors that contribute to fishermen's income since fuel cost is a large part of the operating cost of fishing vessels. The amount of fuel used and the expenditure on fuel consumption in a fishing trip can largely affect fishing behavior and profits. Thus, the higher the consumption of fuel cost, the more time the fishermen will spend on fishing activities, leading to an increase in their income and revenue since they can catch more fish.

Besides, the number of hours spent by fishermen can also affect their income. By spending more hours at sea, they can get more catch from the fishing activities, allowing them to earn more income. For the type of fishing gear, we put the value of 1 for trawlers and 0 for other fishing gear since it was a dummy variable. It was expected that fishermen using trawlers would make more catches and income compared to those using other types of fishing gear, such as drift-nets and fishing rod.

Meanwhile, for the dummy variable of the fishing area, we divided fishing areas into two categories: Perlis and Kedah. The main fishing areas in Kedah were Kuala Kedah, Tanjung Dawai, and Kuala Muda, while in Perlis were Kuala Perlis and Kuala Sungai Baru.

Age can be related to experience; older fishermen will have more fishing experience than younger fishermen. Experienced fishermen will know more about the fishing areas with a bigger stock of fish, and these areas will be their target for their fishing operations. It was expected that more experienced fisherman will catch more fish and earn more income.

In terms of household size, the relationship with the income was expected to be positive. With a bigger family size, the fishermen could work harder to catch more fish to make more income to feed their family members. Moreover, the fishery subsidies that comprise fuel subsidy and catch incentives were included in the model. Fisherman getting more fuel subsidy will make more income. Boat A received a maximum limit of about RM1,100 for fuel subsidy, whereas Boat B received about RM2,300 per month, which means that the higher the fuel subsidy fishermen receive, the more profit they will earn since they can spend more time fishing and make more catches.

Research Findings

In analyzing the background of the participants, 79.7 percent of the household heads were an economically active age group, 89.40 percent of the household were married, and only 9.2 percent were single (Table 3). The average age of the household head was almost 57 years old, and economically active family members were four persons per household. The majority of them had 30 years of experience in fishing activities. On average, they had nine years of formal schooling, which is consistent with the national average of workers in the agriculture sector. On the education attainment of household heads, a high proportion (about 54.8 percent) had only primary education, followed by those having lower secondary education (32.3 percent). The household that had certificates in diploma was only 3.2 percent. This means that most of the fishermen had a basic level of education. During the fieldwork interviews with the fishermen, about half of them said they were willing to switch jobs but not the remainder. Of those willing to switch jobs, they were concerned that they could not seek to secure a job because of the poor level of education. The mean of experience as a fisherman was 30 years,

which shows that the majority of the fishermen in the study had been long involved in fishing activities.

Table 3. Socioeconomic background of fishermen

Socioeconomic variables	Frequency	Percentage
Age of household head		
Below 40 years	55	25.3
41-60 years	137	63.2
61 years and above	25	11.6
Mean	**57**	
Marital status of head		
Single	20	9.2
Married	194	89.4
Divorce	1	0.5
Widower	2	0.9
Educational attainment of head		
Certificates and diploma	7	3.2
Secondary	119	54.8
Primary	70	32.3
No formal education	21	9.7
Mean	9	
Household Size		
Mean	**3.9**	
Experience		
Mean	**30**	

Impact of Fuel Subsidy on Boat A Fishermen's Income

Subsidies, especially fuel subsidy, can reduce the cost of fishing activities. To achieve the objective of this research, the impact of fuel subsidy and incentives (catch incentives, livelihood incentives, and Bantuan Rakyat 1 Malaysia (BR1M)) on fishermen's income operating in Zone A was explored using descriptive statistics (Table 4). The comparison of the effects on income was made according to the fishing area.

On fuel subsidy, fishermen from Kuala Perlis were found to receive higher benefits from the fuel subsidy. They received a fuel subsidy of about RM670 per month, followed by fishermen from Tanjung Dawai (RM640 per month), Kuala Muda (RM602 per month), Kuala Kedah (RM574 per month), and Kuala Sungai Baru (RM567 per month). On the relationship between fuel subsidy receipts and the value of catch incentives received, fishermen in Kuala Perlis were found to have the highest catch incentives at an average of RM185 per month, higher than other fishing areas, such as Tanjung Dawai (RM180 a month) and Kuala Kedah (RM173 a month), suggesting that the more fuel subsidy received, the higher the fishing activity and the higher the catch.

However, on monthly income, measured by the overall income from fishery activities and other income-generating economic activities, fishermen from Kuala Sungai Baru earned the highest monthly income (RM2,308 a month), followed by fishermen from Tanjung Dawai (RM1, 313 per month), Kuala Perlis (RM1,254 per month), and Kuala Muda (RM1,175 per month). It is possible that out-of-fisheries income could have affected the income of fishermen in Kuala Sungai Baru and Tanjung Dawai. During the fieldwork, several fishermen and their family members at Kuala Sungai Baru and Tanjung Dawai were observed to be selling fish caught by

themselves in the fishermen market. These fishermen were expected to get better selling prices than those selling their fish through wholesalers.

