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Conservation of Species and Fishery Subsidy: Relevance of the Global Initiative of SDG 14

Anannya Mohanty

Student, Amity University, Noida, Uttar Pradesh

ABSTRACT

Fishery Subsidies is detrimental to fishery stock because of unsustainable fishing. Fishery stock is depleting because of the human intervention. This may lead to massive harmful effects on mankind because of booming of Jellyfish. Fishery Subsidies has been identified as the key factor for the depletion of species across the globe because of rising industrial fishing. There has been a great divide between developed and developing countries in terms of providing fishery subsidies over the last few decades it has far reaching consequences on industrial and artisanal fishing. The objective of the study is to show that rising fishery subsidy has led to increase in the threatened species in both developing and the developed countries. The study runs OLS regression models to justify the objectives.

Keywords: *Artisanal Fishing, Depletion of Species, Fishery Subsidy, Industrial Fishing, SDG-14, Sustainable Fishing.*

1. INTRODUCTION

Fishery Subsidy has been the key international issue in the context of fish stock and sustainable fishing. The reason why fingers is raised against these subsidies is that there is an unprecedented crisis of depletion of fishery species the world due to use of fishery subsidies. This has become detrimental to the fishery stock because of unsustainable fishing. The process of overfishing has led further intensive efforts to catch more fishes in order to compensate for short fall in fish catch. According to FAO, more than three quarters of world's fisheries have been fished to their biological limits or beyond (UNEP, 2008).

Fishery stock is depleting because of intensive human intervention in the sector. Overfishing due to multiple causes has resulted in depletion of the fishery stock (FAO, 2016). As global population continue to intensify, wild fish and shellfish stock of commercially-captured species can no longer sustain the demand for seafood. This may lead to adverse impact on mankind as depletion of fishery species is directly correlated to the upsurge of Jellyfish population. Studies have emphasized that pollution and overfishing are the two key reasons for large blooms of jellyfish in recent years (Parsons and Lalli, 2002). There is increasing threat coming from rising population of jellyfish across the globe which may stand as a harming element to the mankind and fish species (Boero, 2013).

Fishery Subsidies has been identified as the most important factor for the depletion of species in the world. Fishery Subsidies can harm fish stock in many ways. Fuel subsidies is one of the subsidies that has promoted countries to undergo deep sea fishing. Countries like Spain and Japan have had to loss their exotic fishery species due to such practices. Government of several countries spend to the extent of $20 billion annually to increase the capacity of fishing vessels (UNEP, 2006). This has harmed fishery stock across the globe through aggressive fishing. Fuel subsidies are mostly meant for promoting industrial fishing by developed countries and such subsidies have been critical for sustainable fisheries in several countries.

There has been a great divide between developed and developing countries in terms of providing fishery subsidies over the last few decades. It has far reaching consequences on industrial and artisanal fishing. In case of Malaysia it is found that production level is higher for industrial fishing boats than for artisanal boats. This study has conclusively observed that unequal distribution of gain from commercial fishing is due to fuel subsidy. With fishery subsidy, artisanal fishermen can improve their livelihood situation, but not substantial gain from fishing activities (Islam, Zamhuri, Viswanathan and Abdullah, 2016).

This study discusses about the relationship between the total fishery subsidies and total number of threatened species of fishery stock in developed and developing countries. Second section of the paper discusses about depletion of species and SDG-14. In the third section, experiences of the global and regional economies in regard to fishery subsidy are discussed. Case studies of the US and Argentina are discussed in section 4. In section Five, the impact of fishery subsidy on fishery stock is examined empirically for both developed and developing countries. The last section presents broad conclusions and policy recommendations of the study.

2. DEPLETION OF SPECIES AND SDG 14

Due to many reasons there has been unprecedented depletion in the species of fishery stock in different parts of the world. The global fishery stock is in a critical stage as number of threatened species in several countries is rising alarmingly. The species of fishery stock can be categorized into 3 types of threatened species. They include: (1) Critically Endangered Species, (2) Endangered Species, and (3) Vulnerable Species. As per the definition provided by the IUCN, Red List of Threatened Species, Critically Endangered Species are referred as those species which are considered to be facing an extremely high risk of extinction in the wild. It is the first and foremost threatened species according to the IUCN. The IUCN Red List of Threatened Species has categorized another category which is Endangered Species. This category indicates a taxonomy of species which is likely to be extinct in the near future. According to the IUCN schema, Endangered Species category lines up second to the most severe conservation status for the wild population. The IUCN Red List of Threatened Species includes Vulnerable Species as the last category. It includes a population of species which is considered to be endangered unless the circumstances that are threatening its survival and reproduction improve. (IUCN, 2012).

