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FOOD, WATER AND SECURITY: WHAT ARE THE CONNECTIONS?

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Food, Water and Security: What are the Connections?

ALAN DUPONT

Food, like the soil, water, and atmosphere that sustain it, is a renewable resource. As with all resources food is linked to security by scarcity but the idea of 'food security' has many different interpretations. The UN World Food Programme defines food security to mean that 'all people at all times have access to safe and nutritious food to maintain a healthy and active life. Others, like Indra de Soysa and Nils Petter Gleditsch (1999), focus on agriculture's importance in alleviating poverty and the subsistence crises that drive internal conflicts in developing states. In their view, 'the inability to meet food requirements and other basic needs drives people to adopt alternative survival strategies, one of which is to join rebellions and criminal insurgencies.' The traditional security literature, on the other hand, is more concerned with the possibility that food-rich states might use food as a 'weapon' in pursuit of foreign policy goals, reflecting a wider, historical concern about dependence on foreigners for strategic resources (Christensen 1977).

What is the Concern about Food Security?

While all these themes feature in the contemporary debate about food security the overriding concern is that population growth, environmental degradation and rising demand for a range of essential foodstuffs will lead to future food shortages that could result in widespread political and social unrest. The world is expected to consume twice as much food in the next 50 years as it has in the past 10,000 years. In order to meet this need, world grain production will have to increase 40% by 2020. Some food economists believe that this target can be comfortably met through trade and the promise of modern biotechnology, exemplified by advances in genetically modified (GM) food. However, there is good reason for caution, if not scepticism, about

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such best case scenarios. The corrosive effects of environmental degradation on agriculture and the fishing industry are often underestimated and just as frequently ignored. There has been a steady fall in grain yield increases since the spectacular improvements in productivity recorded during the agricultural 'green revolution' of the 1960s and 1970s and many species of fish, which are a vital source of protein, are over-exploited or in decline. East Asia's food problems are a microcosm of those of the developing world. The ability of East Asian governments to feed their people will have a major bearing on global food security because of the region's size, population and geostrategic importance.

Today's food security anxieties are redolent of those of an earlier era when there was also much apprehension about the emergence of a gap between future global food production and consumption. As populations began to soar in developing countries, and incomes rose in the wealthy, it was argued that more grain would be needed both as a food staple and to feed the growing demand for animal protein associated with more affluent diets. If these demands could not be met, there were fears that violent conflict over diminishing food supplies would result. A major 1974 UN conference on food held in Rome captured the prevailing mood of the time. Pessimists predicted that steeply rising food prices and free-falling food stocks were harbingers of a looming food crisis that would result in mass starvation in the absence of urgent remedial action.

None of this came to pass, however, largely because the green revolution dramatically improved crop yields in the developing world. Confounding the predictions of pessimists, food production actually outpaced population growth by 20% in the thirty years after 1960, causing average food prices to fall by 60% in the same period. Both seafood and grain output registered healthy increases. The seafood catch went from 22 to 100 million tonnes between 1950 and 1990, while grain production virtually quintupled in the 20th century, from 400 million tonnes in 1900 to just under 1.9 billion tonnes in 1998. Much of this increase was due to the expansion of agricultural land and technological advances in farm machinery, higher yielding grain varieties, the use of fertilisers and the spread of irrigation. Chemical fertilisers accounted for 40% of the growth in grain production while land under irrigation has increased six-fold since 1900 (Brown 1995).

By the mid-1990s, however, the green revolution had largely run its course. Agricultural and marine yield increases had begun to slow or stagnate, while demand continued to spiral upwards. In 1994, only four years after record global grain and marine harvests, the UN observed that:

'Global agriculture's steady gains in production over the past

several decades have not fully overcome the problem of rising demand caused by soaring population growth and uneven production progress among regions. The challenge is immense: by the year 2050, global demand for food may be three times greater than today. Moreover, during the past two decades the production growth rate has declined, dropping from 3 percent annually during the 1960s, to 2.4 percent in the 1970s and finally to 2.2 percent in the 1980s. In 1991, global agricultural production actually fell, the first decline since 1983...'(World Resources 1994–95).

The UN's Food and Agricultural Organization (FAO) reported in 1996 that per capita food production had declined in over 50 developing countries since the mid-1970s, while food imports had increased. In the same year, the Rome Food Summit reminded the international community that, despite optimistic predictions made by Henry Kissinger in the 1970s, that within a decade no child would go to bed hungry, some 840 million people still suffered from malnutrition. Without more determined action, 680 million people are forecast to be without sufficient food to meet their basic nutritional needs in 2015. Population pressures account for some of the decline in per capita food production while rising living standards have increased the overall demand for food, especially grain. By the late 1990s, crop yield increases had begun to level off as technology was diverted to the higher priority areas of information technology, telecommunications and urban infrastructure. After rising by 38% in the three and a half decades between 1950 and 1984, per capita grain production declined by 7% between 1984 and 1998. Demand, on the other hand, continues to climb. As a result, net cereal imports by developing countries will probably need to almost double by 2025 to around 200 million tonnes while meat will have to increase eightfold.

