

CHAPTER 2

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FUEL SUBSIDIES TO GLOBAL FISHERIES: MAGNITUDE AND IMPACTS ON RESOURCE SUSTAINABILITY¹

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ABSTRACT

It is generally accepted that global fisheries are grossly overcapitalized, resulting in overfishing in most of the world's fisheries. Fuel prices have recently seen significant increases. Given that fuel constitutes a significant component of fishing costs, it is obvious that, other things being equal, increasing fuel prices will reduce overcapacity and overfishing, because they will reduce the profits that can be made, thereby driving marginal fishers out of fishing. But, other things are hardly equal. Here, the willingness of governments to provide the fishing sector fuel subsidies reduce, if not completely negate, the conservation value of increasing fuel costs. The objective of this contribution is twofold. First, we explore the theoretical basis for the expectation that increasing fuel price faced by fishing enterprises will, everything being equal, reduce fishing pressure. Second, we estimate the amount of fuel subsidies (defined narrowly here as the price differential between what others and fishers pay in an economy) paid to the fishing sector by governments globally. Results from our study indicate that global fuel subsidies stand at between US\$ 6±2 billion per year. This implies that, depending on how much of this subsidy existed before the fuel price increase, fishing enterprises can, in the aggregate, absorb as much as this amount of increase in their fuel budget before we begin to see any conservation benefits from fuel price increases.

INTRODUCTION

A key motivator for commercial fishing is profits. That is, the more profitable it is to fish the more fishing will take place, everything else being equal. Given that many fisheries in the world are currently overfished, and that fuel constitutes a significant component of fishing costs, reaching up to 60% in some fisheries, an obvious question to ask is whether the recent sharp increase in fuel price will help reduce overfishing, as this reduces the profitability of fishing. The chances of this happening can be reduced significantly where fuel subsidies are given to the fishing sector by governments. Fuel subsidies, defined narrowly here as the price differential between what others and fishers pay in an economy, are an example of fisheries subsidies usually defined as direct or indirect financial transfers by the government of a country to its fishing sector. They are given in various forms including grants, loans and loan guarantees, equity infusions, tax preferences or exemptions, and price or income support programmes (OECD, 1997; Milazzo, 1998; Schrank and Keithly, 1999; Clark *et al.*, 2005; Khan *et al.*, this volume).

To help provide research inputs into the debate on the conservation value of fuel subsidies, we estimate global fuel subsidies to the fishing sector, and discuss the potential impact of this on the ability to manage fishery resources sustainably through time. We collected and analyzed time series data on (i) the price differential, if any, enjoyed by the fishing sector in each country relative to other economic sectors due to subsidies, and (ii) the quantity of fuel consumed by the fishing sector. We applied statistical techniques to

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scale this up to estimate, at the global level, the annual dollar amount paid to the fishing sector as fuel subsidies by governments around the world.

To our knowledge, there is currently no global estimate of fuel subsidies to the fishing sector in the literature. However, global estimates of fishery subsidies in general have been provided earlier by the FAO (1992) and Milazzo (1998). A more recent estimate of global subsidies less fuel subsidies, with intermediate value between the two earlier estimates is given in Khan *et al.* (this volume). Regional estimates of fisheries subsidies have also been provided for the Asia Pacific Rim by APEC (2000), and for the North Atlantic by Munro and Sumaila (2002). The OECD publishes annual fisheries subsidies estimates for its member countries (OECD, 2004; 2005a). The current study is the first to provide a global estimate of fisheries fuel subsidies. Our results indicate that global fuel subsidies are in the range of between US\$ 4.2 to 8.5 billion per year, or around 8% of the annual commercial fish catch value of about US\$80 billion (Sumaila *et al.*, 2006).

THEORETICAL FRAMEWORK

It is generally accepted that commercial fishing operations fish for profit. The more profits they can make by going fishing the more they will fish, other things being equal. Profit, π , is determined here by the difference between total revenue, TR, and total cost, TC. TR is a function of price (p) and catch (H) while TC is a function of fishing effort, which in turn is a function of fuel cost (f) and other costs (o) such as the cost of labour. Let profit without fuel price increase, and no fuel subsidies, π_0 , be expressed as

$$\pi_0 = pH(x, E) - C(E(f, o)) \quad (1)$$

Where x is the stock size and E is the fishing effort. Note that well-behaved cost functions, $\partial\pi / \partial f < 0$. That is, the higher f the lower the profit, other things being equal.