Depletion of Fishery has been a major issue as it's not only a crisis of supply of fishery stock but also a reason of growth of population of Jellyfish. The blooming of jellyfish in different parts of the world is the outcome of manmade problems including overfishing, eutrophication, global warming, and changing habitats for the marine organisms (Bakun, Hays, Richardson, and Gibbons, 2009). Jellyfishes are responsible for depletion of fisheries species in several areas because of secretion of toxic elements as well as they are responsible for destroying eggs as well as larvae of fish (Boero, 2013). Rapidly changing ecosystem results in fishery stock depletion which are replaced by unwarranted growth of jellyfish (Bakun, Hays, Richardson, and Gibbons, 2009). It is feared that once the ecosystem is unbalanced on account of growing population of jellyfish, fish cannot return back to its dominance again (Williams, 2015). Jellyfish inflict injuries to bathers, destroy fishery stock in their natural habitat, and often affect functioning of coastal power stations and industrial operations. Their threat has been a major concern for several countries and becoming central cause of revenue losses in the tourism sector (European Commission, 2009). With a large population of jellyfish does not has any importance in the food chain. There is specific food chains present in selected countries which are use specific species of jellyfish for preparation of the processed food. It is important to note that processed food using jellyfish is primarily a low energy food as compared to high energy food chains existing in different parts of the world (Parsons and Lalli, 2002). Also jellyfishes' survival rate is very high because of their physical strength. They can survive in hazardous conditions, particularly with low level of food availability. These species have the tendency to adjust their body size in the absence of sufficient food by sinking themselves and can expand when food is available to them (European Commission, 2009).

Sustainable Development Goal- 14 (SDG-14) provides provisions of fishery conservation. According to the SDG-14, fishery subsidies are contributing to the rapid depletion of many fish species. In accordance to one of the sub goal of SDG-14, it asserts that by 2020, there must be prohibition of certain fisheries subsidies which contributes overfishing and overcapacity. Also eliminate illegal, unreported and unregulated fishing and refrain from introducing new such subsidies. Subsequently, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation.

The following chapter shows the experiences of global and regional fishery subsidy practices.

3. EXPERIENCES OF GLOBAL AND REGIONAL FISHERY SUBSIDY PRACTICES

Fisheries Subsidies plays a major role in capturing fish stocks. Many countries are in practice of giving fishery subsidies in order to increase fish trading. Fish and fish products are among the most traded food products in the world with approximately 40 percent of the total production being exported internationally. According to the forecasts of the World Bank and FAO, fish production and trade will continue to grow as aquaculture develops as a more imperative source of fish for human consumption than capture fisheries. The impact of trade in fisheries products on different traits of sustainable development is unclear. More trade of fisheries product may lead to an unsustainable environment but also a decline in exports which will impact the growth of one country. (Bellmann, Tipping, and Sumaila, 2016)

However, many economies involve in expanding the trade in fisheries product and involve in extensive marine capture fisheries. There is a huge investment in capturing of fisheries, to cover up the burden of the cost and time consumed to export these perishable products, government provides major tariffs and other trade policies. This are given in form of major categories of Fisheries Subsidies, trade rules and trade policies.

Fisheries Subsidies are defined in different ways in different countries. However, one of the major issue which is necessary to be addressed is crafting the regime of use of fishery subsidies and how is subsidies defined in the sector of fishery. SCM Agreement defines the subsidies as a financial support given by, or at on the instruction of, a government, that discusses an assistance. This definition of subsidies by SCM Agreement is considered as legal definition in international trade. The major features of such subsidies involves Direct transfer of funds or potential direct transfer of funds or liabilities; Forgone or uncollected revenues that would otherwise be owed the government; Provision of a good or service to a firm or industry other than general infrastructure; and Any type of income or price support (Porter, G., 2003).

In forming a definition of subsidies in the context of a new fisheries subsidies regime, therefore, four broad alternatives appear to be available to the international community:

• To use the existing definition in the SCM Agreement without amendment.

• To make sector-specific interpretations and adjustments in regard to the scope of the definition, for instance by counting indirect but explicit subsidies and determining what government infrastructure programs in the fisheries sector, if any, should be excepted from the scope of the definition.

• To include the failure to control the costs of some or all fisheries management services to the fishing industry within the scope of the definition, in addition to the amendments in the second alternative.

• To establish a radically extended definition of subsidy in the fisheries sector that would include within its scope not only the broadening in the second and third alternative but the failure by government to enforce adequately sustainable fishing practices within its fisheries. (Porter, G., 2003).

Another issue is that whether the SCM definition covers cost-reducing interventions which would reach to some of costs of access to overseas fishing zones for distant water fleets thru payments to distant countries under consensual fishing access agreements. The major issue in defining a subsidy in the fisheries sector is whether the facility of fisheries infrastructure projects or government fisheries management services without charge to the industry should be encompassed within the possibility of the definition of a subsidy. (Porter, G., 2003). Trade lawyers have proposed that the issue could turn on whether the private sector usually pays for the sort of infrastructure in question, as well as how broadly the benefits are distributed within the sector as a whole (Milazzo, 1998).

