CHAPTER 3

SUBSIDIES TO HIGH SEAS BOTTOM TRAWL FLEETS AND THE SUSTAINABILITY OF DEEP SEA BENTHIC FISH STOCKS[1]

Ussif Rashid Sumaila[1], Ahmed Khan[1], Louise Teh[1],
Reg Watson[1], Peter Tyedmers[2] and Daniel Pauly[1]
[1]*Fisheries Centre, Aquatic Ecosystems Research Laboratory (AERL), University of British Columbia. 2202 Main Mall, Vancouver, BC., V6T 1Z4, Canada*
[2]*School for Resource and Environmental Studies (SRES), Faculty of Management, Dalhousie University, Halifax, NS, Canada*

ABSTRACT

The life spans of demersal species of fishes occurring in deep waters are much longer and their potential growth rates much lower than those of related shallow water species. As a result, deep-sea demersal fish species are more vulnerable to exploitation. This is because low growth rates relative to the available market discount rate for capital makes it desirable for fishing firms to mine, rather than sustainably exploit, these resources even in the absence of fisheries subsidies. However, it is common knowledge that governments around the world do provide subsidies to their fishing industries. The objective of this contribution is to estimate the global amount of subsidies paid to bottom trawl fleets operating in the high seas, i.e., outside of the Exclusive Economic Zones of maritime countries. Our study suggests that fisheries subsidies to these fleets stand at about US$152 million per year, which constitutes 15% of the total landed value of the fleet. Economic data for bottom trawlers suggest that the profit achieved by this vessel group is normally not more than 10% of landed value. The implication of this finding is that without subsidies, the bulk of the world's bottom trawl fleet operating in the high seas will be operating at a loss, and unable to fish, thereby reducing the current threat to deep-sea and high seas fish stocks.

INTRODUCTION

There is evidence that bottom trawling is extending into the deep ocean, where fishing effort, especially on seamounts, has intensified (Morato *et al.*, 2006). The life spans of deep-sea fishes are much longer and their potential growth rates are much lower than those of related shallow water species. As a result, deep-sea fish species are more vulnerable to exploitation (Koslow *et al.*, 2000; Roberts, 2002; Froese and Sampang, 2004; Morato *et al.*, 2004). The point is reinforced when one takes into account the incentives that commercial fishers face. The low growth rates of the fishes that inhabit the deep and high seas make it desirable for fishing firms to mine rather than sustainably exploit these resources. In the absence of effective regulation, fleets compete to catch as much as they can before others do (Gordon, 1954). Fisheries subsidies make matters worse by keeping fleets at sea beyond the time when fishing is profitable (Clark *et al*., 2005). Even if there were no competition for deep-sea resources, low biological regeneration rates provide economic incentives to run down fish stocks as quickly as possible, and then invest the profits in other sectors of the economy (Clark, 1973; Sumaila and Walters, 2005).

Global estimates of fishery subsidies in general have been provided earlier by the FAO (1992) and Milazzo (1998). Khan *et al.* (this volume) provide the latest estimate of global non-fuel subsidies, while Sumaila *et al.* (this volume) provide an estimate of global fuel subsidies. The sum of the two recent estimates provides an

[1] Cite as: Sumaila, U.R., Khan, A., Teh, L., Watson, R., Tyedmers, P., Pauly, D. 2006. Subsidies to high seas bottom trawl fleet and the sustainability of deep sea benthic fish stocks. *In* Sumaila, U.R., Pauly, D. (eds.), Catching more bait: a bottom-up re-estimation of global fisheries subsidies. Fisheries Centre Research Reports 14(6), pp. 49-53. Fisheries Centre, the University of British Columbia, Vancouver, Canada.

intermediate global fishery subsidy value that is nicely bracketed by the two earlier estimates. The current contribution is the first to provide a global estimate of subsidies to the global bottom trawl fleets operating in the high seas, and belonging to the 12 leading high seas bottom trawl fishing nations.

