Volume 6 | Issue 10 | Article ID 2927 | Oct 03, 2008

On Meat, Fish and Statistics: The Global Food Regime and Animal Consumption in the United States and Japan

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The easiest way to compare dietary commonalities or peculiarities of individual nations is to check the food balance sheets that the UN's Food and Agriculture Organization (headquartered in Rome) prepares for virtually all of the world's countries (FAO 2008). These accounts are based on the best available national statistics of food production and trade and on the estimates of plant and animal harvests diverted to animal feeding, seed and other non-food uses or lost during storage and industrial processing. Their final tallies show per capita annual consumption of individual foodstuffs (in kilograms) and daily intakes of food energy (in kilocalories) and dietary proteins and fats (both in grams). Perhaps the most obvious measure of dietary affluence is the average consumption of animal foods eaten for their special tastes and distinguished in nutritional terms particularly because of their relatively high content of perfect protein.

All proteins, be they of plant or animal origin, have all essential amino acids that are required by human metabolism in order to produce our body proteins -- but no plant proteins have the ideal ratio of these amino acids. Most important, all cereal proteins (in wheat, rice or corn) are deficient in lysine while all leguminous proteins (in peas, beans, lentils or soybeans) have suboptimal amounts of methionine. Careful combination of cereal and leguminous foods can satisfy the overall protein requirements -- but it is easier, and for most people more enjoyable, to consume animal foodstuffs with their perfect proteins. When looking at the two most obvious indicators of a national animal food supply -- at the total annual per capita availability and at the average daily protein supply derived from animal foods -- the US rates appear to be far above the Japanese numbers.

In 2003 (the latest year for which FAO's food balance sheets are available, with 2005 figures coming soon) America's annual supply of animal foods amounted to 427 kg/capita compared to 196 kg/capita in Japan (more than a twofold difference) and these totals corresponded to daily per capita food availability of 73 g in the US and 51 in Japan, a difference of 50%. Total meat supply (red meat, poultry and edible offal) was about 123 kg in the US and only 43 kg in Japan. By contrast, the total seafood (fish, crustaceans and other marine species) amounted to 21 kg in the US and 66 kg in Japan. But if you were to consult the annual statistics published by the US Department of Agriculture you would find the latest (2004) annual meat supply rate at just 84 kg/capita (USDA 2008), and that of seafood at 7 kg; correspondingly, Japan's Ministry of Agriculture, Forestry and Fisheries put the 2004 meat and seafood availability means at, respectively, just 28 kg and 35 kg (MAFF 2008).

Fortunately, these are only apparent disparities as FAO's balance sheets assess animal carcass weight and total seafood supply (landings and imports) while the USDA and MAFF statistics express the supply in boneless meat available at the retail level. Note that the ratios for the two ways of accounting for meat supply are

virtually identical for both countries (the latter is 68% of the former in the US and 65% in Japan) while the value for seafood is lower in the US (33% of landed catch ending as retail) than in Japan (where about 53% ends in the final distribution category). This difference is easily explained by Japan's much higher consumption of cephalopods (squid and octopus) and a much higher share of processed fish products made by using virtually the entire fish (*yaki-chikuwa*, *kamaboko, age-kamaboko*). Following the approach preferred by the USDA as well as by Japan's MAFF we end up with the total supply of animal foods available at the retail level at about 385 kg/capita in the US in 2004 and 175 kg/capita in Japan for the same year (Fig. 1). These totals translate to daily animal protein availability of approximately 75 g vs. 50 g/capita. For comparison, protein shares of all lean meats as well as of all commonly eaten seafood are around 20% of the raw weight (but squid is only 16% while tuna has up to 25%), while eggs have about 13% and whole milk 3.5% of protein.

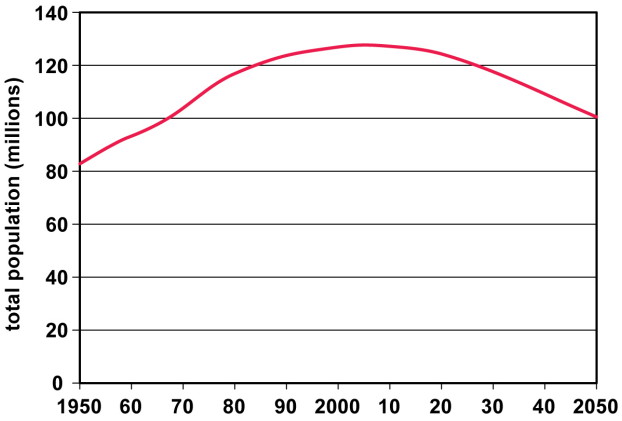

Figure 1. Animal per capita food consumption in US and Japan (kg/year). Plotted from data in USDA (2008) and MAFF (2008).