After discussing about how subsidies were defined in the SCM Agreement, it's vital to understand how WTO defined and discussed about the existence of fisheries subsidies in Trading in fishery sector. The journey of fisheries subsidies in the WTO began in the 1990s. By then studies by institutions like FAO, UNEP, and others revealed the contribution of fisheries subsidies to overfishing. In the year 1998, there was a demand for calling WTO's action on fisheries subsidies. Hence in 2001 WTO Doha Mandate clarified and improved WTO disciplines on the subsidies. After the World Summit on Sustainable Development in 2002, gave a successful conclusion to the negotiations as a top priority for achieving sustainable fisheries. With emergence of new fisheries subsidies disciplines consensus on environmental dimensions were to be negotiated during the period of 2003-04. In the year 2005 in Hong Kong during the WTO Ministerial Declaration called for the prohibition of fisheries subsidies. This was because WTO considered fishery subsidies contributed to overcapacity and overfishing which harmed the sustainability of ocean and marine resources. It was from 2005 to 2007 when different technical proposals on specific issues were tabled by WTO delegations at the WTO Rules Negotiating Group. Till now there is a debate between the developed and developing countries whether to prohibit the subsidies completely or not. (UNEP, 2008).

Fishery subsidies according to their impact to the marine ecosystem are categorized as bad fishery subsidies, ugly fishery subsidies and good fishery subsidies. According to many studies say that fishery subsidies are excessively utilized by developed countries in comparison to developing countries. (Sumaila, U. R., Lam, V., Manach, F. L., Swartz, W., & Pauly, D., 2013).

4. CASE STUDY: US AND ARGENTINA

The concept of trade, fishery subsidies and depletion of fishery subsidies are inter-related. According to reports, it is observed that the trend of fishery subsidies and depletion of fish stock is different in Developed countries like US and different for developing countries like Argentina.

Case Study of US

US being a developed country has seen a trend of use more subsidies to promote trading of fishery products. Aswathy N and Shyam. S. Salim presented that by evaluating data on both state and federal subsidies, they found that government support to the U. S. fishing industry averaged $713 million per year for the period 1996-2004. The U.S. fisheries subsidies accounted nearly 20 per cent of the value of the catch itself. In the study all the subsidies were classified as harmful or ambiguous subsidies, according to the classification scheme put forth by Khan *et al.* 2006. From 1996 to 2004, 56 per cent of government funds went to harmful subsidies and 44 per cent went to ambiguous subsidies. (Aswathy N and Shyam. S. Salim, 2012) Also there is seen a declining trend in fishery stock. The subsidies helps the trade to undergo bulk capturing of fish stocks. This helps in going for industrial fishing. Thereby, depleting the fishery stock. To have a sustainable ocean and marine life it is very much important to have a restriction on these activities.

Case Study of Argentina

Trade may be risky to stock conservation and may even lead to welfare sufferings, but it can also generate welfares and may sometimes lead to enhancements in stock conservation. In the 1990s, the government of Argentina adopted a far-reaching structural regulation program, which implied several reforms, including a fixed foreign-exchange rate, a tight monetary policy, privatization of public utilities and enterprises, deregulation of markets and economic activities, and openness of trade regimes. As a result, several conditions changed at the same time, so the impact of the trade reform cannot be seen in isolation. Many of these changes came into play in Argentina's fisheries sector. Although its citizens did not have a high domestic consumer preference for fish, Argentina expanded its fisheries sector for export. It was a minor sector before this change, but started to grow at unprecedented rates until it became one of the country's most dynamic economic sectors. Value-added amplified steadily and exports were raised by virtually 500 percent amid 1985 and 1995 (Abaza and Jha 2002b).

In the 1980s, the fisheries sector was categorized by a high degree of economic protection, where the most important legislation alleged that only Argentine-flag vessels could fish within the EEZ. In the early 1990s, which allowed imports of second-hand vessels and reduced the required proportion of domestic crew members. Further, subsidies from the EU established joint-ventures with local

firms in order to provide access for EU member-country vessels within the EEZ of Argentina. Severe deficiencies in law enforcement and other control measures and more widespread bribery and corruption undermined it and led to a crisis in the Argentine fisheries by the end of the century.

The development of Argentina's fisheries during 1985–2000 in many respects mirrored the textbook description of an open-access fishery. The EU gave subsidies in conjunction with its agreement with Argentina (to gain access to the Argentine waters) estimated at US$ 230 million which were classified as "good" subsidies because it was presumed they would reduce burden on stock in European waters. Further, the active EU role seems to have contributed to the rise in bribery and other substantial corruption practices. Vessel licensing was irregular, there were indications that catches were not being reported, and practices with permits to fish often did not meet required criteria.

The trade liberalization and the development of the fisheries sector in Argentina during the period 1985–1999 is an example of both positive and negative impacts. Fisheries production increased, e.g., fisheries exports and employment in the remote south (Patagonia) and in the harvest sector. Several negative effects have been documented. The total quantity of fish in the area tarnished and marine ecosystems experienced deterioration. In addition, corruption became endemic during this time, and over-capitalization developed, not only in terms of the fleet but also ports and other fisheries-related investments. Working conditions deteriorated and unemployment even caused social unrest, particularly when the declining hake catches led to stricter regulations.