This study is timely because of the current ecological concerns expressed on the increasing activity by bottom trawlers in the high seas, and the general view that this could not be possible without the existence of fisheries subsidies (Pauly *et al.*, 2003; Gianni, 2004). Of the three major gear types targeting deep-sea bottom species, i.e., gillnets, longlines and bottom trawlers, the latter are by far the most commonly used and most damaging. Around 80% of high seas catch of bottom species are taken by bottom trawlers (Gianni, 2004). The main species fished by these trawlers on the high seas are roundnose grenadier (*Coryphaenoides rupestris*), blue ling (*Molva dypterigia*), smoothheads (*Alepocehalus* spp.), black scabbardfish (*Aphanopus carbo*), Greenland halibut (*Rheinhardtius hippoglossoides*), orange roughy (*Hoplostethus atlanticus*) and deep-water sharks (Gianni, 2004).

METHOD

We first generated a list of all countries that have landings by bottom trawlers in the *Sea Around Us* Project catch database (www.seaaroundus.org). We then identified the world's 12 current leading high seas bottom trawl fishing nations. The countries that made this list were: Japan, Russia, Spain, Korea, Australia, Ukraine, Faeroe Island/Denmark, Estonia, Iceland, Lithuania, Latvia and France (Table 1). New Zealand would have been in this list but for the fact that our research informs us that the country does not give subsidies to its fisheries. It should be noted that the 10 countries included in Gianni (2004) are all included in our list. Gianni (2004) notes that fishing vessels flagged by 13 countries took over 95% of the reported high seas bottom trawl catch in 2001. We then estimated the amount of fisheries subsidies received by their high seas bottom trawlers using the results reported in Sumaila *et al.* (this volume) and Khan *et al.* (this volume), as explained below.

Khan *et al.*, (this volume) and Sumaila *et al.* (this volume) identified 12 types of subsidies, i.e., (i) boat construction, renewal and modernization; (ii) fishing port construction and renovation; (iii) marketing support, processing and storage infrastructure; (iv) tax exemption; (v) vessel buyback; (vi) fuel subsidies; (vii) rural fisheries community development; (viii) fisheries management and services; (ix) fishery research and development; (x) fishery development projects and support services; (xi) foreign access agreements; and (xii) fisher assistance programs. Of these, only (i)-(vi) appeared to be applicable to high seas bottom trawlers. We therefore estimated and ascribed only these subsidies to the class of vessels under study.

Estimating fuel subsidies to high seas bottom trawlers

We obtained the quantity of fuel consumed by bottom trawlers operating in the high seas (defined as ocean areas outside of countries' EEZ) from each of these countries from Tyedmers *et al.* (2005), and subsidy per liter by country reported in Sumaila *et al.* (this volume). From these two sets of data, the total subsidy to bottom trawlers in each of the 12 countries was calculated. For the purposes of further analysis, we also compiled total catch, and catch by high seas bottom trawlers in each of these countries based on the geo-referenced catches of the *Sea Around Us* Project (see www.seaaroundus.org; Watson *et al.*, 2004). Finally, we assessed the total landed value of bottom trawl catches using information in Sumaila *et al.* (2006).

Estimating non-fuel subsidies to high seas bottom trawlers

Non-fuel subsidy estimates relevant to bottom trawlers active in the high seas, for the 12 high seas bottom trawling nations being studied, were taken from Khan *et al.* (this volume). We then used the ratio of bottom trawl catch to total catch by all the fleets active in each of the 12 countries to prorate the total relevant non-fuel subsidies in each country to the portion of the relevant non-fuel subsidies that can be ascribed to high seas bottom trawlers.

How profitable are bottom trawlers?

According to Statistics Iceland, profit per revenue of about 3.5% was recorded in 2000 (the year for our analysis); while Statistics Norway reported 7% operating profits for trawlers that process fish onboard in 2002.

We assumed that profits from other trawl fisheries from around the world are not likely to be higher than these numbers.

Table 1. Summary of data in fisheries subsidies to high seas bottom trawl (HSBT) fleets.