Environmental degradation has played a central role in slowing the growth in food productivity by reducing the global 'carrying capacity' of the land and sea, defined by Paul Ehrlich as 'the number of people that the planet can support without irreversibly reducing its capacity to support people in the future'. Rampant commercial and industrial development, soil erosion and loss of soil fertility through over-logging and intensive pesticide use have led to the steady disappearance of farmland. It has been estimated that nearly half the 29 million tonnes gained every year from advances in technology and investments in irrigation, fertiliser and other inputs, is lost because of environmental degradation. Since 1981, the area given over to grain production has shrunk from 732 million hectares to 690 million hectares, while the per capita grain area has halved. Protein derived from fish and other marine resources is under threat from pollution and over-fishing. Less

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water is available for irrigation globally because of falling water tables and the insatiable demand of urban dwellers and industry for fresh water. The green revolution ultimately petered out because it transgressed many of the principles of sustainable development. There was too much reliance on irrigation, chemical fertilisers, pesticides and expensive farm equipment that were not compatible with the environment or the needs of poorer countries.

East Asia's Food Situation

Food availability in East Asia has closely paralleled global trends. From 1960–1990, food production exceeded population growth. Grain output doubled in China, Indonesia, the Philippines, Vietnam and South Korea in the twenty years between 1970–1990 and East Asian cereal production averaged 270 kilograms per person, 46 kilograms more than the world average. Asia increased its share of world cereals by 8% in 1966–1990, from 33% to 41%, and rice yields rose by over one third, from 2 tonnes to more than 3 tonnes per hectare. However, these gains slowed significantly during the 1990s. At the end of the decade over 500 million Asians did not have enough to eat, due to chronic poverty, population pressures on agricultural land and environmental degradation (Takahashi 1997).

Although less important than it once was, rice is still a vital food staple providing 60% of the carbohydrate and second class protein consumed by Asians. By 2020, East Asia will need to produce 50% more rice than it did in 1998, but the region's rice yields have levelled off or declined from their peaks in the 1980s. Asian rice production in 1998 was 526.3 million tonnes, 16 million tonnes less than 1997, a fall which prompted a warning from the FAO that the region's food security is precariously balanced. Few regional states seem likely to achieve self-sufficiency in rice. Population growth in the Philippines is expected to outpace rice production early this century. Domestic shortfalls have forced Manila to import increasing quantities of rice since the late 1980s. After briefly attaining rice self-sufficiency in the mid-1980s, Indonesia has returned to its previous position as the world's largest importer of rice as well as becoming an expanding market for other food staples. By 2025, China may have to import as much grain as the world produced in 1998.

Fears about the impact of China's rising demand on world grain markets lie at the heart of the debate about food security in East Asia. Lester Brown, the iconoclastic President of the Washington-based Worldwatch Institute, argues that China may soon emerge as 'an importer of massive quantities of grain—quantities

so large that they could trigger unprecedented rises in world food prices.’ As China’s consumption patterns change and the Chinese eat more livestock products and grain, subsequent price rises will overwhelm global markets, causing widespread shortages and ‘an unprecedented degree of insecurity’, especially in the developing world. Thus food scarcity, ‘rather than military aggression’ will become the principal threat to security. (Brown 1995)

In support of these conclusions, Brown points to the four-fold expansion of China’s economy since 1979. Never before in human history have the incomes of so many people expanded at such a rate. As incomes rise, China is beginning to follow the same pattern of consumption as wealthier Japan, Taiwan and South Korea, all of which diversified their diets away from a starch staple, rice, to one that included much greater consumption of meat, eggs, milk and other livestock products. However, it takes two kilograms of feed grain to produce a kilogram of poultry; pork requires four kilograms of feed and beef needs seven. Brown calculates that if 1.2 billion Chinese eat more of these products, as seems likely, the country’s grain imports will outstrip the world’s exportable level of grain, driving up prices. ‘In an integrated world economy, China’s rising food prices will become the world’s rising food prices. China’s land scarcity will become everyone’s land scarcity.’

Brown is not the only one to take a pessimistic view of China’s capacity to feed itself. The Czech economist, Vaclav Smil, has documented in considerable detail China’s loss of farmlands to environmental degradation. Smil calculates that 40 million hectares of farmland have been denuded since the 1950s, approximately the equivalent of all the fields in Argentina and enough to feed 350 million people. With one-fifth of the world’s population, but only one-fifteenth of its arable land, China can ill afford losses of this magnitude. Changing farming practices, such as substituting synthetic chemicals for natural fertilisers, have exacerbated the problem by moving ‘China’s agroecosystem further away from sustainable practices’ (Smil 1996). Even Beijing concedes that a land crisis is approaching as farmland loss reaches record levels. In February, 1995, Jiang Chunyun, a member of the Communist Party Central Committee conceded that: ‘In the long run, China’s agriculture faces, on the one hand, the tremendous pressure of population growth and fast improvement in living standards and industrialisation and, on the other, the severe restrictions imposed by a dwindling farmland, shortages of water resources, and a weak infrastructure.’

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Is a Food Crisis Likely?