With a fuel price increase from f to f' , the profit can be expressed as

$$\pi'_0 = pH(x, E) - C(E(f', o)) \quad (2)$$

Since f' is greater than f , the profit will be less.

With fuel subsidies, $0 < s \leq (f - f')$, the effect of the increase in fuel cost is either reduced or completely negated. Or, in the case of a fishery that is well connected politically, a fuel price increase could be exploited to get a subsidy that is higher than the fuel price increase, resulting in a higher level of fishing effort than before the fuel price increase.

The scenario given above is captured neatly in the case of open access fisheries by Figure 1 below. Figure 1 *a, b, c,* and *d* illustrate what could happen with an increase in fuel prices to fishing effort using the simple Gordon-Schaefer model (Gordon, 1954). In Figure 1a, we have the standard model with total revenue curve (TR) and the initial linear total cost function (TC_0). Under open access the equilibrium effort is E . Figure 1b shows a swing in the total cost curve from TC_0 to TC'_0 with an equilibrium effort of E'_0 . If this was all that happened, the fuel price increase will have a conservation value. However, as seen in many countries after the recent increases in fuel prices, the fishing sector normally advocates for fuel subsidies in the face of increasing fuel cost. Depending on how successful the sector is in this regard, TC'_0 can swing to anywhere between TC_0 and TC'_0 (Figure 1c) or to TC_{0f_2} (Figure 1d).

The outcomes under open access illustrated in Figure 1 can be shown to apply under a sole owner profit maximizing economic agent model by setting up a Hamiltonian function and solving it with the objective of maximizing discounted profit under the relevant stock constraint (Clark, 1990).

COMPUTING FUEL SUBSIDIES

Data collection and compilation

We researched printed and online sources to compile data on fuel subsidies worldwide. We also enlisted the help of colleagues worldwide, including academics, government officials, and NGOs. We categorized countries into those that provided (or were likely to provide) fuel subsidies, and those not likely to do so. For each country in the former group with available relevant and useable fuel subsidies data, we computed the cost of a subsidized litre of fuel (usually diesel). We then estimated the country's total fuel subsidies based on the fleets' fuel consumption. Fuel consumption data was obtained from Tyedmers *et al.* (2005).