Country	HSBT fuel used (m liters)[a]	Subsidy per liter (US$)[b]	HSBT fuel subsidy (US$m)[c]	HSBT non-fuel subsidy (US$m)[d]	HSBT total subsidy (US$m)[e]	Total catch all species ('000 t)[f]	HSBT catch ('000 t)[g]	Total real catch value all species (US$m)[h]	HSBT real value (US$m)[i]
Japan	101.76	0.25	25.44	9.48	34.92	4,895	92	20,567	290
South Korea	96.57	0.18	17.38	9.74	27.12	1,805	88	5,538	146
Russia	90.93	0.18	16.37	13.69	30.06	3668	66	9,001	163
Spain	69.70	0.10	6.97	12.70	19.68	183	6	1,748	22
Australia	5.17	0.20	1.03	8.92	9.95	552	37	1,354	92
Ukraine	24.40	0.15	3.66	3.20	6.86	393	27	963	66
Faeroe Isl.[j]	19.01	0.15	2.85	12.49	15.34	454	18	1,114	45
Estonia	8.37	0.15	1.26	3.68	4.94	109	14	267	34
Iceland	9.88	0.18	1.78	0.16	1.94	1,981	11	853	33
Lithuania	3.04	0.15	0.46	0.00	0.46	77	5	189	13
Latvia	1.94	0.15	0.29	0.00	0.29	135	3	333	8
France	2.66	0.14	0.37	0.24	0.61	621	2	1,386	6
Total	**433**	**-**	**78**	**74**	**152**	**15,453**	**400**	**43,851**	**985**

a) Adapted from Tyedmers *et al.* (2005.); b. based on Sumaila *et al.* (this volume); c) this is the product of high seas bottom trawl fuel consumption, and subsidy per liter; d) calculated using data in Khan *et al.* (this volume); e) this is the sum of (c) and (d); f) and g) are calculated using data in Watson *et al.* (2004); (h) and (i) are obtained from Sumaila *et al.* (2006); and j) Data for Denmark reported in Sumaila *et al.* (this volume) is used to make the calculation here. We assumed that Estonia, Lithuania and Latvia give fuel subsidies to their fishing fleets.

RESULTS

The results of the analysis are given in Table 1. The following observation can be made from that table:

- Total amount of fuel consumed by the high seas bottom fleet (HSBT) of the 12 countries studied is 433 million litres a year;
- Total catch by those countries by all fishing gear in all areas including the high seas stands at just over 15.5 million tonnes, while the equivalent catch by only the HSBT fleet is 400 thousand tonnes. Thus, the HSBT catch is about 2% of the total catch of the 12 countries and less than 1% of the global marine catch;
- The total landed value from all fish catch of the 12 countries is about $44 billion a year. The total HSBT landed value is estimated at about $985 million, which is less than 3% of the total landed value of these countries, and about 1% of total global marine catch value;
- Total fuel subsidies to this fleet are estimated at about $78 million, while the non-fuel subsidy estimate stands at $74 million per year. Therefore, fuel subsidies account for just over 5o% of the total subsidy to the HSBT fleet of about $152 million a year;
- Total subsidy to the HSBT fleet is about 15% of the total landed values from the catch of these fleets in the high seas, which is higher than the reported profit per landed value of not more than 10% for trawlers (Anon, 2005a; 2005b).

DISCUSSION

Our analysis shows that the bottom trawl fleets operating in the high seas contribute only small percentages of global marine fish catch and landed values, as was also found by Gianni (2004). The fleets consume a large quantity of fuel, which is subsidized by governments around the world. In fact, these subsidies represent the overwhelming portion of the financial transfers received by these fleets.

Expressing the numbers in percentage of the world's catch reveals that the HSBT of the 12 countries do not contribute much, and therefore should not subject the high seas ecosystem and species to such high risk. Simply put, the risk-return equation does not favor continued exploitation in the high seas by bottom trawlers.

There is at present two fora to which these findings are relevant (see Gianni, 2004):

i) WTO negotiations on global subsidies disciplines in agriculture and fisheries (see Khan *et al.*, 2006); and

ii) The ongoing debate at the U.N., where a proposal is being considered to establish a moratorium on high seas bottom trawling due to the damage to the habitats that trawlers cause.

Given the current profitability of trawlers, it appears that subsidies, in particular, fuel subsidies may prove to be the Achilles' heel of the deep sea trawl fleets: their huge fuel consumption makes them extremely sensitive to fuel price increases (Tyedmers *et al.*, 2005).