Although recognising that ensuring sufficient food production is a long-term challenge, the Chinese Government has hotly disputed Brown's contention that the country is on the verge of a food crisis and points to the bumper grain harvests the country enjoyed at the end of the 1990s (Information Office 1996). In 1999, Premier Zhu Rongji optimistically declared that China had put an end to the situation of chronic grain shortages. Chinese spokesmen have complained that Brown's arguments are merely a further example of the West's reluctance to come to terms with China's rising power. Most Chinese economists, while agreeing that demand is likely to rise roughly in line with Brown's forecasts, contest his judgement that there is little scope for increases in grain production. They argue that China only has to lift its annual production of grain by 1%, which would see grain production rise from 500–640 million tonnes by 2030 when the country's population reaches its peak population of about 1.6 billion. In their assessment this target is attainable from either an economic or technical point of view based on the past performances of the country's agriculture and the potential of resources. The Chinese predictions are generally in line with those of the majority of international food economists. The consensus of these experts is that while developing countries will increasingly become net importers of food, there will still be an increase in global food production into the 21st century, with cereals expected to grow at a rate of about 1.5 % per annum. Pessimists, on the other hand, believe that the growth in cereals will not exceed 1%.

Brown's focus on trends in grain production obscures the fact that China has been a net exporter of food since the mid-1980s, more than offsetting its imports of grain. The country's net food exports were valued at \$2.3 billion in 1985 and had increased to \$3.8 billion in 1995. By the mid-1990s, China imported only 0.4 % of its annual grain requirements, down from 3% in the early 1980s. Grain imports are expected to rise to somewhere between 5 and 10 per cent of demand but they will be offset by increases in the production of other agricultural commodities. There is, therefore, considerable reason to question the worst case predictions of a major food crisis developing in China and other developing East Asian states. Given sufficient political will by governments, and financial incentives for farmers, shortfalls in food production could be avoided. The US Department of Agriculture has argued that, were China to adopt world-class agricultural technology, it could improve yields by as much as 30%. The Chinese government calculates that 10 per cent of the nation's grain crop is lost due to mishandling and inefficiencies in administration and distribution; other analyses put the losses as high as 30

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%). If Beijing can halve these losses, it could reclaim 20 million tonnes annually for consumption by 2030.

While Brown and his fellow pessimists may have overstated their case there are, nevertheless, grounds for concern that the balance between supply and demand is more delicately poised than many food economists are prepared to admit. At first glance, the apparently small discrepancy between low and high estimates of cereal production seems relatively minor and hardly the basis for concerns about the world's ability to feed itself. However, the difference becomes quite critical when compounded over several decades, producing a far less sanguine food outlook than optimists envisage. Chinese estimates of future grain output exceed those of many independent studies by a sizeable margin while its projections for grain imports are understated. A major Sino-US research project on China's future food, which reviewed the major models used to calculate Chinese grain needs, concluded that China will need to import increasingly large quantities of food over the next 25 years.

Highlighting the uncertainties about making accurate long-term food projections, given the number of variables involved, the project nevertheless assessed that China would be forced to import between 50–200 million tonnes of grain a year by 2020. Since the current world grain market averages around 200 million tonnes, China's grain requirements will clearly have a major impact on the world grain market. China cannot be self-sufficient in food grain as well as feed grain and livestock. With demand for beef, pork and poultry all rising there will have to be a trade-off between grain self-sufficiency and domestic meat production. Chinese subsidies costing nearly \$25 billion keep the cost of domestic grain artificially high and obscure the fact that a large percentage of Chinese grain exports bring in only about one third of what they actually cost to produce. Millions of tonnes of Chinese hybrid rice are barely edible and go to waste. (Asia 2000 Year Book)

The FAO believes that China and East Asia's looming food shortfalls could be met by increasing domestic production and earning sufficient foreign exchange to import the rest. However, relying on the market carries its own risks. It assumes that the export earnings of regional states will be sufficient to meet the cost of importing food. As the Asian economic crisis demonstrates, sudden economic collapse and deteriorating foreign exchange rates may preclude the import of expensive foreign food. In addition, food projections are particularly sensitive to the assumptions on which they are based. For example, a 10% fall in expected wheat yields, or a 20% increase in rates of population growth

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would probably result in a price rise of 30% in the cost of wheat (Hunter 1997). Relatively small changes in world output may thus generate large changes in volume and price fluctuations. As the gap between global supply and demand for a range of primary foods narrows, price volatility on world markets is likely to increase and will be exacerbated by the reduction in food stockpiles mandated by the implementation of the Uruguay Round Agreement. Without the moderating influence of substantial grain stocks, a confluence of unfavourable political, economic and climatic influences could create local scarcities. Higher prices weaken current accounts as governments strive to maintain prices at affordable levels in order to avoid sparking food riots and domestic unrest. This was precisely the situation Indonesia faced as the economic crisis took hold in early 1998, eventually forcing President Suharto's resignation.

Food economists are inclined to ignore or discount the widely different national approaches to food security. For historical and cultural reasons Asian states commonly equate minimum levels of food self-sufficiency with national security. China and Japan, for example, promote measures aimed at achieving self-sufficiency in basic foods, especially rice, and rely upon strategic food stockpiles to manage price fluctuations. As one Chinese economist has argued 'it is imperative for the government to ensure a high rate of grain self-sufficiency as a necessary condition for stability'. With a rural labour workforce of 400 million and mindful of the lessons of its own history, China sees grain production as crucial to maintaining the incomes of farmers and stimulating employment in the countryside. Japan, although an inefficient producer of many primary foodstuffs, has resisted fully opening its agricultural markets for domestic political and security reasons. Food security is considered so important that it has been designated as one of the six major policies designed to achieve comprehensive national security. East Asia's approach to food is further complicated by its symbolic and cultural importance. Rice is seen by many Asians as possessing a 'spiritual' quality that transcends its simple nutritional function.