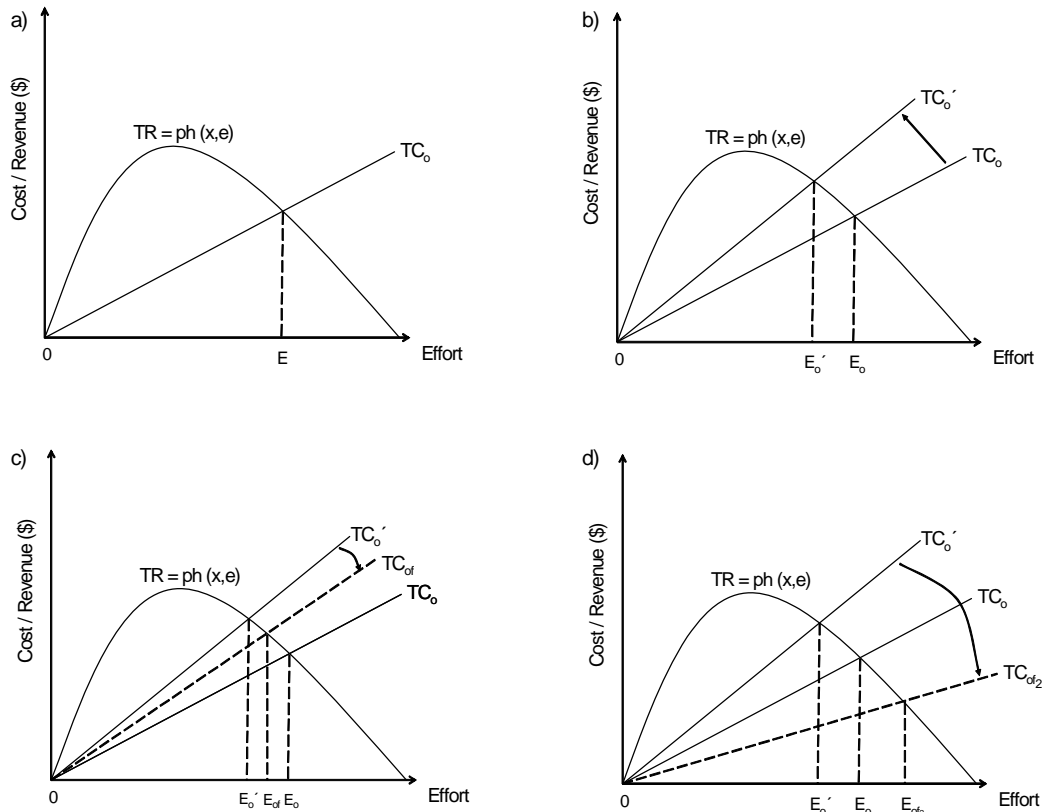


Figure 1. Figure 1a illustrates the standard model with total revenue curve (TR) and the initial total linear cost function (TC_0). Figure 1b shows a swing in the total cost curve from TC_0 to TC'_0 . Depending on the size of fuel subsidies, TC'_0 can swing to anywhere between TC_0 and TC'_0 (Figure 1c) or to TC_{of_2} (Figure 1d).

We created a database of fuel subsidies for 144 coastal countries which had engaged in fishing activity in the year 2000, and were not territories or dependences. Information related to fuel subsidies was compiled from primary and grey literature, the internet, and newspaper articles. Even though this is a static analysis for 2000, we used the closest available data within the period from 1995 to 2006, for countries for which we did not have year 2000 data, Data from years prior or after 2000 were normalized to constant 2000 US dollars by applying the consumer price index (CPI). CPI rates were extracted from the International Financial Statistics website available at <http://pacific.commerce.ubc.ca/ifs/>.

Information for each country was filtered into three groups, progressing from countries with specific fuel subsidy data to those with coarse or no information. Group 1 countries had the best data, i.e., the actual monetary value of fuel subsidy per litre, or total cost of fuel subsidies. In the case of countries where the total value of subsidies was provided, we calculated the per litre subsidy by dividing total subsidies by the country's total fuel consumption (based on data Tyedmers *et al.* 2005). Group 2 countries were those with

qualitative information available about the provision of fuel subsidies in the respective countries. Group 3 countries were those for which we have no information. There were 24, 25, and 60 countries in Groups 1, 2, and 3, respectively. In addition, there were 35 countries which, according to our research, did not provide subsidies (Table 1).