However the positive effect out-shadowed the negative effects. Hence, it seems fair to say that trade liberalization led to welfare improvement and reduced stocks, but the development was far from an optimal, implying that welfare gains could have been substantially larger.

In response to the deteriorating fish stocks and catches in the late 1990s, Argentina reviewed its fisheries management. (Eggert, H. and Greaker, M., 2009).

The following chapter will show how the fisheries subsidies influence the depletion of fisheries species.

6. LINKAGES BETWEEN FISHERY SUBSIDIES, DEPLETION OF SPECIES, AND CONSERVATION STRATEGIES

This chapter focuses on examining the relationship between fishery subsidies and the depletion of fishery species in industrialized and developing countries to demonstrate the intensity of problem in these countries. It is argued in the literature that developing countries are the victim of the activities of developed countries in terms of their support to the capture fisheries with massive sectoral subsidies. This issue was raised in Doha Development Agenda (DDA) in 2001.

In the existing literature, there are empirical studies examining various dimensions of depletion of fishery species, fishery subsidies and linkages between these two elements examined. There are studies focusing on these aspects of fisheries in developed and developing countries. The present study is different from the earlier studies in two different ways. Firstly, it would examine the impact of fishery subsidy on depletion of fisheries stock. Secondly, the study will focus on the above relationship in developed and developing countries using econometric analysis. The empirical analysis will bring out the critical nature of fisheries stock and fishery subsidies in these group of countries in a more comprehensive manner. The study would focus whether developed and developing countries face similar situation in regard to their policy support towards fishery sector through subsidies. In this regard, several studies highlight that both develop and developing countries adopt fishery subsidy policies towards different groups of fishing communities (i.e., artisanal and industrial fishing), and therefore, the impact is felt differently in these country groupings.

Empirical Model and Methodology

In this study, we will be examining the relationship between depletion of fishery stock and fishery subsidy where it is argued that depletion of fisheries stock is the outcome of the adverse effects of fishery subsidy. This relationship is rather robust with developed countries as compared to developing countries.

For examining the hypothesis, a two variable regression model is undertaken, where the dependent variable is number of threatened species and the independent variable is per capita fishery subsidy. The functional relation between them is represented in equation (1) as:

Threatened Species = f(fishery subsidy) …… …… …… …… …… …… (1)

It is drawn from the literature that the above technical relationship between the variables is different for developed and developing countries. There will be two regression models, representing developed and developing countries separately. They are:

$TS_{Dev,i} = \alpha + \beta\ FS_{Dev,i} + u_i$ …… …… …… …… …… …… …… …… (2)

where TS denotes number of threaten species and FS represents per capita fishery subsidy.

The equation (2) represents groupings of developed countries and

$TS_{Ding,i} = \alpha + \beta\ FS_{Ding,i} + u_i$ …… …… …… …… …… …… …… (3)

refers to the group representing developing countries

It is expected that the positive intercept term shows incident of depletion of species when there is pressure on fish catch. When threat to stock depletion increase, fish species declines, and the direction of regression line will change. In such a situation, intercept term tends towards zero or the origin.

The magnitude of the coefficient of exogenous variable will show the level of its impact on the dependent variable but it depends upon statistical significance of the coefficient. Comparison of a coefficient between two equations can be possible when each coefficient is found to be significant statistically.

Data Sample

In this paper regression analysis requires two sets of countries representing developed and, representing developed and developing economics. United Nations Statistical Division classifies countries into developed and developing nations. Based on this classification, we have selected 27 countries from developed and 140 countries from the developing world for the present analysis. For these 167 countries, we have collected data for threatened fishery species and fishery subsidy.

Availability of data on fishery subsidy at cross country level is very scanty due to sensitivities associated with the issue and also definitional problems relating to fishery subsidy across countries. Taking into account these considerations, only single database is available globally for number of countries and also for selected types of fishery subsidy. In this database, availability of data is only for 2 years, particularly for the years 2003 and 2009. In this study, the latest year data of 2009 is undertaken for the empirical work.

Variables for the model

Species depletion: In the literature, depletion of species is represented by threatened species for individual countries. According to the UNEP, three types of threatened species are classified for each country in terms of degree of vulnerability of species for extinction. When number of threatened species increases, it implies that situation in regard to depletion of species is becoming serious for the country. The data for depletion species is represented by the threatened spicy which is the sum of (1) Critically Endangered Species, (2) Endangered Species, and (3) Vulnerable Species. Number of threatened is taken as the dependent variable in the model.

Fishery subsidy: Country experiences indicate that fishery subsidy takes several forms in different countries. There has been debate in the WTO since 2001 about definitional issues concerning fishery subsidy. Taking into account these elements in to consideration, Sea Around Us (SAU) has developed a database for the fishery subsidy at two points of time for number of countries across the globe. Considering the diversity of economics in providing subsidy, the SAU has presented fishery subsidy in 13 categories. Similarly, the data of Fishery Subsidies is the sum of bad fishery subsidies, ugly fishery subsidies and good fishery subsidies.