The more optimistic forecasts of East Asia's future food production have failed to factor in the detrimental effects of environmental degradation. More than a quarter of Asian farmland is either moderately or severely degraded, 'the victim of over-cultivation, soil erosion, salinisation of irrigated lands and desertification' (Rambo 1997). By one estimate China alone loses 12 billion kilograms of food each year from polluted farmland. Even if it were possible to put more land under cultivation the increase would be marginal and add little to levels of food production. Biotechnology is the key to improving yields and

reducing the cost of expensive fertilisers and pesticides. Genetically modified organisms (GMOs) offer the promise of higher yielding crops that are disease resistant and require minimal or no pesticides and chemical fertilisers. They may also be genetically enhanced to include nutritional supplements for communities that are deficient in vitamins and iron. Although the East Asian track record in using and adapting biotechnology is poor, GM crops are probably the region's best hope of reversing falling yields and attaining the order of magnitude increases in food production that will be required this century. Modern transgenic technology is particularly suited to the tropics because it can help to reduce the huge crop losses (often amounting to 30%) from insects and plant disease.

However, it is doubtful whether biotechnology is yet capable of creating another green revolution. The main contribution of genetic research to agriculture in the foreseeable future will be to make plants more resistant to disease. Despite impressive advances, current biotechnology is beginning to approach the upper limits of the yield increases that can be obtained in cereals. Although new rice strains being developed at Los Banos in the Philippines are expected to improve yields by 10–25%, increases of this order are still well short of the 250% gain in yields obtained in the second half of the 20th century and they may not be enough to arrest the decline in per capita grain production that has occurred in the 1990s. So far only the United States, Argentina and Canada are making extensive use of GM seeds. The backlash against globalisation that was evident at the 1999 World Trade Organization Meeting in Seattle suggests that GMOs are likely to be aggressively opposed by a coalition of environmental groups, NGOs and some European governments. Opposition to GMOs has already spread to East Asia. Although China and Singapore look set to wholeheartedly embrace the new technology, consumer movements and leftist groups in Japan, Thailand and the Philippines are demanding controls on the use of genetically modified crops, while religious factors may proscribe their use in Muslim Indonesia and Malaysia.

Perhaps the greatest constraint on future food production will be the availability of water for irrigation. The expansion of land under irrigation has been a boon to agriculture and a major factor behind the impressive rates of growth in grain production recorded during the 20th century. In the first half of the century, irrigation doubled from 48–94 million hectares, and then virtually tripled again to 260 million hectares by the end of the 1990s, allowing multiple cropping, higher yields and turning previously arid areas into productive farmland. Irrigation now accounts for some 40% of world food production. However, irrigated land per

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person has declined since 1978 and will continue falling for at least the next half century because of population growth and natural limits to the amount of usable water. Water tables are dropping across the globe and major rivers are beginning to run dry before they reach the sea as their flows are tapped for hydro-electric power and irrigation.

The reduction in the water flow of China's Yellow River is a warning of the fate that awaits other major river systems in Asia should usage exceed sustainable levels. The Yellow River provides a significant proportion of central China's irrigation requirements and food production. After flowing uninterrupted for thousands of years the Yellow River ran dry in 1972 for the first time in recorded history and then flowed intermittently in every year between 1985 and 1997. Water shortages are likely to affect food production in East Asia more than any other region of the world because of the greater dependence of Asian states on irrigation for growing rice and cereals. China, for example, relies on irrigation for almost 70% of its grain harvest. In an era of declining water availability East Asian governments will have to carefully choose how they allocate what was once an abundant resource. In a contest between agriculture and industry, the other main user of water, agriculture may be the loser because water used for irrigation generally produces a smaller economic return than water diverted to industry.

Food Shortages in North Korea

Marxist and isolated North Korea is the most troubling example, in East Asia, of a state chronically unable to feed its people. Televised images of peasants scouring the countryside for edible roots and grass in the mid-1990s first alerted the world to the possibility that North Korea was suffering food shortages. Reports of widespread starvation were initially discounted, partly because of suspicions that Pyongyang was playing upon the sympathies and fears of its neighbours and the wider international community to extract political concessions and food aid in a bid to strengthen its hold on power. The regime's obsessive secrecy and the lack of even rudimentary data on the population, economy and agriculture also made it difficult to judge the seriousness of food shortages.

Nevertheless, by 1997, it was clear that North Korea was in the throes of a prolonged and severe famine, the worst in its modern history. The state's food shortfall had increased steadily throughout the 1990s, and was compounded by adverse weather conditions in 1995–97. Cereal harvests in this period were consistently 1–1.5 million tonnes short of the 5 million tonnes needed

to provide a minimal level of calories. The country recorded a grain shortfall of about 1 million tonnes in 1996, with the average diet down to a little over one bowl of rice a day. In 1997, at the peak of the famine, North Koreans were subsisting on a daily ration of 100 grams of corn, one-fifth of the daily minimum requirement. According to the UN's WFP, many city-dwellers in North Korea were receiving only 15% of the daily ration given to refugees in Africa's camps. Some 800 000 North Korean children were malnourished, 80,000 of them seriously. This was despite the fact that international relief agencies spent more than \$1 billion on food aid for North Korea between 1995–1998. By 1999, an estimated 2–3 million people, or between 10–15 per cent of North Korea's entire population, had died from malnutrition and starvation.

