

# Towards Understanding the Impacts of the Pet Food Industry on World Fish and Seafood Supplies

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**Abstract** The status of wild capture fisheries has induced many fisheries and conservation scientists to express concerns about the concept of using forage fish after reduction to fishmeal and fish oil, as feed for farmed animals, particularly in aquaculture. However, a very large quantity of forage fish is being also used untransformed (fresh or frozen) globally for other purposes, such as the pet food industry. So far, no attempts have been made to estimate this quantum, and have been omitted in previous fishmeal and fish oil exploitation surveys. On the basis of recently released data on the Australian importation of fresh or frozen fish for the canned cat food industry, here we show that the estimated amount of raw fishery products directly utilized by the cat food industry equates to 2.48 million metric tonnes per year. This estimate, plus the previously reported global fishmeal consumption for the production of dry pet food suggest that 13.5% of the total 39.0 million tonnes of wild caught forage fish is used for purposes other than human food production. This study attempts to bring forth information on the direct use of fresh or frozen forage fish in the pet food sector that appears to have received little attention to this date and that needs to be considered in the global debate on the ethical nature of current practices on the use of forage fish, a limited biological resource.

**Keywords** Aquaculture · Forage fish · Low valued fish · Pet food industry · Trash fish

## 1 Introduction

Approximately 25% of the 106 million tonnes (metric tonne) of yearly global capture fisheries production is considered as forage fish (FAO 2007a), which is transformed, via

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reduction processes, into fishmeal and fish oil (Alder and Pauly 2006; Tacon et al. 2006). Over the last two decades, wild capture fisheries have been in a phase of stagnation that is thought to be a result of stock over-exploitation, weather changes related phenomena, and the consequent implementation of quotas to support the FAO Code of Conduct for Responsible Fisheries (Pauly et al. 2002; Walther et al. 2002; Shepherd et al. 2005; Alder and Pauly 2006; FAO 2007a). Consequently, the global fishmeal production has reached a plateau at around 6 million tonnes (Barlow 2002), and as a result of the incessantly rising demand for these commodities, the prices (Peruvian fishmeal, Peru 65%, FOB) have increased rapidly in recent years from US\$550 in January 2004 to approximately US\$1200 per tonne in October 2006 (INFOFISH 2007).

Recently, there has been a growing view that it would be possible to adopt a more logically correct and less wasteful utilization of forage fish than the current practices (Alder and Pauly 2006; Hasan 2008). The excessive exploitation of this limited resource has been criticized on the grounds that the raw material, the forage fish, could be better used for human consumption directly, particularly amongst the poorer nations of the world, in preference to utilizing the reduction industry products to produce high valued fish species destined for luxury markets (Naylor et al. 2000; Powell 2003; Aldhous 2004). Many cultured aquatic species, particularly carnivorous species, require fish or fish derived products (e.g., fishmeal) in their diets, and in this context the actual contribution of the aquaculture sector to global fish and seafood supplies has been criticized (Naylor et al. 2000).

The exploitation of forage fish by different sectors has been the object of several studies, and was recently reviewed by Alder and Pauly (2006) and Tacon et al. (2006). However, the past surveys analyzed primarily the trends of the utilization of forage fish that was transformed into fishmeal and fish oil, while the direct exploitation of raw, untransformed, forage fish has been overlooked. Recognizing this important but rarely addressed issue, recently, the Fisheries and Aquaculture Department of the Food and Agriculture Organisation of the United Nation (FAO) organized an expert consultation on the “Use of Wild Fish and/or Other Aquatic Species to Feed Cultured Fish and its Implications to Food Security and Poverty Alleviation” (Hasan 2008). The workshop developed 10 principles/guidelines for the utilization of wild fish in aquaculture, one of which was, “*formulation of policies related to the use of fish as feed should not exclude other users of this primary resource,*” and related to other users of forage fish (Hasan 2008).