Table 1: List of data sources

Country	Subsidies provided? Y/N	\$/Litre (US\$) bracket = estimated	Source (s)
Albania	Y	0.33	Albania Directorate of Fisheries Policies, 2004. Fisheries Economy Analysis. http://www.dfishery.gov.al Accessed 21 Aug 2006
Angola	Y	(0.15)	WTO (2006)
Antigua and Barbuda	N	-	Caribbean Regional Fisheries Mechanism (CRFM) http://www.caricom-fisheries.com/members/antigua.asp Accessed 21 Aug 2006
Argentina	Y	(0.18)	Onestini, M. and G. Gutman 2001
Australia	Y	0.20	Parliament of Australia Library. Research Note 24 2000-01 http://www.aph.gov.au/library/Pubs/rn/2000-01/01RN24.htm . Accessed 24 Aug 2006
Bahamas	N ³		CRFM http://www.caricom-fisheries.com/members/bahamas.asp Accessed 21 Aug 2006
Bangladesh	Y	0.04	Khatun, 2004
Barbados	Y	(0.15)	a. Barbados Fisheries Division – Fisheries Management Plan. http://grid2.cr.usgs.gov/cepnet/barbados/czmu/bbsoc/barbados.htmBarbados Accessed 21 Aug 2006 b. CRFM http://www.caricom-fisheries.com/members/barbados.asp Accessed 21 Aug 2006
Belgium	N ²	--	a. OECD, 2005c b. Cox, 2003
Benin	N	-	Personal communication (E. Fiogbe, 2006)
Brazil	Y	0.11	Brazil Secretariat of Agriculture and Fisheries. www.planalto.gov.br/seap Accessed 22 Aug 2006
Cameroon	N		FAO fisheries management profile. http://www.fao.org/fi/fcp/fr/CMR/body.htm Accessed 22 Aug 2006
Canada	Y	(0.18)	a. http://www.gnb.ca/acts/acts/g-03.htm (fuel tax exemption in New Brunswick) b. http://www.finances.gouv.qc.ca/en/ministre/discours/20050902.asp (fuel tax exemption in Quebec)
Cape Verde	Y	(0.15)	FAO Fishery Profile. http://www.fao.org/fi/fcp/fr/CPV/body.htm
China	Y	(0.18)	Xinhua Online news, 27 March 2006. Fuel prices jump to aid battered refiners. http://news.xinhuanet.com/english/2006-03/27/content_4349323.htm Accessed 24 Aug 2006
Colombia	N ¹	-	FAO Fishery Profile. http://www.fao.org/fi/fcp/en/COL/profile.htm
Congo (Dem Rep)	N ¹	-	FAO Fishery Profile. http://www.fao.org/fi/fcp/en/COD/profile.htm
Congo (Rep)	N ¹	-	Sustainable Fisheries Livelihoods Programme Bulletin 16. http://www.sflp.org/eng/007/pub1/bul16_1.htm#_ftn1
Costa Rica	Y	0.20	La Nacion online news, 12 March 2006. Pescadores anclados a pobreza pese a millonaria ayuda estatal. http://www.nacion.com/ln_ee/2006/marzo/12/pais1.html Accessed 24 Aug 2006
Cote d'Ivoire	Y	(0.15)	Overa, 2001
Denmark	N ²		OECD, 2005c
Dominica	Y	(0.15)	CRFM http://www.caricom-fisheries.com/members/dominica.asp Accessed 24 Aug 2006
Ecuador	N ¹	-	FAO Fisheries management country profile. http://www.fao.org/fi/fcp/es/ECU/BODY.HTM Accessed 24 Aug 2006
El Salvador	N ⁴	-	FAO Fishery Profile. http://www.fao.org/fi/fcp/es/SLV/profile.htm
Fiji	N ¹	-	a. Fiji Times, 2 January 2006. Fiji fishing industry in crisis. http://www.ecsiep.org/index.php?option=com_content&task=view&id=533&Itemid=63 Accessed 24 Aug 2006 b. http://www.fijivillage.com/budget/index.html
France	Y	0.14	Financial Times Online, 27 April 2006. Federation chief wants answers on French fuel move. http://www.fishupdate.com/news/fullstory.php/aid/4426/Federation_chief_wants_answers_on_French_fuel_move_.html Accessed 22 Aug 2006
Gabon	Y	0.23	Personal communication (G. Bernart, 2006)
Gambia	Y	(0.15)	FAO, 2003
Germany	N ²	-	OECD, 2005c