By these accounts an average American, whose annual supply of animal foods weighs 2.2 times more than that of average Japanese, makes a considerably higher claim on the world's food resources. But the reality is different. A closer look should consider the origin of these foods and the efficiency with which they are produced: the most obvious distinction is between foods that do not require the killing of animals (all dairy products and eggs) and those that are produced by killing mammals, birds, fish or invertebrates after they reach their slaughter weight or are caught in the wild. America's high consumption of milk and dairy products (274 kg/capita in 2004) and moderate eating of eggs (about 15 kg/capita) mean that about 73% of the total weight of its animal foods and about 40% of all animal protein supply does not require killing animals. In contrast, in 2004 the two corresponding shares in Japan were 10% lower at, respectively, 63% and 30%.

But two much less obvious adjustments bring an even greater change. Feeding domestic animals is a far more inefficient way of using plant biomass than eating it directly: for example, it takes about four kilograms of good feed to produce a kilogram of chicken meat, for boneless lean pork the ratio is around 10 and there is an even higher ratio for beef depending on how much time an animal spends on pasture and in a finishing feedlot (Smil 2008; Fig. 2). We are willing to incur these energy losses in order to eat high-quality animal protein –- but we do not have to kill other animals in order to produce broilers or pork chops. In contrast, many species produced by modern aquaculture are carnivorous species (salmon, seabream, seabass, amberjack, bluefin tuna) that must be fed other marine organisms, and some ocean species are also used as feed in protein supplements for land animals. With the landings of nearly 1.5 million t/year Japan's aquaculture is now the fifth largest in the world (FAO 2006). As a result, in 2003 about 27% of Japan's total supply of seafood was used as feed compared to less than 9% in the US. Adjusting just for this capture for domestic uses (and not counting the feed fish used to produce carnivorous fish produced abroad and exported to Japan) made

for total landings and imports of about 92 kg of marine species in Japan and 23 kg in the US.

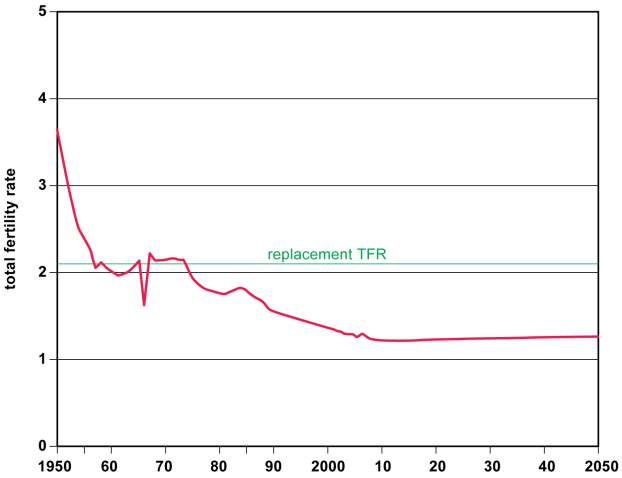

Figure 2. Typical efficiencies in animal feeding (Smil 2008).

According to the FAO, by 2007, 43 percent of all fish catch came from aquaculture.

And when broilers or pigs are ready for slaughter no other animal species end up as collateral kill. In contrast, fishing for particular species always entails considerable amount of by-catch most of which is simply discarded over board. This by-catch contains both unwanted species not targeted by a fishery as well as the desirable commercial species that are under the allowable size, over the permissible catch quota or simply not valuable enough in comparison to the principal catch. The best available review of by-catch, based on some 800 studies, showed its worldwide mean to be about 35%, with specific rates ranging from less than 10% for cephalopods, more than 60% for redfish and basses, 75% for flounders and soles, more than 80% for eels, nearly 250% for crabs to more than 500% for shrimp (Alverson et al. 1996). A recent detailed analysis of by-catch by small trawlers in the Ariake Sea (the largest bay on the western coast of Kyushu) indicated a very similar rate of about 33% (Hirai and Nishinokubi 2004).