The global aquaculture production in 2005 was 65.9 million tonnes with a farm-gate value of US\$ 74.3 billion, accounting for nearly 43% of all the aquatic foods consumed currently (FAO 2007b). However, the sector also negatively impacts on total fish availability as it has been, and still is, a major consumer of wild caught fish, primarily as fishmeal and fish oil. It has been estimated that in 2006, the aquaculture sector consumed approximately 3.06 and 0.78 million tonnes of fishmeal and fish oil accounting for 56% and 87% of the total global production of these commodities, respectively (Tacon 2007). However, the fact that in addition to the latter, a significant quantity of forage fish is also used in traditional terrestrial agriculture/animal husbandry (processed and/or also as raw forage fish by the pet food industry) has gone un-noticed.

Pet ownership is increasing globally. It has been reported that the increase of disposable income, together with increasing urbanization and associated attitude shifts, are responsible for the dramatic increase in pet ownership, such as for example in China (Zhuang 2005) and in developing countries in general (Bernstein 2005). Consequently, pet food is now one of the fastest growing products in world trade (Gehlhar and Coyle 2001) and the import/export global flow of pet food increased dramatically reaching 2.5, 3.7 and over 5 million tonnes in 1995, 2000, and 2005, respectively (FAO 2007c). The market for pet

food and pet care products has been reported to be growing at an annual average rate of 4% in value terms and reached US\$49 billion in 2003, with pet food representing about 80% of the global pet industry market (Combelles 2004a). Recent market research also reported that the pet food market has been experiencing a trend towards premium and super-premium products (Combelles 2004b). It has been hypothesized that pet owners are treating their companions progressively more as a family member, and consequently, expenditure on pet food is growing. Premium and super-premium cat food often include high content of chopped or whole forage fish such as pilchard and sardines, and in some instances even tuna.

This study attempts to quantify the quantum of forage fish directly utilized by the pet food industry in the overall context of forage fish utilization by different sectors, and contribute to a much needed dialogue in respect of the use of a limited biological resource for overall human benefit.

## 2 Methods and Data Analysis

The raw material used for the production of fishmeal and fish oil, the process popularly referred to as “reduction fisheries,” are termed variously, and range from forage fish, trash fish to low valued fish (De Silva et al. 2008). In this paper, the term forage fish is adopted. The reduction process and the major forage species used and other related aspects have been described previously (FAO 1986). Undoubtedly the efficacy of the reduction process technology has improved over the years but the basics remain unchanged. The data used in this paper are based on published information on fishmeal production (Tacon 2004; RSBP 2004; Tacon et al. 2006; FAO 2007b) and on the global production of food from animal origin (FAO 2007c).

In respect of the estimation of the use of forage fish in pet foods the numbers of registered pets (domestic cats) were utilized (Euromonitor 2007). Our research in a number of pet food outlets in a number of countries indicated that an increasing amount of premium and super premium cat food preparations claim to contain considerably high content of raw fish. However, pet food products carry only a list of ingredients in each preparation but not the quantities of each. As such, we utilized the information of an Australian study (Gooley et al. 2006) that indicated the amounts of ingredients used in cat food preparations in 2003 as the standard to extrapolate the amounts used elsewhere. Also, in using the above data, the two following assumptions were made: (a) in highly industrialized countries pet owners’ purchasing behavior is similar, and (b) only 20% of the cats in less industrialized countries are maintained on canned food. In view of the ambiguities in the data on pet ownership and the degree of use of industrially prepared can foods for the pets in the People Republic of China, we have opted to exclude China from the estimations. For example, the Chinese cat population in 2006 reported in the Euromonitor International database was 10,701,399,000 (Euromonitor 2007), but Zhuang (2005) in a report prepared for the same consulting agency (Euromonitor International Plc.) reported that the Chinese domestic cat population in 2004 was 291,315,000.

Consequently, as a precautionary measure, considering the risks associated with the use of unreliable data (Watson and Pauly 2001) and the difficulty in obtaining trustworthy data, in the present paper we will not attempt to estimate the global consumption of forage fish in the pet cat food industry. As such the present appraisal, not considering China’s contribution, is likely to be an underestimation.