Country	Subsidies provided? Y/N	\$/Litre (US\$) bracket = estimated	Source (s)
Georgia	N ¹	-	FAO Fishery Profile. http://www.fao.org/fi/fcp/en/GEO/profile.htm
Ghana	Y	0.10	EUROPA i centre. http://trade-info.cec.eu.int/doclib/cfm/doclib_section.cfm?sec=168&lev=2&order=date Accessed 24 Aug 2006
Greece	Y	0.20	OECD, 2005b
Grenada	Y	(0.15)	CRFM. http://www.caricom-fisheries.com/members/grenada.asp Accessed 24 Aug 2006
Guinea	N ¹	-	FAO Fishery Profile. http://www.fao.org/fi/fcp/fr/GIN/profile.htm Accessed 24 Aug 2006
Guyana	N ¹	-	Associated Press, 1 September 1 2005. Guyana deep-sea fishermen suspend operations due to high fuel costs. http://www.icsf.net/jsp/english/externalnews/newsDetails.jsp?id=23189 Accessed 24 Aug 2006
Hong Kong	Y	0.40	China Fisheries, 17 May 2006 Hong Kong :Fishermen's fuel-subsidy call rejected. http://en.cappma.com/news/readnews.asp?newsid=21140 Accessed 24 Aug 2006
Iceland	Y	(0.18)	Scottish Executive Publications online. http://www.scotland.gov.uk/library3/environment/ccna-11.asp Accessed 24 Aug 2006
India	Y	0.11	The Hindu Online, 26 Oct 2004. No sales tax on diesel for fishermen. http://www.hindu.com/2004/10/26/stories/2004102608930400.htm Accessed 22 Aug 2006
Indonesia	Y	0.07	LKBN Antara. 19 April 2006. Government provides subsidized fuel supply for fishermen. http://www.antara.co.id/en/ Accessed 22 Aug 2006
Italy	N ²	-	OECD, 2005c
Jamaica	Y	(0.15)	CRFM. http://www.caricom-fisheries.com/members/jamaica.asp
Japan	Y	0.25	Milazzo, 1998.
Marshall Islands	N ¹	-	Marshall Island Chamber of Commerce. http://www.majurochamber.net/Marshall%20IsIs%20Journal%20News.htm Accessed 22 Aug 2006
Malaysia	Y	0.11	a. New Straits Times, 16 March 2006. Petrol price for coastal fishermen reduced. http://www.nst.com.my Accessed 22 Aug 2006 b. Pertubuhan Berita Nasional Malaysia, 4 Jan 2006. Syndicates Lure Fishermen to Sell their Subsidised Diesel. http://www.bernama.com Accessed 22 Aug 2006
Malta	N ¹	-	FAO Fishery Profile. http://www.fao.org/fi/fcp/en/MLT/profile.htm Accessed 24 Aug 2006
Mexico	Y	(0.18)	FAO country fisheries management profile. http://www.fao.org/fi/fcp/en/MEX/body.htm Accessed 24 Aug 2006
Mozambique	N ¹	-	Tembe, 2004
Namibia	Y	(0.15)	FAO Fisheries management profile. http://www.fao.org/fi/fcp/en/NAM/body.htm Accessed 24 Aug 2006
Netherlands	N ²	-	OECD, 2005c
New Zealand	N	-	OECD, 2005c
Nigeria	N	-	Personal communication (C. Isebor, 2006)
Norway	Y	(0.18)	Tietze et al., 2001
Pakistan	N	-	Daily Times Newspaper, February 12, 2006. Government considering subsidy on diesel sales to fishermen. http://www.dailytimes.com.pk/default.asp?page=2006%5C02%5C12%5Cstory_12-2-2006_pg5_6 Accessed 22 Aug 2006
Panama	N	-	FAO country fisheries management profile. http://www.fao.org/fi/fcp/es/PAN/body.htm Accessed 24 Aug 2006
Papua New Guinea	N	-	Sokimi and Chapman, 2005
Peru	N	-	EUROPA i centre http://trade-info.cec.eu.int/doclib/cfm/doclib_section.cfm?sec=168&lev=2&order=date Accessed 22 Aug 2006
Philippines	Y	(0.15)	Rab et al., 2002
Poland	Y	(0.18)	a. OECD, 2005c b. FAO Fishery Profile. http://www.fao.org/fi/fcp/en/POL/profile.htm Accessed 24 Aug 2006
Portugal	N ²	-	OECD, 2005c
Russian Federation	Y	(0.18)	Milazzo, 1998
Saint Lucia	Y	(0.15)	FAO Fishery Profile. http://www.fao.org/fi/fcp/en/LCA/profile.htm Accessed 22 Aug 2006
Saint Kitts and Nevis	N	-	CRFM. http://www.caricom-fisheries.com/members/stkitts.asp Accessed 22 Aug 2006
Samoa	Y	(0.15)	SPC Samoa profile. http://www.spc.int/coastfish/Sections/Community/samoa.htm Accessed 22