In order to represent the intensity of fishery subsidy provided to each fisherman in a country, we have calculated per capita subsidy for each country, for the year of 2009. For the estimation of per capita fishery subsidy, population variable is taken from the World Development Indicators (WDI), World Bank. Per capita fishery subsidy is the explanatory variable in the model.

7. DEVELOPED COUNTRIES

Based on the literature, disposition of developing countries in DDA (2001) has been that developed countries are mostly responsible for depletion of fishery species with the use of large fishery subsidy and therefore, we have a taken a group of 27developed countries for the regression analysis to examine this assertion. Regression analysis for developed countries explains the impact of independent variable (per capita fishery subsidies) on dependent variable (Y, Threatened Species) as given in equation 2.

Estimating a regression model for developed countries, the results show that rise in per capita fishery subsidy has given rise to increase in the number of threatened species and this relationship has been robust for developed countries. In the estimated equation (as shown in the box below), both the regression coefficients (intercept and slope) are statistically significant at 1% level, indicating per capita fishery subsidy is explaining significant variations in number of threatened species in developing countries.

$$\text{Fishery Stock}_{Ded,I} = 18.5937^{\dagger} + 4.4375E\text{-}06^{\dagger}\ \text{Fishery Subsidy}_{Ded,I} + e_i$$
$$(6.5769) \quad (5.8227) \qquad \text{Adj-}R^2 = 0.558$$

Note: † significant at 1%, figures in the parenthesis indicate t-statistics

Table 1

	A	B	C	D	E	F	G	H	I	J
1	SUMMARY OUTPUT									
2										
3	*Regression Statistics*									
4	Multiple R	0.758673744								
5	R Square	0.575585849								
6	Adjusted R Square	0.558609283								
7	Standard Error	13.66679222								
8	Observations	27								
9										
10	ANOVA									
11		*df*	*SS*	*MS*	*F*	*Significance F*				
12	Regression	1	6332.766057	6332.766057	33.90472773	4.516E-06				
13	Residual	25	4669.53024	186.7812096						
14	Total	26	11002.2963							
15										
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*	
17	Intercept	18.59369145	2.827079624	6.576996027	6.85831E-07	12.77121198	24.41617093	12.77121198	24.41617093	
18	979224	4.43751E-06	7.62095E-07	5.822776634	4.516E-06	2.86794E-06	6.00707E-06	2.86794E-06	6.00707E-06	
19										

The summary output of the regression analysis is presented in Table 1. The regression results indicate that there is a direct relationship between per capita fishery subsidy and number of threatened species in case of developed countries. This implies that there is an inverse relationship existing between fishery subsidy and depletion of fishery species in these countries. The p-value of regression coefficients are tending towards zero, indicating robustness of both the regression coefficients in the model. This is further corroborated by t-values, which are significant at 1 per cent level.

The goodness of fit of the regression model is robust in this case since Adjuster-R^2 is estimated at 0.558. This means that the 55.7 per cent of variation in number of threatened species is explained by the independent variable, i.e., per capita fishery subsidies. According to the regression model, the average fishery subsidy utilization is more with the developed countries, and therefore, the situation in regard to depletion of species is rather more acute in these countries. Therefore, there is a conclusive evidence to demonstrate that when there is a significant increase in the number of threatened species, it is the outcome of increase in the per capita fishery subsidy, particularly to promote industrial fishing in developed countries.

8. DEVELOPING COUNTRIES

Several studies indicate that developing countries are characterized by artisanal fishing, mostly to engage in subsistence fishing for livelihood security. Therefore, provisions for fishery subsidy in developing countries may have little bearing on the depletion of fisheries stock. For the empirical analysis, we have chosen 140 countries from developing world. For examining the relationship between depletion of species and fishery subsidy, we have chosen a similar model for developing countries (see equation 3) as applied for developed countries.

A separate equation is estimated for developing countries with the same specifications as we have done for developed countries. We have received weak evidences to show the relationship between depletion of fisheries species and fishery subsidies in developing countries. The estimated equation for developing countries is given below in the box. The results show that positive relationship exists between number of threatened fishery species and per capita fishery subsidy in developing countries but this result may not be taken seriously as the slope coefficient is turning out to be statistically insignificant.

$$\text{Fishery Stock}_{\text{Ding,I}} = 23.8765^{\dagger} + 8.871\text{E-}06^{\dagger\dagger}\ \text{Fishery Subsidy}_{\text{Ding,I}} + e_i$$
$$(22.991)\quad (1.7501) \qquad\qquad \text{Adj-}R^2 = 0.014$$

Note: † significant at 1% and †† at 10%, figures in the parenthesis indicate t-statistics

Summary output of the regression results is presented in Table 2. The weak influence of fishery subsidy on depletion of fishery stock demonstrates that fishery subsidy has less detrimental effects on fishery sector in developing countries, unlike those of industrialized economies. The slope coefficient is not only insignificant in terms of t-statistics but also having large p-value, indicating less significance of the slope coefficient. This shows weak relationship between independent and dependent variables in the model for developing countries.