Next, the percentage of income from fuel subsidy and the total subsidy was estimated. From this estimation, we can predict what will happen to the total income of fishermen if the fishery subsidy policy is abolished. We found that the fishermen's total gross income would be significantly lowered by about more than 25 percent (total of fuel subsidy per month, divided by total gross income) when fuel subsidies were rationalized.

Table 4. Impact of fuel subsidy and incentives on income of Boat A fishermen

Fishing Areas (BoatA) / Characteristics of fishing Operations	**Kuala Perlis**	**Kuala Sungai Baru**	**Kuala Kedah**	**Tanjung Dawai**	**Kuala Muda**
Trip/Month	18.16	24.12	18.88	20.16	19.28
Fisheries subsidies and other incentives					
Catch incentives (RM/Month)	184.51	120.00	172.84	180.00	122.50
Livelihood incentives (RM/Month)	300	300	300	300	300
BR1M (RM/Month)	54	54	54	54	54
Fuel Subsidy (RM/Month)	670.00	567.50	574.00	640.00	602.00
Total fisheries subsidies and other incentives	1,208.51	1,041.5	1,100.84	1,174.00	1,078.50
Total income (RM/month)	1,254.59	2,308.82	1,039.20	1,313.37	1,175.00
Total income with subsidies and incentives (RM/month)	2,463.10	3,350.32	2140.04	2487.37	2253.50
Percentage income from fuel subsidy (%)	27.20	16.94	26.82	25.73	26.71
Percentage income from fisheries subsidies and other incentives (%)	49.06	31.09	51.44	47.20	47.86
N	22	23	14	19	22
% by State	48.9%	51.1%	25.5%	34.5%	40.0%

Impact of Fuel Subsidy on Boat B Fishermen's Income

Fishermen in the category of Boat B were expected, on average, to have a higher monthly income because they use larger boats and better fishing gear to capture more fish, such as trawlers and longer drift nets. Table 5 presents the results.

Overall, Boat B fishermen in all fishery areas surveyed had an average income of more than RM2,600 per month. Fishermen from Kuala Sungai Baru were found to earn the highest

monthly income of RM4,433 a month, followed by fishermen from Kuala Kedah (RM3,290 a month), Tanjung Dawai (RM2,689), and Kuala Perlis (RM2,600 a month). On catch incentives, fishermen from Kuala Sungai Baru received the highest catch incentive of an average of RM750 a month. They also received the highest average fuel subsidy of RM1,572 a month compared to fishermen in other areas who received fuel subsidies ranging from RM977 to RM1,429 per month.

The result showed that fuel subsidies and catch incentives increased the income of Boat B fishermen in every fishing area, especially those in Kuala Sungai Baru. On the percentage of income from fuel subsidies and other incentives given by the government, fishermen operating in Kuala Kedah were likely to be the most adversely affected when fuel subsidies were to be rationalized because their total gross income would be diminished by 29.70 percent (total of fuel subsidy per month, RM977 divided by total gross income, RM3,289) than fishermen from other areas, such as Kuala Perlis (39.42 percent), Kuala Sungai Baru (35.46 percent), Tanjung Dawai (42.10 percent), and Kuala Muda (37.83 percent). If all subsidies were rationalized, fishermen in Tanjung Dawai would experience a decrease in the total income of more than 79.79 percent compared to Kuala Sungai Baru (59.23 percent).

Table 5. Impact of fuel subsidy and incentives on income of Boat B fishermen

Fishing Areas (Boat B) / Characteristics of fishing Operations	Kuala Perlis	Kuala Sungai Baru	Kuala Kedah	Tanjung Dawai	Kuala Muda
Trip/Month	13.62	18.09	14.16	15.12	14.46
Fisheries subsidies and other incentives					
Catch incentives (RM/Month)	609.09	750	809.14	693.33	556.25
Livelihood incentives (RM/Month)	250	250	250	250	250
BR1M (RM/Month)	54	54	54	54	54
Fuel Subsidy (RM/Month)	1,025.00	1,572	977	1,148.22	1,429.00
Total fisheries subsidies and other incentives	1,938.09	2,626.00	2,090.14	2,145.55	2,289.25
Total income (RM/month)	2,600.00	4,433.33	3,289.50	2,688.89	3,777.50
Total income with subsidies and incentives(RM/month)	4,538.09	7,059.33	5,379.64	4,834.44	6,066.75
Percentage income from fuel subsidy (%)	39.42	35.46	29.70	42.70	37.83
Percentage income from fisheries subsidies and other incentives (%)	74.54	59.23	63.54	79.79	60.60

Regression Analysis on Factors Influencing Fishermen's Income

This study also attempted to determine if a relationship exists between fishermen's income (Y) and fuel subsidy, age of fisherman, operating costs, number of fishing trip per month, number of fishing hours, household size, and a dummy variable of fishing area (Zone B = 1; Zone A = 0). The estimation result presented in Table 6 shows that the fuel subsidy, operating costs, number of fishing hours, and fishing area were statistically significant and had the expected sign.