Country	Subsidies provided? Y/N	\$/Litre (US\$) bracket = estimated	Source (s)
			Aug 2006 Accessed 24 Aug 2006
Senegal	Y	0.22	UNEP, 2002
Seychelles	Y	(0.15)	a. FAO Fishery Profile. http://www.fao.org/fi/fcp/en/SYC/PROFILE.HTM Accessed 22 Aug 2006 b. International Trade Centre UNCTAD/WTO, 1999
Soloman Islands	Y	(0.15)	Hand, 1999
South Africa	Y	0.10	South Africa Budget Review 2000. http://www.treasury.gov.za/documents/budget/2000/review/chapter_4.pdf Accessed Aug 21 2006
South Korea	Y	(0.18)	Tietze et al., 2001
Spain	Y	0.10	Pravda.Ru, 27 October 2005. Spanish fishermen keep up protests against fuel prices. http://newsfromrussia.com/world/2005/10/27/66385_.html . Accessed April 26,
Sri Lanka	Y	(0.15)	Parliament Speech by President of Sri Lanka 25 Nov 2005. http://www.presidentsl.org/data/html/speeches/2005/new_session_of_parliament.htm
Sweden	N ²	-	OECD, 2005c
Taiwan	Y	0.09	a. Taipei Times Online, 22 Dec 2004. EPA tackles air pollution, illegal diesel. http://www.taipetimes.com/News/taiwan/archives/2004/12/22/2003216188 Accessed 24 Aug 2006 b. Hong Kong Legislative Council Secretariat Information Note IN09/05-06. http://www.legco.gov.hk/vro5-06/english/sec/library/0506in09e.pdf Accessed 22 Aug 2006
Tanzania	N ³	-	Budget speech 2004. http://www.tanzania.go.tz/budgetspeech/2004/financeE.htm Accessed 24 Aug 2006
Thailand	Y	0.13	Bangkok Post Online, 11 June 2006. Fuel prices hit southern fishermen. http://www.bangkokpost.com/breaking_news/breakingnews.php?id=100889 Accessed 22 Aug 2006
Togo	Y	0.12	Personal communication (Sedzro, 2006)
Tonga	Y	(0.15)	Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. National Report Tonga, December 2005. http://www.wcpfc.org/tcci/pdf/WCPFC-TCC1-NR8-TO.pdf#search=%22SPC%20report%20Tonga%20fisheries%20subsidies%20
Trinidad and Tobago	Y	(0.15)	CRFM. http://www.caricom-fisheries.com/members/tt.asp Accessed 22 Aug 2006
Tunisia	Y	0.20	Fishing Development Strategy in Tunisia. http://www.utap.org.tn/htmlang/pech_agr/bas_1_6.htm Accessed 24 Aug 2006
Turkey	Y	0.09	EU Twinning Project TR/2004/I/AG/01 February 2006. www.tarim.gov.tr/AB_Tarim/balikkilik/avrintili_tarama_sunumlar/7-state_aid_in_fisheries.ppt Accessed 22 Aug 2006
Ukraine	Y	(0.15)	FAO Fishery Profile. http://www.fao.org/fi/fcp/en/UKR/profile.htm Accessed 22 Aug 2006
United Kingdom	N	-	OECD, 2005c
Uruguay	N		FAO Information on fisheries management in the country. http://www.fao.org/fi/fcp/es/URY/body.htm Accessed 22 Aug 2006
USA	Y	0.06	a. Weber, 1994 b. http://www.chevron.com/products/prodserv/fuels/bulletin/diesel/L2_3_11_fs.htm Accessed 24 Aug 2006
Vanuatu	Y	0.23	Asian Development Bank, 2000
Vietnam	N		Impacts of Oil Price to Vietnamese Fisheries Sector. Global News Wire. 15 Nov 2005. Lexis Nexis.
Yemen	Y	(0.15)	Yemen embassy economic report. http://www.yemenembassy.org/economic/Reports/Heritage%20Foundation/Yemen_2004%20Index%20Of%20Economic%20Freedom.pdf Accessed 22 Aug 2006

¹ Likely no subsidies due to limited fuel supplies for fishing fleet or high fuel cost with no reported subsidies.

² No fuel subsidies listed under direct government transfers in OECD Fisheries Review (2005).

³ Other types of input subsidies (e.g. gear, boats) available, but fuel subsidies not mentioned.

⁴ The government has set up the PESCA Trust to use tax from fuel to support artisanal fishing organizations.

Note: Countries with insufficient or no information include: Bahrain, Chile, Cyprus, Estonia, Finland, Ireland, Israel, Kuwait, Lithuania, Qatar, Singapore, United Arab Emirates, Algeria, Belize, Brunei Darussalam, Bulgaria, Cambodia, Comoros, Croatia, Cuba, Djibouti, Dominican Rp, Egypt, Equatorial Guinea, Eritrea, Guatemala, Guinea Bissau, Haiti, Honduras, Iran, Jordan, Kenya, Kiribati, Latvia, Lebanon, Liberia, Libya, Madagascar, Maldives, Mauritania, Mauritius, Micronesia, Morocco, Myanmar, Nauru, Nicaragua, Oman, Palau, Romania, Sao Tome and Principe, Saudi Arabia, Sierra Leone, Somalia, St. Vincent, Sudan, Suriname, Syria, Venezuela.