The seeds of North Korea's food problems were sown decades earlier, when the *juche* (self-reliance) philosophy was first developed by 'Great Leader' Kim Il Sung. It is, however, doubtful whether North Korea could ever have become self-sufficient in staple foods given its generally inhospitable terrain, climate and population density. Deep-seated flaws in agricultural policy were compounded by the decline in the non-agricultural sector, which reduced the availability of key fertilisers, agricultural machinery and irrigation flows. Overshadowing this policy failure was a number of self-inflicted environmental disasters. Collectivisation was accompanied by large-scale land clearance and deforestation designed to expand the area available for cultivation. Once trees had been felled, rain washed away a large proportion of the replacement crops, causing soil erosion and serious flooding. The rate of deforestation accelerated as peasants felled trees for fuel, chemical fertilisers were over-used and soil fertility decreased. By the mid-1980s, exhausted soils had forced North Korea into dependence on food imports, sowing the seeds of the famines of the late 1990s (Natsios 1999). Without major agricultural reforms North Korea will be unable to feed its people, but improvements are unlikely while Kim Jong Il remains at the helm of the North Korean ship of state. Fundamental economic reform would risk ushering in political change that could well prove fatal to Kim's regime.

Fish Shortages

North Korea aside, the relationship between food scarcity and security is most evident at sea. Asians are heavily dependent on the Pacific Ocean for food and it has been aptly described as the region's 'rice bowl' for the 21st century. Fish is the main source of protein for an estimated one billion Asians and fishing supports

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more people than in any other region of the world. Over half the world's fish catch is taken in Asian waters, and five of the top ten fishing nations are in East Asia. Unfortunately, the Pacific is showing signs of environmental degradation from coastal pollution, over-fishing and unsustainable exploitation of other forms of living marine resources. Asia has already lost half its fish stocks. The depletion of fish species is a major concern in the North-west Pacific, which provides nearly one-third of the world's marine harvest. Fish yields in the Yellow, South and East China Seas fell significantly in the 1990s (Asia 1997 Yearbook).

The decline in East Asia's reserves of fish is part of a worrying global trend. In the past 50 years the world's fish catch has risen five-fold, but because of increasing demand per capita fish consumption has remained virtually unchanged since the late 1960s. It is clear that many fish species are now at risk. In 1994, a World Bank study concluded that 'the current harvesting capacity of the world's fleet far exceeds the estimated biological sustainability of most commercial species'. According to the FAO, around two-thirds of the world's major fish species are either fully exploited or in decline. Another 20–30 million tonnes of fish will probably be required to meet demand by 2010, a target that will be difficult to achieve as over-fishing and poor fisheries management threaten the ability of many species to recover and regenerate (Feidi 1999). While aquaculture may meet some of the shortfall in supply, it is unlikely to become a substitute for marine fishing. Fish farming requires far more resources than harvesting fish caught in the wild; depends on an adequate supply of fresh water, which is in increasingly short supply; and can cause significant environmental damage.

State subsidies, illegal, unregulated and unreported fishing (IUU), flag of convenience operations and the expansion in fishing fleets are exacerbating the global and regional shortage of fish. Despite clear indications that world fisheries are in trouble, governments still provide \$45 billion worth of annual subsidies to their fishing industries. The practice of registering ships in countries that are not signatories to fish management regimes and treaties allows owners to fly flags of convenience and complicates efforts to control IUU. 136 000 new ships have been added to the world's fishing fleets since 1989, accelerating the decline in fish numbers and causing prices to rise, a sure sign of scarcity. In 1998, the bulk of the 1.2 million vessels in these fleets operated in Asian waters. China alone has an estimated 450 000 fishing boats and like many other Asian states has developed a sizeable deep water fishing fleet.

Conflict over Fish

As traditional fishing grounds are exhausted, competition for remaining stocks has intensified. Countries which once welcomed foreign fishing fleets now restrict their access and quotas, while fishing nations have become much more protective of their own resources. In 1981, Japan, which relies heavily on fish as a dietary staple, was allowed to catch 1.2 million tonnes in the 200-mile US EEZ; by 1988, quotas had been cut virtually to zero. South Korea and Taiwan have suffered similar reductions, and their trawlers have been forced well into the South Pacific to make up the shortfall. The fishing fleets of South-East Asia have also been compelled to move further afield, and the Chinese seem likely to join the hunt for dwindling stocks by building more ocean-going trawlers. As fishing fleets grow and venture further into the Pacific, the area of ocean open to international fishing is shrinking. A large percentage of the marine resources of the Western Pacific are either claimed or contested. As a result, the frequency and seriousness of incidents at sea have steadily increased as foreign trawlers have illegally encroached into other countries' EEZs and territorial waters. Gun battles have broken out between the navies of regional states intent on defending the activities of their national fishing fleets or preventing perceived territorial violations by others.