Given the inherently great variability of these estimates, as well as the fact that recent improvements in fishing methods have undoubtedly lowered many by-catch ratios, I will assume the by-catch ratio of no more than 30%. And given the even greater ranges of discard mortality estimates –- ranging from lows of just a few percent to highs of more than 80% or even 100% for such different species as halibut, king crab and salmon (Alverson et al. 1996) –- I will assume, very conservatively, that just half of the discarded by-catch does not survive the violent experience. With this dual (by-catch/discard mortality) adjustment Japan's overall claim on seafood amounted to about 106 kg/capita compared to about 26 kg/capita in the US. When adding the corresponding rates of overall meat supply (123 kg/capita in the US and 43 kg/capita in Japan) we end up with an identical rate of animal foods whose consumption requires killing the animals, roughly 150 kg/capita.

American culture is, of course, principally an overseas extension of Judaeo-Christian beliefs that include the human dominion over all living creatures and that entail a number of dietary rules but no absolute proscriptions of carnivory.

In contrast, the Buddhist faith is one of Japan's ancient cultural pillars and *ahimsa* -- defined by Vyasa's commentary on *Yoga Sutras* as "the absence of injuriousness (*anabhidroha*) toward all living things (*sarvabhuta*) in all respects (*sarvatha*) and for all times (*sarvada*)" –- is one of that faith's cardinal tenets (Chappel 1993). Moreover, there used to be various ShintÅ taboos on the eating of cattle, horses and particularly of fowl, which were seen as announcers of dawn rather than a source of food, and these taboos were generally respected until the 15th century (Ishige 2000).

Gradually, and after 1945 rather precipitously, everything changed. Japan is now one of the world's leading importers of horse meat even as horse slaughter is seen as highly objectionable or has been outlawed in Western nations (I hasten to add that the total horse meat consumption of some 15,000 t/year amounts to less than 0.3% of the total domestic meat supply). More importantly, much more beef would be eaten if it were less expensive, and fowl is now more fit for KFC or home consumption than for announcing dawn. And above all, as I have demonstrated, Japan's quest for animal protein now operates -- surprisingly and counterintuitively –- on a level comparable with the intensity of American carnivory. And because it is Japan's seafood consumption that makes the key difference, one more adjustment is in order, a qualitative one that cannot be converted to numbers.

Of course, the westward expansion of America's cattle-based agriculture was one of the key factors leading to the demise of the continent's enormous herds of wild buffalo during the 19th century and the feeding of large numbers of domestic animals puts great pressure on the country's soil quality and water. Intensive monocultural feed production (corn after corn) leads to increased soil erosion and the concomitant loss of organic matter that is not adequately replenished because cattle feeding is increasingly concentrated in giant feedlots). Water availability is affected due to more frequent irrigation and its quality suffers due to higher nitrate run-off (now affecting even the coastal waters of the Gulf of Mexico). Moreover, intensive feed cultivation also requires high-energy inputs, directly to fuel machinery and indirectly to make and transport it and to synthesize fertilizers, herbicides and pesticides. But America's current meat-centered agriculture does not result –- unlike Japan's truly global quest for every imaginable kind of seafood –- in massive decline of wild species.

Most US cattle are raised in feedlots.

Until 1952 Japan's fisheries were limited by MacArthur's restrictions to sectors in the western Pacific; by 1970 expansion of distant operations brought the catch from most of the Pacific as well as from the Indian Ocean and from the Central Atlantic, and by 2000 catches and imports came from virtually every major fishing area, including the Antarctic waters (Swartz 2000). The world's oceans are, literally, vacuumed to bring scores of common and exotic marine species to Tsukiji (Bestor 2004) and to Japan's other major trading centers (Fig. 3). Among the species that have been particularly endangered by Japan's overfishing are most kinds of tuna (particularly the largest bluefins used for *sashimi* and *sushi*) and the family of groupers and sea breams. During the past two decades the pressure on bluefins has also increased because of increasing popularity

of *sushi* in North America, Europe and Australia.