Within each group, countries were divided into two categories – developed, and developing – based on their score on the Human Development Index (HDI) of the United Nations. This was to take into account the fact that developed and developing countries face different economic constraints, and therefore, are likely to have different abilities to provide fuel subsidies.

The HDI runs from 0 to 1, and we assumed in this study (as in Khan *et al.*, this volume) that countries with scores ranging from 0 to 0.79 were developing countries, and those with scores above 0.79 were developed countries. Some adjustments were made to this general rule as follows: Russia, China and Taiwan with HDI of less than 0.79 were nonetheless assigned to the developed country category. This was because their fisheries are highly industrial with the potential for high fuel subsidies to be advanced to the fishing sector. Also, countries such as Trinidad and Tobago, Cuba, and Uruguay had HDI scores greater than 0.79, but were classified as developing countries due to the less developed nature of their fishing sectors (this also follows Khan *et al.*, this volume).

For Group 1 countries, we multiplied each country's per unit fuel subsidy by the annual amount of fuel consumed by the country's fishing fleets. This gave the total annual fuel subsidies provided by each country to their fishing sector in constant 2000 US\$.

For Group 2 countries we estimated total fuel subsidy per country by multiplying each country's fuel consumption by the average real cost per litre of subsidized diesel obtained from Group 1 countries. Fuel consumption data was obtained from a global database of fisheries fuel consumption (Tyedmers *et al.* 2005).

For Group 3 countries, that is, the remaining 60 countries with no information, we assumed that no fuel subsidies were provided. This is clearly a strong assumption, with the implication that our estimates are conservative. It should be noted, however, that the total fuel consumption for these countries was 0.8 and 2.8 billion litres for the developed and developing countries, respectively, and accounted for only about 8% of the total fuel consumed for all countries in our analysis.

Finally, we obtained an estimate of global fuel subsidies to the world's fishing sector by adding the Group 1 and 2 estimates.

RESULTS

Subsidy cost for Group A countries

As of August 25, 2006 we had information for 86 out of 144 countries. Of the 86 countries with information, 52 were believed to have subsidies, and 34 did not. There were altogether 24 Group 1 countries, of which 8 were categorized as developed, and 16 as developing countries.

For Group 1 developed countries, we calculated an average real (2000) cost per litre of subsidized diesel to be US\$ 0.18 ± 0.11 (S.D.). The total cost of subsidies for this group was US\$ 1.75 billion (Table 2). For the developing countries, corresponding values were US\$ 0.15 ± 0.08 per litre, with a total subsidy cost of almost US\$ 1 billion (Table 3).

Table 2. Estimated fuel subsidy for Group 1 developed countries

Country	Subsidies (US\$ per Litre)	Fuel consumption (m litres)	Total subsidy cost (US\$m)
Australia	0.20	205	41
France*	0.14	673	94
Greece*	0.20	68	14
Hong Kong	0.40	155	62
Japan	0.25	4,459	1,115
Spain	0.10	1,259	122
Taiwan ¹	0.09	1,329	120
USA	0.06	3,010	184
Total		11,158	1,752

* Total subsidy value provided.

¹ Average of subsidies from two separate sources: a) The Taipei Times online <http://www.taipetimes.com/News/taiwan/archives/2004/12/22/2003216188> and b) Taiwan Legislative Council Secretariat Information Note IN09/05-06 Available at <http://www.legco.gov.hk/vr05-06/english/sec/library/0506in09e.pdf>.

Table 3. Estimated fuel subsidy for Group 1 developing countries

Country	Subsidies (US\$ per litre)	Fuel consumption (m litres)	Total subsidies (US\$m)
Albania	0.33	2	1
Bangladesh	0.04	203	8
Brazil	0.11	550	61
Costa Rica	0.20	48	10
Gabon	0.23	20	5
Ghana	0.10	176	18
India	0.11	2,304	233
Indonesia	0.07	3,127	171
Malaysia	0.11 [†]	1,012	116
Senegal	0.22	139	30
South Africa	0.10	256	27
Thailand	0.13	1,856	241
Togo (artisanal sector)	0.12	6	1
Tunisia	0.20	77	15
Turkey*	0.09	190	17
Vanuatu	0.23	107	25
Total		10,073	976

* Total subsidy provided.