Table 2

	A	B	C	D	E	F	G	H	I	J
1	SUMMARY OUTPUT									
2										
3	*Regression Statistics*									
4	Multiple R	0.147351845								
5	R Square	0.021712566								
6	Adjusted R Square	0.014623527								
7	Standard Error	11.83683918								
8	Observations	140								
9										
10	ANOVA									
11		*df*	*SS*	*MS*	*F*	*Significance F*				
12	Regression	1	429.1363082	429.1363082	3.062836165	0.082324346				
13	Residual	138	19335.28512	140.1107617						
14	Total	139	19764.42143							
15										
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*	
17	Intercept	23.87649071	1.03849825	22.99136344	4.84843E-49	21.82306444	25.92991698	21.82306444	25.92991698	
18	4508811	8.87131E-06	5.06904E-06	1.750096045	0.082324346	-1.15172E-06	1.88943E-05	-1.15172E-06	1.88943E-05	
19										

The overall fitness of the regression equation is not strong since adjusted-R^2 remind 0.014 in Table 2. This indicates that the regression equation explains 1.4% of the total variations in the dependent variable. From these results, it may not be possible to draw any conclusive interpretation about the positive association between depletion of fishery stock and rise of fishery subsidies in developing countries.

To sum up, empirical evidences drawn from above exercises, led us to draw the conclusion that fishery subsidy has a detrimental effect on fishery stock in developed countries but the situation is not that acute in developing countries.

The following chapter discusses about the case study of one developed country and other of developing country.

9. CONCLUSION

During the last two decades, the world economy is witnessing a serious situation where sustainability of fishery sector is at stake because of depletion of fishery at an alarming level. Fishery catch is declining persistently over the years as demand for fish is growing unabatedly across the globe. Declining fishery catch is replaced by rise in aquaculture in both developed and developing countries. Among others, fishery subsidy and IUU fishing are the key factors for the depletion of fishery stock in recent years. It is often observed that developed countries are to a large extent responsible for depletion of fisheries stock and their policies in the sector are detrimental to livelihood security of millions in developing countries. IUU fishing is taking place in the door steps of several countries by fishermen coming mostly from relatively advanced countries. Because of such activities, most of the littoral countries are adversely affected with varying magnitude. Endangered fishery species in terms of their threat levels differ significantly in individual countries as defined by FAO, UNDP, RFMOs and various other domestic fishery agencies. Various initiatives at the national, regional and international level are underway to mitigate the adverse effects of fishery depletion.

In the Doha Development Agenda (DDA) in 2001, developing countries raised their concerns about depletion of fishery stock which could be disastrous for their large fishing communities. Depletion of fishery stock has been the outcome of large fishery subsidy provided by developed countries to promote their industrial fishing. By providing enormous fuel subsidy and other forms of bad subsidies by these economies, large fleets of fish catching vessels are encouraged to venture into fishing areas of other countries and also deep sea fishing. Policies of developed countries to provide fishing subsidy have gave rise to IUU fishing across the globe and becoming a major threat to the global fish catch. In the DDA, members of the WTO have adopted a resolution to work towards reduction of fishery subsidy through regular consultation and there has been no substantial progress in the WTO, even after the 9th WTO ministerial conference, held at Argentina in 2017. UNDP with SDG-14 has been perusing sustainable fishery in order to restrict fishery subsidy and IUU fishing in individual countries and most of the developing countries are working towards these goals with the support of international community.

In the economic literature, there has been a debate on the issue that fishery subsidy by developed countries is the central cause for depletion of fisheries stock and promoting IUU fishing globally. While developed countries pump huge resources on fishery subsidy in order to promote their industrial fishing, developing countries support their large artisanal fishing community with very less amount of fishery subsidy. Some estimates show that largest segment of global fishery subsidy is appropriated by industrial economics, and perhaps developing countries do not stand anywhere close to these economics. The key issues in the global debate are centered on (a) restricting size of fishery subsidy for industrial fishing and (b) continuing provisions for fishery subsidy for small fisherman in order to maintain their livelihood. Such just but discretionary practices for artisanal fishermen may be argued on the ground of livelihood security and less harmful effect of such support on fishery stock. Fishery subsidy should be continued to promote certain other fishery stock enhancing activities such as promoting marine protected area, R&D activities in fishery sector, etc. Developing countries are not in favour of complete ban on fishery security but such support should be restricted in developed countries to prohibit industrial and IUU fishing. However, the key issue is to find a solution to the stand taken by both developed and developing countries in WTO and other forums to seize harmful subsidy. If depletion of fishery stock continues, the space vacated by fishery stock will be taken over by jellyfish, which is going to be detrimental to the welfare of the mankind.