### 3 Results

Recent data from Australia (Gooley et al. 2006) indicates that the Australian pet food industry in 2003 used 7,400, 10,500 and 15,700 tonnes of chunk fish, non-chunk fish and imported fish per year, respectively, totalling 33,600 tonnes valued between US\$3.4 and 6.3 million per year (US\$1 = AU\$0.65, average exchange rate in 2003). The cost of chunk fish utilized varied between US\$230 and 520 and non-chunk from US\$160 to 230 per tonne (Gooley et al. 2006). The above were used for the production of 83,400 and 27,900 tonnes of canned and dry feed, respectively, primarily for cats (Gooley et al. 2006), whose Australian population in 2003 was estimated to be 2.45 million, as registered pet-cats (Euromonitor 2007), equating to an average utilization of 13.7 kg of forage fish per cat per year.

It is reported that in 2006 there were 166,783,100 domestic cats within the highly industrialized countries (USA, EU, Japan, Canada, and Australasia), 69,711,600 domestic cats in the rest of the world (excluding People Republic of China). The total forage fish used in the cat feeds globally (excluding P.R. China) was estimated as 2,478,520 tonnes per year (Table 1). This estimate of 2.48 million tonnes of raw forage fish directly used for the production of moist canned food for domestic cats does not include the use of fishmeal in some other pet foods (e.g. dog feeds, dried cat feeds, croquettes and ornamental fish feeds) and the amounts utilized by the fur animal industry. On the other hand, it has been estimated that 585,000 tonnes of fishmeal was utilized by the pet and fur animal feed industry in 2002 equating to more than 2.9 million tonnes of raw fish (raw fish to fishmeal conversion 5:1), and it is expected to increase by 167% to 975,000 tonnes of fishmeal (approximately 4.9 million tonnes of raw fish) by year 2010 (RSBO 2004). The approximate proportions of forage fish used in different food production sectors and the pet food sector are given in Fig. 1.

The proportion used in the aquaculture sector is the largest. Aquaculture used 44.8% of the global forage fish catch (4 million tonnes as raw fish and 13.4 million tonnes reduced into fishmeal), followed by poultry and pig industries, 22.5% and 18.4%, respectively. Ruminant farming accounted only for 0.8% of total forage fish consumption (Fig. 1).

It has been estimated that in 2002, aquaculture consumed in total 17.4 million tonnes of forage fish. However, it is important to take into consideration that this consumption corresponds to a global production through the sector of over 32.2 million tonnes of finfish and crustacean (FAO 2007b), the only form of aquaculture in which forage fish and or fishmeal are utilized. Terrestrial animal husbandry accounted for a total utilization of 3.25 million tonnes of fishmeal (16.25 million tonnes of raw fish) (RSBP 2004; Tacon et al. 2006), which are used in the global yearly production of 260.1 million tonnes of meat, 626.4 million tonnes of milk and 63.3 million tonnes of eggs (FAO 2007c).

It is therefore evident that a significant quantum of the global wild fish catch, 5.40 million tonnes, is utilized not for human food production (unlike in the case of aquaculture and the terrestrial animal farming) with moist canned cat food accounting for 6% and other dry pet and fur animal production for 7.5% of the global forage fish catches.

### 4 Discussion

The proportion of wild caught forage fish used in the aquaculture sector, compared to the other food production sectors, is significantly higher. This is primarily a result of recent fast growth and production level reached by the aquaculture sector and, from a nutritional viewpoint, on the basic metabolism of fish, which depends on protein catabolism to obtain the basic energy needs (De Silva and Anderson 1995). Added to this is that the science of

**Table 1** The estimated yearly consumption of forage fish in the cat food industry

Country	Domestic cat population ( $\times 10^6$ ) <sup>a</sup>	Yearly forage fish consumption per cat (kg)	Total forage fish consumption per year for cat food production (tonne) <sup>b</sup>
The yearly consumption of forage fish in the Australian cat food industry in 2003			
Australia	2.450	13.71	33,600
Country	Domestic cat population ( $\times 10^6$ ) <sup>c</sup>	Yearly forage fish consumption per cat (kg) <sup>d</sup>	Total forage fish consumption per year for cat food production (tonne)
Estimated yearly consumption of forage fish in the cat food industry in 2006			
USA	82,239.5	13.71	1,127,856
EU	63,266.6	13.71	867,656.2
Japan	9,596.0	13.71	131,602.2
Canada	8,111.0	13.71	111,236.6
Australasia	3,570.0	13.71	48,960
P.R. China <sup>e</sup>	Reliable data not available	(Excluded)	(Excluded)
Rest of the World	69,711.6	2.74	191,209.0
All countries (P.R. China excluded)			2,478,520