[†] Subsidy for Malaysia is the average between diesel and petrol subsidy.

Subsidy cost for Group 2 countries

Our research suggested that 28 Group 2 countries provide fuel subsidies, although the amount was not known. Of these, 9 were developed countries, and 19 were developing countries. The total fuel consumption for Group 2 developed and developing countries was around 18 and 2.3 billion litres, respectively. We multiplied total fuel consumption with the average fuel subsidy cost to obtain total subsidy costs of US\$ 3.2 billion and US\$ 0.3 billion for developed, and developing countries, respectively (Tables 4 and 5). In addition, a high and low estimate was obtained by using the upper and lower ranges (one standard deviation) of the Group 1 subsidy means. This produced an upper and lower range estimate of US\$ 5.3 billion and US\$ 1.3 billion for Group 2 developed countries. Subsidy costs for developing countries ranged from a high of US\$ 0.5 billion to a low of US\$ 0.2 billion.

Table 4. Estimated fuel subsidy for Group 2 developed countries (based on subsidy of US\$ 0.18 per litre)

Country	Fuel consumption (m litres)	Real 2000 subsidy cost (US\$m)
Argentina	640	115
Canada	519	93
China	10,087	1,814
Iceland	530	95
Mexico	974	175
Norway	786	116
Poland	80	15
Russian Federation	2,732	491
South Korea	1,841	331
Total	18,189	3,246

Table 5. Estimated fuel subsidy for Group 2 developing countries (based on subsidy of US\$ 0.15 per litre)

Country	Fuel consumption (m litres)	Real 2000 subsidy cost (US\$m)
Angola	119	17.6
Barbados	4	0.6
Cape Verde	13	2.0
Cote d'Ivoire	34	5.0
Dominica	1	0.2
Gambia	7	1.0
Grenada	2	0.4
Jamaica	4	0.6
Namibia	319	47.1
Philippines	1,122	165.6
Samoa	9	1.4
Seychelles	53	7.8
Soloman Islands	27	4.0
Sri Lanka	282	41.7
St. Lucia	2	0.3
Trinidad and Tobago	14	2.1
Tonga	3	0.4
Ukraine	150	22.1
Yemen	82	12.0
Total	2,249	332.0

Total global cost of fuel subsidies

The sum of Group 1 and 2 countries gave us a global estimate for fisheries fuel subsidies of US\$ 4.6 billion, ranging from US\$ 4.2 to US\$ 8.5 billion (Table 6).

	Group 1		Group 2		Total subsidies (US\$b)
	Developed	Developing	Developed	Developing	
Average	1.75	1.00	3.27	0.33	6.35
High	1.75	1.00	5.27	0.51	8.53
Low	1.75	1.00	1.27	0.16	4.18

CONCLUDING REMARKS

We have presented in this paper the theoretical expectation that an increase in fuel price increase paid by fishers to go fishing should have conservation value. We also demonstrated that fuel subsidies to the fishing sector could subvert the workings of the market, and completely negate the expected conservation value of a fuel price increase. In fact, recent events have demonstrated this to be true, as rises in fuel price

have led to an increase in fisheries fuel subsidies in some countries. For example, in June 2006, the Malaysian government started providing coastal fishers with subsidized petrol at RM1 per litre, a RM0.92 (US\$0.25) subsidy (New Straits Times, 2006). In October 2005, the Spanish government agreed to a 60% increase in fuel subsidies after fishers blockaded several Mediterranean ports (PravdaRU, 2005) in the country. The preceding cases illustrate that in some instances, the decision to provide fuel subsidies is influenced more by political and social concerns, rather than on the sustainability of fisheries resources.

We have determined the amount of fuel subsidies globally of up to US\$8.5 billion, implying that global fishing enterprises can, in the aggregate, absorb as much as this amount of increase in their fuel budget before we begin to see any conservation benefits from fuel price increases. Comparing this amount to the US\$ 25.7 billion of global fisheries subsidies less fuel subsidies reported in Khan *et al.* (this volume) means that fuel subsidies amount to about 25% of total fisheries subsidies. Fuel subsidies inflate the proportion of global subsidies defined as 'bad subsidies' or subsidies that lead to overcapitalization in Khan *et al.*, (2006) to about US\$21 billion or over 65% of total global fisheries subsidies.

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