For understanding relative positions of developed and developing countries, we have taken two country studies representing both the group of countries. We have chosen the US country case study representing developed countries and Argentina representing developing countries. In the US, fishery subsidy it sourced from state and federal budgets and such subsidy accounts for 20 per cent of the total value of catch of the country. Nearly 56 per cent of such subsidy is considered as harmful and is used for capture fish. Promotion of industrial fishing with the support of subsidy has led to depletion of fisheries stock, promotion of IUU and venturing into deep sea fishing.

In case of Argentina, successive actions such as economic reforms during 1985- 99, and joining the European Union had a disastrous impact on its fisheries sector. The country revived its fishery policies and enacted plethora of structural regulation programs to boost its fisheries stocks. Several sectoral policy measures have been taken by the country including allowing argentine flag vessels for capturing fish, reduction of required proportion of domestic crew, etc. to revive the sector. Being part of the European Union, vessels of the EU are allowed in EEZ of Argentina, causing serious damage to domestic fishery in the EEZ, and several corrective measures are taken to reverse the damage caused to the domestic fishery sector.

It is imperative from the literature that the existing conditions in developed and developing countries are different in regard to the impact of fishery subsidy on depletion of fishery stocks. In case of developed countries, fishery subsidy causes serious impact on threat to fishery stock, whereas same relationship does not hold good in case of developing countries. In the present study, this hypothesis is examined drawing samples from developed and developing countries separately for the year 2009. Results for developed countries show that per capita fishery subsidy causes rising threat to fishery species in a robust manner, whereas similar conclusions may not be drawn conclusively for developing countries based on regression analysis. It is further suggested that large bad subsidy is promoting industrial fishing and IUU fishing, resulted in depletion of fisheries species in developed countries. However, lower subsidy in this sector may have threat to the fishery stock in developing countries, but it is not statistically significant to establish the relationship. The result has a significant bearing on policy making process for the global community. Empirical evidences in the study demonstrate that fishery subsidy in developed countries may be restrained but not in developing countries. With such a policy based on nature of fishing in developed and developing countries, fishery sector may revive globally with sustainable fishing.

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APPENDIX

TABLE1: Extent of Threatened Species in The Developed Countries

Country-Name	Critically Endangered Species	Endangered Species	Vulnerable Species	Total Species	Threatened Species
Australia	7	12	66	4720	85
Japan	7	12	56	4033	75
USA	10	14	51	3380	75
Spain	7	12	33	940	52
Portugal	5	9	31	844	45
Italy	9	11	22	543	42
France	7	11	23	743	41
Canada	2	8	29	949	39
Greece	11	9	18	498	38
Malta	7	7	17	398	31
UK	4	6	16	365	26
Ireland	4	6	15	378	25
Cyprus	4	6	14	276	24
New Zealand	1	1	19	1129	21
Norway	4	3	10	275	17
Sweden	4	2	10	201	16
Denmark	3	2	10	187	15
Iceland	3	4	8	305	15
Netherlands	4	3	8	164	15
Belgium	4	1	9	143	14
Germany	3	2	8	161	13

Latvia	2	1	3	50	6
Estonia	1	1	3	66	5
Lithuania	1	1	3	41	5
Finland	2		3	46	5
Romania	1	1	2	79	4
Bulgaria		1		108	1
Slovenia	0	0	0	329	0
Slovakia					
Austria					
Luxembourg					
Switzerland					

Source: World Development Indicator, 2016, World Bank

TABLE2: Extent of Threatened Species of the Developing Countries

Country-Name	Critically Endangered Species	Endangered Species	Vulnerable Species	Total Species	Threatened Spec
Afghanistan					
Algeria	9	10	23	457	42
American Samoa		2	14	742	16
Andorra					
Angola	4	7	25	630	36
Anguilla	2	4	15	432	21
Antigua and Barbuda	2	4	15	498	21
Argentina	4	9	28	513	41
Aruba	3	5	18	578	26
Bahamas	3	5	24	861	32
Bahrain	2	3	15	377	20
Bangladesh	2	3	10	342	15
Barbados	2	5	16	527	23
Belarus					
Belize	4	5	18	598	27
Benin	5	7	18	461	30
Bermuda	4	4	16	472	24
Bhutan					
Bolivia					
Botswana					
Bouvet Island	0	0	0	13	0
British Indian Ocean Territory		1	15	764	16
British Virgin Islands	2	4	14	476	20
Brunei Darussalam		3	6	392	9
Burkina Faso					
Burundi					
Cambodia	1	2	16	493	19
Cameroon	5	7	19	518	31
Cape Verde	1	8	29	704	38
Cayman Islands	2	4	15	467	21
Central African Republic					