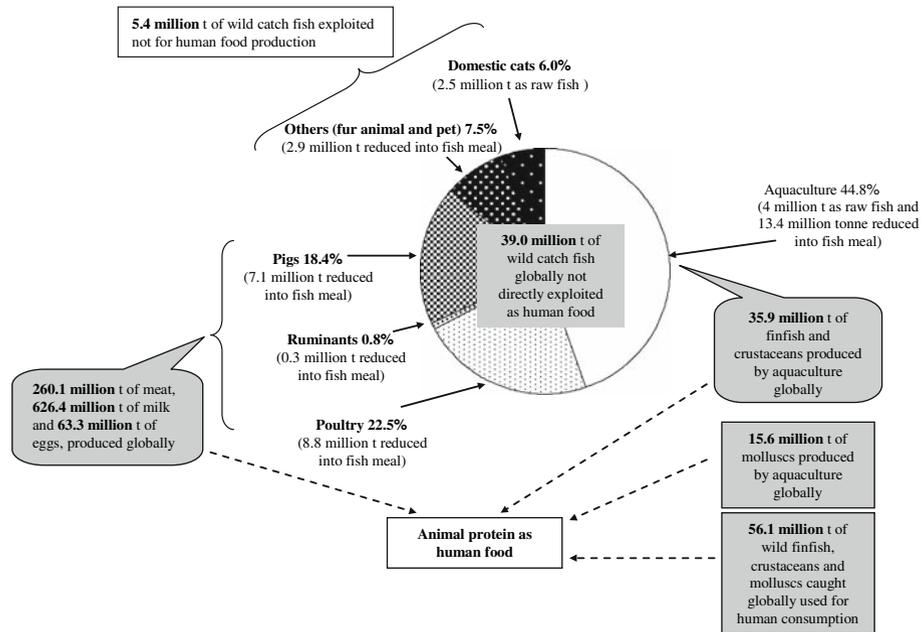
<sup>a</sup> The Australian cat population in 2003 (Euromonitor 2007)

<sup>b</sup> Import of forage fish for cat food production in 2003 (Gooley et al. 2006)

<sup>c</sup> Cat population per country in 2004 (Euromonitor 2007)

<sup>d</sup> Estimated yearly forage fish consumption per cat for highly industrialized countries (= 100% of the measured Australian value); estimated yearly forage fish consumption per cat for other countries (= 20% of the measured Australian value)

<sup>e</sup> P.R. China has been excluded by the present computation (data not reliable)



**Fig. 1** The global exploitation of fish not for direct human consumption. Total estimated exploitation of forage fish (expressed in live weight equivalents) in 2002 was 39.0 million tonnes. Values are expressed as % of total fish and million tonnes used by species/sector. A total 5.40 million tonnes of wild catch fish is estimated to be exploited by the pet and fur animal food production. The global production of food from animal origin in 2005 is also reported. Estimation of raw fish used for fishmeal production based on 5:1 conversion rate (Tacon 2004; RSBP 2004; Tacon et al. 2006; FAO 2007b, c; and present estimates)

aquaculture is relatively young and the strides made by the animal husbandry sectors in reducing the protein levels in the feed (hence less fishmeal) have not yet been attained in the former (Swick and Cremer 2001). This task is not made any easier given that the aquaculture sector deals with over 300 species (several of which are carnivores unlike omnivorous/herbivorous livestock), each with its own nutrient requirement (De Silva and Anderson 1995). On the other hand, it is important to underline that on the global balance of human food supplies, aquaculture in 2005 was also responsible for the production of 31.5, 4.4, and 15.6 million tonnes of finfish, crustaceans, and molluscs, respectively (FAO 2007b) and similarly the overall terrestrial animal farming activity supplies 260.1, 626.4 and 63.3 million tonnes of meat, milk, and eggs, respectively (FAO 2007c) (Fig. 1).