Fishing Disputes in South-East Asia

In South-East Asia, competition for fish and other living marine resources has historically been most intense in the Gulf of Thailand. With the third-largest fishing fleet in East Asia, Thai fishermen had begun to exhaust stocks in their traditional fishing-grounds by the late 1970s and to encroach into the EEZs and territorial waters of neighbouring states. In the 1980s and 1990s, seizures of Thai fishing vessels became more common throughout South-East Asian waters, particularly in the Andaman Sea, the Gulf of Tonkin, the Luzon Strait and in the waters off Indonesia. Illegal fishing by Thai vessels has been a worsening source of friction between Bangkok and its neighbours during the 1990s. In the Andaman Sea, hundreds of Thai fishing vessels regularly plunder Burma's EEZ. Burma's navy has minimal capability to protect the country's extensive coastline. The larger Thai vessels commonly carry heavy machine guns and rocket-propelled grenade launchers which they seldom hesitate to use if challenged. Thai fishermen also enjoy better intelligence information from radio centres that warn of approaching patrol boats. In late 1998 and again in early 1999, disputes over fish threatened to escalate into serious military confrontation between Thailand and Burma

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The fishing vessels of virtually all South-East Asian states regularly intrude into neighbouring EEZs and territorial seas.

following two fatal naval clashes which resulted in the deaths of several Thai and Burmese sailors. Both incidents occurred when Thai naval vessels intervened during Burmese attempts to intercept Thai fishing vessels in contested waters of the Andaman Sea. On the second occasion, the Thai National Security Council considered deploying a squadron of F-5 fighter aircraft to the area.

Since 1995, Thai fishing vessels have also clashed with the navies of Malaysia and Vietnam. On 31 May 1995, Thai and Vietnamese gunboats exchanged fire after the Thai Navy attempted to protect Thai fishing vessels from being seized by the Vietnamese Navy: a Thai fisherman and two Vietnamese sailors were killed and five of the six Thai fishing boats impounded, along with 62 of their crew. Bangkok was forced to caution its own fishermen about illegally fishing in Malaysia's territorial waters after 6 trawlers were impounded by Malaysia and 80 Thai fishermen were arrested in April and May of 1999. Thailand, which earned \$3.4 billion from fish exports in 1993, may be the worst offender, but it is not the only culprit. The fishing vessels of virtually all South-East Asian states regularly intrude into neighbouring EEZs and territorial seas. Vietnam has fired on fishing boats from China, Malaysia and Taiwan, and the Philippines has seized Chinese and Taiwanese trawlers. The collision between a Philippines' naval patrol boat and a Chinese fishing boat which sank in July 1999 off the island of Palawan is a further illustration of the potential of these disputes to damage broader political and security ties. China condemned the Philippines' action and claimed that the fishing vessel was deliberately rammed (Asia 2000 Yearbook). In an earlier 1997 incident in which the Philippines arrested 23 Chinese nationals for illegal fishing it warned that Manila ran the risk of ruining the 'friendly relations' between the two countries.

Fish are central to the Spratlys dispute; according to one UN study, the waters around the Spratlys yield 7.5 tonnes of fish per square kilometre a year. The abundance of commercially valuable tuna and shrimp has created lucrative fishing industries in virtually all the South China Sea littoral states, providing employment for millions of people as well as substantial foreign-exchange earnings. Malaysia, for example, earns about \$50 million a year from harvesting one species alone; the country puts the total value of tuna resources around the island of Layang-Layang in the Spratlys at around \$600 million. States in the region have also enacted laws and established institutions to protect their marine resources from foreign poaching. The Philippines Senate passed legislation imposing large fines on foreign poachers on 6 August 1997. In the same year Indonesia gave notice that it would ban foreign fishing vessels from its 6.5 million square kilometres of

territorial waters from 2000 and inaugurated an 18-member National Maritime Council to 'protect the wealth and potential' of its seas against 'illegal exploitation by foreign parties'. Such 'exploitation' is estimated to cost the country over \$4 billion annually. In the Council's inauguration ceremony, President Suharto made it clear that the protection of marine resources was closely linked with national security and defence. When Abdurrahman Wahid came to power in 1999, he created a new Ministry for Marine Exploration and Fisheries and nominated illegal fishing as one of his government's chief priorities.

Fishing Disputes in North-East Asia

During the 1990s, illegal fishing, territorial/EEZ encroachments and maritime incidents in North-East Asia have become increasingly regular. The risk of significant political and military confrontation over competition for diminishing fish and other marine resources has emerged as a genuine security issue for China, Japan, the two Koreas and Russia. In March 1999, officials at Japan's Maritime Safety Agency revealed that fishing boats, mainly from China and South Korea, had penetrated Japan's territorial waters 'several hundred times each year' and had been intercepted or chased away by Japanese patrol boats. In 1996, Seoul placed its navy in the Yellow and Eastern Seas on alert following an attack by Chinese fishermen on a South Korean trawler in which 11 people were injured.