Chad					
Channel Islands	3	3	5	101	11
Christmas Island		2	13	657	15
Cocos (Keeling) Islands		2	5	513	7
Comoros	1		9	547	10
Congo (Brazzaville)	5	6	15	434	26
Congo, (Kinshasa)	4	6	16	391	26
Cook Islands		2	12	570	14
Costa Rica	4	6	37	1026	47
Côte d'Ivoire	5	7	20	493	32
Cuba	4	6	31	1103	41
Djibouti		3	18	395	21
Dominica	2	5	15	497	22
Dominican Republic	2	5	15	491	22
Ecuador	3	4	51	952	58
El Salvador	2	2	7	560	11
Equatorial Guinea	5	7	14	461	26
Eritrea		2	13	341	15
Ethiopia					
Falkland Islands (Malvinas)		1	4	87	5
Faroe Islands					
Fiji	2	2	29	1250	33
French Guiana	3	4	19	654	26
French Polynesia		3	19	871	22
Gabon	5	7	19	510	31
Gambia	5	8	24	493	37
Ghana	5	8	20	491	33
Gibraltar	7	10	7	327	24
Greenland		3	6	262	9
Grenada	2	4	16	497	22
Guadeloupe	2	4	15	420	21
Guam		2	17	1014	19
Guatemala	3	5	18	772	26
Guinea	5	8	25	577	38
Guinea-Bissau	5	8	23	592	36
Guyana	3	5	20	544	28
Haiti	3	5	16	503	24
Honduras	2	5	18	957	25
Hong Kong, SAR China	2	7	30	1017	39
Iran	3	3	14	398	20
Iraq	1	3	9	214	13
Isle of Man	4	3	9	171	16
Israel	4	9	25	648	38
Jamaica	4	5	15	614	24
Jordan		4	16	552	20
Kenya	2	2	23	760	27
Kiribati		1	13	525	14
Korea D P	1		9	240	10
Kuwait	2	3	16	381	21
Lao PDR			1	1	1

Lebanon	5	7	15	315	27
Lesotho					
Liberia	5	6	17	467	28
Libya	5	7	17	278	29
Liechtenstein					
Macao, SAR China	1	3	15	149	19
Madagascar	3	6	27	1047	36
Malawi					
Maldives		4	23	1137	27
Mali					
Marshall Islands		1	15	966	16
Martinique	2	5	15	444	22
Mauritania	6	10	26	699	42
Mauritius	2	4	26	1172	32
Mayotte		2	19	343	21
Micronesia		5	20	1251	25
Monaco	6	9	16	287	31
Mongolia					
Montenegro	4	8	14	281	26
Montserrat	2	4	15	401	21
Morocco	8	10	27	680	45
Mozambique	3	8	39	1594	50
Myanmar	3	5	13	579	21
Namibia	3	3	21	569	27
Nauru			4	76	4
Nepal					
New Caledonia		6	30	2385	36
Nicaragua	3	5	26	1037	34
Niger					
Nigeria	5	7	19	480	31
Niue		1	5	223	6
Norfolk Island		1	7	315	8
Northern Mariana Islands		2	16	795	18
Oman	3	4	30	1028	37
Pacific Islands			2	28	2
Pakistan	4	4	21	504	29
Palau		4	23	1548	27
Palestinian Territory					
Panama	4	7	30	1238	41
Papua New Guinea	3	8	37	2595	48
Paraguay					
Pitcairn		2	4	346	6
Puerto Rico	2	5	16	761	23
Qatar	2	4	15	339	21
Réunion	1	1	19	962	21
Rwanda					
Saint Helena	4	2	15	286	21
Saint Kitts and Nevis	2	4	15	462	21
Saint Lucia	2	4	15	492	21

Saint Pierre and Miquelon		1	1	12	2
Saint Vincent & Grenadines	2	4	15	484	21
Samoa		2	16	985	18
San Marino					
Sao Tome and Principe	3	4	12	354	19
Saudi Arabia	2	5	25	716	32
Senegal	6	11	30	662	47
Serbia					
Seychelles		3	25	1219	28
Sierra Leone	5	7	21	543	33
Singapore	1	3	22	575	26
Solomon Islands			7	926	7
Somalia	2	5	29	874	36
South Sudan					
Sri Lanka	3	6	30	997	39
Sudan		2	13	351	15
Suriname	4	4	21	726	29
Svalbard and Jan Mayen Islands			4	43	4
Swaziland					
Syrian	5	6	14	335	25
Tanzania	2	3	26	992	31
Timor-Leste			3	154	3
Togo	5	6	17	455	28
Tokelau			5	113	5
Tonga		2	13	1163	15
Trinidad and Tobago	6	4	26	959	36
Tunisia	6	9	17	349	32
Turks and Caicos Islands	2	5	13	376	20
Tuvalu		1	10	189	11
UAE	2	4	14	357	20
Uganda					
Uruguay	4	9	32	473	45
Vanuatu			11	759	11
Venezuela	3	5	27	819	35
Viet Nam	4	10	50	1852	64
Virgin Islands, US	2	5	15	565	22
Wallis and Futuna Islands		1	5	173	6
Western Sahara	7	7	16	439	30
Yemen		4	23	733	27
Zambia					
Zimbabwe					

Source: World Development Indicator, 2016, World Bank