Thus, combining (i) and (ii) above, we believe that given continued increases in petroleum prices, many of the conservation goals of NGOs may be achieved by focusing their efforts on persuading governments not to increase fuel subsidies in particular, to these fleets (Pauly *et al.*, 2003). The key argument in favor of this stance is that – given climate change driven by the burning of fossil fuels – there surely is a better way for governments to spend money than by increasing subsidies to a fleet that wastes fuel to maintain paltry catches of fish, from highly vulnerable stocks, while destroying their habitat in the process.

ACKNOWLEDGEMENTS

We are grateful to the *Sea Around Us* Project, a Partnership of the Pew Charitable Trusts, for support. R. Sumaila also acknowledges the support of the European Community's Program for International Scientific Co-operation (INCO) through Contract 003739 for INCOFISH project, the Lenfest Ocean Program and the Marine Conservation Biology Institute. We also thank Gianni Matt Gianni for useful comments on an earlier draft of this paper.

REFERENCES

Anonymous, 2005a. Profitability in fishing and fish processing 2003. (Available at: www.statice.is/lisalib/getfile.aspx?ItemID=975)" (Statistics Iceland, 2005).

Anonymous, 2005b. Operating results of whole-year operated fishing vessels 13 meters and more, by fishery. Average per vessel. 2002. Available at: www.ssb.no/english/subjects/10/05/nos_fiskeri_en/nos_d321_en/tab/tab-52.html" (Statistics Norway, 2005).

Clark, C.W., 1973. The economics of overexploitation. Science 181, 630-634.

Clark, C.W., Munro, G.R., Sumaila, U.R., 2005. Subsidies, buybacks, and sustainable fisheries. J. Environ. Econ. Manage. 50, 47-58.

FAO, 1992. Marine Fisheries and the Law of the Sea: A Decade of Change. FAO Fisheries Circular No.853, FAO, Rome.

Froese, R., Sampang, A., 2004. Taxonomy and biology of seamount fishes. In: Morato, T., Pauly, D. (Eds.), Seamounts: Biodiversity and Fisheries, pp. 25–31. Fisheries Centre Research Reports 12(5). [Available at: http://www.seaaroundus.org/report/seamounts/08_RFroese/RF_TEXT.pdf].

Gianni, M., 2004. High seas bottom fisheries and their impact on the biodiversity of vulnerable deep-sea ecosystems: Summary findings. International Union for Conservation of Nature & Natural Resources. Available at: http://www.iucn.org/themes/marine/pdf/MattGianni-CBDCOP7-Impact-HS-BottomFisheries-Complete.pdf#search=%22Gianni%20high%20seas%22.

Gordon, H.S., 1954. The Economic Theory of common property resource: the fishery. J. Polit. Economy. 62, 124-143.

Khan, A., Sumaila, U.R., Watson, R., Munro, G., Pauly, D., 2006. The nature and magnitude of global non-fuel fishery subsidies. *In*: Sumaila, U.R., Pauly, D. (ed.) Catching more bait: a bottom-up re-estimation of global fisheries subsidies. Fisheries Centre Research Reports 14(6). Fisheries Centre, University of British Columbia.

Koslow, J.A., Boehlert, G., Gordon, J.D.M., Haedrich R.L., Lorance P., Parin, N., 2000. Continental slope and deep-sea fisheries: implications for a fragile ecosystem. ICES J. Mar. Sci. 57, 548–557.

Milazzo, M., 1998. Subsidies in world fisheries: a re-examination. World Bank Technical Paper. No. 406. Fisheries series, The World Bank, Washington, DC.

Morato, T., Watson, R., Pitcher, T., Pauly, D., 2006. Fishing down the deep. Fish Fish 7 (1), 23-33.

Morato, T., Cheung, W., Pitcher, T.J., 2006. Vulnerability of seamount fish to fishing: fuzzy analysis of life-history attributes. J. Fish Biol. 68, 209–221.

Pauly, D., Alder, J., Bennett, E., Christensen, V., Tyedmers, P., Watson, R., 2003. The future for fisheries. Science. 302, 1359-1361.