North Korean patrol boats have crossed the maritime buffer zone separating North and South Korea on several occasions to protect their fishing fleet. North Korean fishing vessels in search of crab during the height of the crab-fishing season crossed the buffer zone in the Yellow Sea on 15 June 1999, accompanied by torpedo boats from the North Korea Navy. Despite repeated warnings from challenging South Korean naval ships, the torpedo boats refused to turn back, precipitating the most serious armed clash between the two states since the end of the Korean War in 1953. In the ensuing fire-fight, one North Korean torpedo boat was sunk with the loss of its entire crew, while two others were damaged. 'Fraternal relations' between the Chinese Communist Party and the North Korean Workers' Party failed to prevent North Korean gunboats from firing on a fleet of Chinese trawlers in 1992. In 1994, Russia despatched a Kara-class cruiser to the East China Sea to halt what the Russian Foreign Ministry called 'pirate' attacks on its vessels. Russia has also detained Chinese trawlers for illegal fishing near the island of Sakhalin.

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Maritime incidents involving fish resources are linked to North-East Asia's most intractable territorial disputes.

Maritime incidents involving fish resources are linked to North-East Asia's most intractable territorial disputes. While most commentators have emphasised the geostrategic significance of the Diaoyu/Senkaku or the presence of oil as the underlying causes of the dispute over the islands, few seem to have recognised the importance of fish resources (Diaoyu Dao means 'fishing islands' in Chinese). Taiwanese President Lee Teng Hui made clear in August 1996 that the real importance of the Diaoyu/Senkaku was fishing rights. Taiwan's national fishing association estimates that the country's ships bring in about 40,000 tonnes of fish worth some \$65 million a year from the waters around the islands. Enacting the Territorial Waters Bill in January 1999, Taiwan reaffirmed its claim to the islands by specifically declaring them to be an integral part of the Republic of China.

In the North Pacific, the Kuril Island group is the subject of a long-running territorial dispute between Japan and Russia. The islands have important strategic and emotional significance for both countries because of the way in which they were 'acquired' by Moscow at the end of the Second World War. However, fish are also central to the dispute. The Kurils lie at the heart of one of the world's richest fishing grounds. Russia's ownership has allowed Moscow to claim an EEZ of 100 000 square kilometres containing fish, invertebrates and water-plants with an estimated market value of \$1billion. Around 25% of Russia's annual fish catch of 6–7 million tonnes comes from the southern Kuril region. Japan's determination to reclaim the Kurils has been reinforced by the knowledge that the region's rich marine resources would reduce the nation's dependence on more distant foreign waters.

As the cost of deep-ocean fishing rises and other fish reserves near exhaustion, Japanese vessels have been more willing to risk penetrating the Russian EEZ around the Kurils. The Russian Navy has seized Japanese fishing boats on numerous occasions since the end of the Cold War. Tensions between the two states over fishing disputes reached a peak in 1994, when Moscow allowed its Border Guards to open fire on foreign vessels trespassing in Russian waters. A month later, the Russian Coast Guard sank a Japanese fishing boat. In an attempt to reach a political accommodation, an agreement was signed in 1998 allowing Japanese vessels to fish in the area around the South Kuril Islands for the first time since the Second World War, provided they are accompanied and supervised by Russian Border Guard boats. Although the risk of military confrontation has been reduced, the potential for conflict remains. Only a few weeks after the agreement went into effect, several Japanese vessels intruded into Russian waters in the South Kuril region and began fishing

illegally using the presence of 'legal' boats to disguise their poaching. Senior Russian Border Guard officials branded the poaching as a 'provocation' and part of a deliberate strategy by Tokyo to maintain its claim to the Kuril Islands and their bountiful marine resources.

Until 1997, Japan had refrained from delineating fishing zones in the East China Sea and Sea of Japan to avoid aggravating historical disputes with China and South Korea over the Diaoyu/Senkaku and Tok-do/Takeshima islands. The government took this position despite intense pressure from the powerful domestic fishing industry, which had complained vociferously about Chinese and South Korean illegal fishing and attacks against Japanese fishing boats. Tokyo has since moved to tighten control over its own fishing grounds, while seeking to maximise access to the resources of disputed areas. In 1997, the Japanese government declared a 200 nautical mile EEZ that incorporated the Tok-do/Takeshima group. South Korea, which has a small maritime resource base, responded swiftly by declaring its own 200 mile EEZ. When asked to clarify the status of Tok-do by reporters, South Korea's Foreign Minister, Yoo Chong Ha, stated that the zone 'starts from the limit of South Korea's territorial waters' and that Tok-do was 'within South Korean territorial waters'.

Seoul's subsequent actions underline both the capacity of these disputes to escalate, and the increasing links between maritime food resources and territorial issues in post-Cold War East Asia. Accusing Japan of violating the terms of a 1965 accord by unilaterally altering agreed fishing boundaries, Yoo Chong Ha demanded in July 1997 that Tokyo revoke its EEZ declaration until a new fishing agreement could be negotiated. The South Korean National Assembly subsequently passed a unanimous resolution protesting against Japan's 'illegal' change of the fishing boundaries. Between 8 and 15 June 1997, the Japanese Maritime Safety Agency seized four South Korean fishing boats for allegedly penetrating the newly declared maritime boundary, further angering Seoul, which warned that such incidents would have grave consequences for the bilateral relationship. In retaliation, South Korean trawlers continued to fish in contested waters especially near the northern Japanese island of Hokkaido. Leaders of Hokkaido's fishing cooperatives branded the Korean actions as inflammatory and 'an act tantamount to a declaration of war.'