The adjusted R square (i.e., 0.56) was quite reasonable, and the regression was significant based on the F statistics (p-value = 0.000). The coefficient of the fuel subsidy (FUEL_subsidy) had a positive sign and was statistically significant at the 5% level. The estimated effect of the FUEL_subsidy variable implies that an increase in the fuel subsidy by RM1 will increase the income of the fisherman by an estimated RM27. An increase in fuel subsidy means that the fishermen can spend more time fishing, generating more catches and income.

As expected, an increase in the operation costs by RM1 will increase income by about RM50 because the increase in the operation costs, such as wages for 'awak-awak' (assistant fisherman), fuel, and food expenditures, which means that the fishermen can increase their fishing efforts and catch more fish to get more income.

The coefficient for hours of fishing was positive and significant. When fishermen spend more hours fishing, they can catch more fish and generate more income. From the model, it is estimated that every extra hour in fishing will generate an extra income of RM34. Lastly, on the dummy variable, Boat B fishermen had more income than Boat A fishermen by RM1,980 per month. Since Boat B fishermen used a bigger boat and had better fishing gear, such as trawlers, they could catch more fish than Boat A fishermen.

Table 6. Result of regression analysis on factors that influence fisherman income

	Unstandardized Coefficients		Standardized Coefficients		
Variables	B	Std. Error	Beta	t	Sig.
(Constant)	-229.276	741.120		-.309	.757
FUEL_Subsidy_X1	.270	.128	.119	2.103	.037
Age_X2	1.467	15.794	.005	.093	.926
Operatingcost_X3	**.503**	**.053**	**.519**	**9.480**	**.000**
Number_trip_Month_X4	44.302	70.501	.032	.628	.531
Number_hour_X5	33.984	16.378	.114	2.075	.039
Household_size_X6	-21.600	76.019	-.016	-.284	.777
Fishing_zone_B_X7	**1979.984**	**487.461**	**.254**	**4.062**	**.000**

a. Dependent Variable: INC_Y

N = 217
Adjusted R Square = 0.561
F-probability = 0.000

Note: Significance levels are denoted by one asterisk (*) at the 10% level, two asterisk (**) at the 5% level, three asterisk (***) at the 1% level.

Conclusion and Implications

Fishermen operating in Zone B (Boat B) were found to benefit more from the fishery subsidy in terms of income than fishermen in Zone A (Boat A). Boat B operators normally use towed gear, such as trawl-nets, compared to Boat A operators, who use static-gear, such as drift-nets and trap. Boats that use towed gear consume more fuel that makes up a significant fishing cost than static-gear boats. Also, fishermen using Boat B fishing boats operate in Zone B, which is between 5 and 12 nautical miles from the coastline, and use more fuel than fishermen in Boat A who operate in Zone A, which is less than 5 nautical miles from the coastline. Logically speaking, boats that operate far from the coastline will require more time and more fuel for their fishing activities. Hence, if the government implements a policy to reduce subsidies, especially by rationalizing the fuel subsidy, Zone B fishermen would be more affected than fishermen operating in Zone A. If the objective of the subsidy policy is to provide assistance for the production of fish, establishment of economic stability, and stabilizing of fish price, the possibility of an increase in the operational costs should be taken into account by the government. Otherwise, it is possible that fishermen operating in Zone B will change their fishing area from Zone B to Zone A. As a result, the number of fish catches will decline, and with the assumption that the demand for fish remains constant, the fish price in the local market will increase.

The result of the regression analysis showed that the income of the fishermen was influenced by factors, such as fuel subsidy, type of fishing gear, and catch incentives. Given the current fisheries management, it is quite difficult, from the social and political perspective, to rationalize the fuel subsidies policy. Fuel subsidies policy is very popular among fishermen and has long been implemented in Malaysia (Ali et al., 2017; Sumaila et al., 2012; Gazi et al., 2013). Programs that can enhance fishery resources, such as the implementation of the Marine Protected Areas Program and the Artificial Reef Program, and programs to encourage fishermen to find employment in non-fishing activities, such as in the agriculture and manufacturing sectors, can be considered to be implemented. Some fishermen can also engage in part-time work, such as operating passenger boats and recreational fishing. The ability of these small-scale fishermen to diversify their economic activities will enable them to be flexible and less dependent on fishery activities, especially in the event of a decline in fish stocks.

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