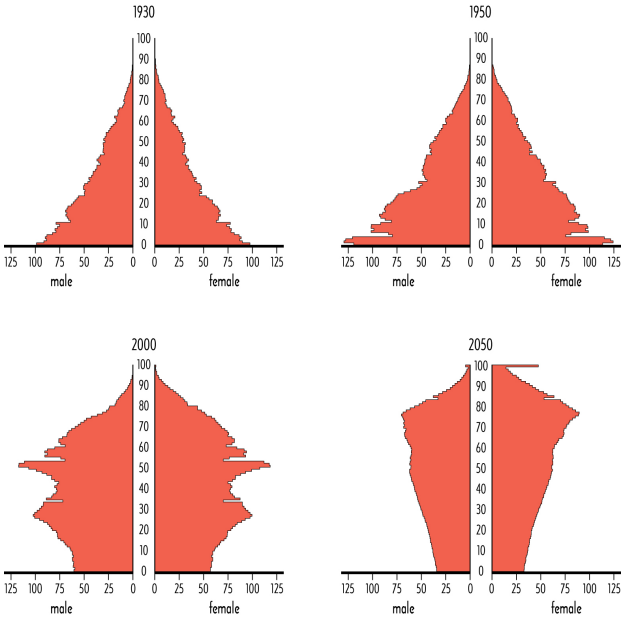

Figure 3. The origin of fish consumed in Japan in 1950 and 2000 (t/km2). Reproduced from Swartz (2000).

Tokyo's Tsukiji, the world's largest wholesale fish market

This brief comparison of two very different meat- and fish-eating systems ends up with very similar conclusions. America's pattern of excessive red meat and poultry consumption cannot be extended to the rest of the world. The US population is now less than 5% of the world total but it consumes nearly 15% of all terrestrial meat. If a similar level of consumption were to be replicated worldwide there would not be enough high-quality feed (corn and soybeans) to produce so much poultry, pork and beef; moreover, the requisite energy needs would further tax the global supply of hydrocarbons and the combustion of these fuels would increase the overall CO_2 emissions while larger ruminant herds would produce more methane, a more powerful greenhouse gas than is CO_2. And high levels of meat intake would be problematic even if the environmental impacts of intensive animal husbandry were kept to a minimum: international comparisons indicate that extraordinarily high levels of carnivory contribute to high rates of overweight, obesity and common chronic diseases.

Japan's claim on oceanic protein is relatively even greater than America's share of global terrestrial meat eating: the country with not even 2% of the world's population now consumes more than 8% of the global landings of all seafood and this overconsumption cannot serve -- notwithstanding all the talk about the nutritional desirability of eating fish -- as a model for any populous modernizing nation because all of the world's major fishing regions are either already overfished or their exploitation is very close to maximum sustainable capacity. Japan and the United States, so different in so many ways, share this important, and unenviable, common attribute: they have both overreached in their quest for animal protein and their ways of, respectively, meat and fish eating are neither sustainable nor

replicable by nations seeking to expand protein consumption. Many developing countries properly aspire to increase consumption of high-quality animal protein but they can best secure it by consuming more dairy products, more eggs and more aquacultured herbivorous fish, not by following either the American or the Japanese way of protein consumption.

This is, of course, not the only case of disproportionately large claims that the affluent nations make on the global commons: they consume excessive shares of virtually all basic natural resources (from fossil fuels and mineral ores to wood and water) and generate commensurately high shares of solid and liquid wastes, air pollutants and greenhouse gases. Global convergence toward a high-consumption mode typified by the US and Japan is a physical impossibility on a planet with finite resources. The only hope for a more equitable sharing of the world's natural resources, and for the reduction of the deleterious environmental consequences of their use, is in moderating the rich world's reach in order to allow for higher per capita claims by the modernizing nations. Although this appears to be the only rational solution (only some fabulous technical breakthroughs that would provide us with unlimited amounts of inexpensive energy would open another path toward more equitable modernization) its adoption is by no means certain and future generations will most likely see more inequality, more conflicts and more destruction of the global commons.

Vaclav Smil is Distinguished Professor, University of Manitoba, Canada. His interdisciplinary research has roamed broadly over issues of environment, energy, food, population, economics, and policy studies. His recent books include Global Catastrophes and Trends: The Next Fifty Years *and* Energy in Nature and Society: General Energetics of Complex Systems*.*

This article was written for Japan Focus*. Posted on October 19, 2008.*

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