The reported data on Australian usage of raw fish for the pet food industry is an eye opener in two respects: firstly bearing in mind that the Australian pet population, amongst the developed countries, is considerably less than those of others such as the US, countries in the European Union, and Japan, in which cats are a popular pet. Secondly, the above forage fish utilization (13.7 kg per cat) far exceeds the Australian average per capita fish and seafood consumption, which is reported to be little more than 11 kg (ABARE 2005).

The point made here is that as much as concern is expressed about the use of fishmeal and forage fish in producing food for human consumption, in this instance for aquaculture, a very large, but globally un-estimated quantity of forage fish is being used by the pet food

industry. This fact for some unknown reason has gone unnoticed and unaddressed by fisheries and conservation scientists concerned with the over-exploitation of forage fish, and the more correct and ethical use of it.

The estimated forage fish consumption in the pet food industry brings to the forefront a much needed debate in an area that warrants further and urgent investigation. Other sectors that make use of wild catch fish for non human food production such as fur animal rearing, feed for ornamental fish and aquatic animals, and bait and attractants for recreational fishing, also need to be monitored.

Observing the present estimate of forage fish used by the domestic cat food industry and the salmon industry, an apparent paradox is evident. It has been reported that in 2002, the global salmon industry, against a consumption of 554,000 tonnes of fishmeal, accounted for a yearly production of 1,217,000 tonnes of highly valued fish for human consumption (Tacon 2004). On the other hand, the cat food industry utilized 2,478,520 tonnes of raw forage fish, which equates to the potential production of 485,887 tonnes of fishmeal. If we were to hypothesize this potential source of fishmeal to be used in the salmon industry, it can be anticipated a doubling of the global salmon production without impacting on wild pelagic fish stocks and/or needing any improvement in salmon feed utilization efficiency.

The authors here do also flag the need to reduce, significantly, the fishmeal and fish oil usage in aquaculture if it were to sustain in the long term. In this regard, it is important to note that all sectors associated with the aquaculture industry are making a concerted attempt to reduce the inclusion level of fishmeal/fish oil, primarily pushed by economic concerns, and discourage the use of forage fish (e.g., Gatlin et al. 2007). On the other hand, the pet food industry is proceeding towards a constant increase of production and producing and marketing premium and super-premium preparations. These gourmet pet foods contain a significant amount of fish as the primary raw material that may be suitable for direct human consumption, while different raw materials unsuitable for human consumption, such as the by-products of the fish filleting industry or other fishery products transformation and also terrestrial animal by-products, can be efficiently utilized by the pet food industry.

It is at this point important to testify that fortunately some dialogue is being initiated in this regard. As previously reported, recently the FAO organized an export workshop on the “Use of Wild Fish and/or Other Aquatic Species to Feed Cultured Fish and its Implications to Food Security and Poverty Alleviation” (Kochi, India, 16–18 November 2007) and one of the recommendation of this expert workshop to the FAO was that (Hasaan 2008):

It is recommended that FAO initiate the dialogue on the use of fish as feed between the different non-human food production sectors (aquaculture, livestock, pet foods, etc.) that use this resource, both globally and at the regional level. The objective is to build awareness and consensus on the ethical usage of finite fisheries resource.

## 5 Conclusions

The central issue is not an advocacy of pets versus aquaculture or other agricultural/animal husbandry activities, but the need for a more objective and a pragmatic approach to the use of a limited and a decreasing biological resource, for human benefit. There is a need to impress on sectors that utilize limited biological raw materials in a more judicious manner, as seen in the aquaculture sector, attempting to reduce its usage with suitable, readily available substitutions, for which unfortunately evidence is not forthcoming from other users, in particular the pet food industry sector.

The present attempt of estimating total forage fish consumption by the pet food industry is likely a cautious underestimation, and needs to be primarily considered as an eye opener. It is therefore evident that better, more reliable and accurate data relative to the actual forage fish exploitation by the pet food industry is urgently required, allowing the potential development of an informed debate on the ethical issues in forage fish exploitation and usage.

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