A breakthrough in the dispute came when the Kim Dae Jung government signed a new fisheries agreement with Japan in late 1998. The accord, which came into effect on 23 January 1999, shelved the territorial issue and established a joint fishing zone around Tok-do/Takeshima. Resistance in South Korea to the new

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agreement remains strong, however, and the opposition Grand National Party (GNP) succeeded in delaying its ratification for several weeks. The GNP claimed that 70% of South Koreans disapproved of the agreement because of the belief that it would damage the local fishing industry and does not recognise Seoul's sovereignty over Tok-do/Takeshima. Many influential Japanese are also dissatisfied with the outcome of the negotiations and see potential for future disputes over the linked issues of sovereignty and fish quotas. A Japanese Foreign Ministry official conceded that: 'If another dispute between both countries over fishing stocks and operation regulations were to occur, it might affect the issue of Takeshima, I'm afraid.'

China and South Korea have also become embroiled in disputes over fish. In contrast to the vitriol that accompanied South Korea's verbal attacks on Japan, Seoul has been relatively restrained in its response to Chinese illegal fishing. Nevertheless, evidence of a harder line emerged during talks in 1997 aimed at renegotiating fishing agreements to accommodate both countries' newly declared EEZs. The South Korean delegation urged China to crack down on illegal fishing in South Korean waters, and President Kim Young Sam's Cabinet banned foreign fishing vessels from entering designated prohibited zones in the West Sea from 7 November 1997. After protracted negotiations China and South Korea eventually signed a fisheries agreement on 11 November 1998, that established a regime governing each country's fishing activities and marine catches in previously contested areas of the Yellow Sea.

Conclusion

Inter-state confrontation over fish and other marine living resources is emerging as a significant long-term security issue for East Asia. The declining availability of fish is a global problem, but East Asia's dependence on the oceans for food suggests that disputes over fish may trigger wider conflicts between regional states unless steps are taken to manage and conserve fish stocks nationally and internationally. The number and severity of incidents at sea generated by the competition for fish has steadily increased since the end of the Cold War, notwithstanding the signing of a raft of important bilateral fishing agreements. Major wars over fish are unlikely; but as the remaining stocks of wild fish have diminished, regional states have come to regard them in the same light as oil and gas—high value resources that are worth contesting and defending, if necessary by military force. The competition for fish in the Pacific is also complicating and making more difficult the resolution of several festering territorial and

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island disputes of which the Kurils, Tok-do/Takeshima, Diaoyu/Senkaku and the Spratlys are the most prominent and intractable.

More generally, food is destined to have greater strategic weight and import in an era of environmental scarcity. While optimists maintain that the world is perfectly capable of meeting the anticipated increases in demand for essential foodstuffs, there are sufficient imponderables to suggest that prudent governments would not want to rely on such a felicitous outcome. East Asia's rising demand for food and diminishing capacity to feed itself adds an unpredictable new element to the global food equation for several reasons. The gap between production and consumption of key foodstuffs globally is narrowing dangerously and needs to be reversed. The 1996 fall in the world's grain stocks to their lowest level ever recorded and the drawing down of cereal reserves below safe levels in 1999 should be seen in this context. While due mainly to short-term and probably reversible factors, grain and cereal stocks are the world's first level of defence against short-term supply disruptions. An unanticipated rise in consumption or fall in production caused by climatic variables, political and social disturbances, economic mismanagement, shifts in government policies and environmental stress is more likely to precipitate food shortages when buffer stocks are low.

Food scarcity most commonly becomes a security issue as a result of sudden and unexpected fluctuations in supply and demand or, as in the case of North Korea, of political and economic failure. North Korea should be seen as a salutary, but extreme, example of what can happen when man-made environmental degradation, adverse weather conditions and misguided government policies combine to undermine a state's ability to feed its citizens. Nonetheless, the country's difficulties illustrate several broader points about the connections between food scarcity and security. First, even localised and relatively short-term food shortages can generate social and political tensions within states which may be the precursors of more serious conflict. Second, while there is a direct link between environmental degradation and the region's declining agricultural productivity, the relationship between the environment and security is more complex: food shortages have rarely been a primary cause of major conflict between states. However, they can contribute to state failure and death on a massive scale in developing states and aggravate interstate tensions by stimulating refugee flows and resource conflicts. Third, food shortages are generally symptomatic of flawed political and economic systems, policy failures, and lack of access due to the uneven distribution of food or income inequalities. Elites rarely suffer from hunger even in the

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poorest countries. A meaningful definition of food security must therefore incorporate people as well as states.

Neither a sudden fluctuation, nor a failure on the North Korean scale, is in prospect elsewhere in the region nor is East Asia likely to encounter insurmountable problems in feeding itself in the immediate future. Although friction over diminishing fish supplies will increase, food shortages are most likely to threaten the security of states and people when they coincide with other threats to political and economic stability. Earlier fears that food would be used as a 'weapon' by food rich states have faded because of the liberalisation of agricultural trade and diversified world grain markets. The real food security issue for East Asia, in the long term, is the cumulative and accelerating destruction of the region's food-producing capacity due to population pressures, urbanisation and environmental degradation. Anxieties over China's future food requirements must be seen in this light. Even though food production in China has kept ahead of population growth and further improvements in agriculture are achievable, a deteriorating physical environment in conjunction with political instability and economic failure may endanger China's food security and have global repercussions. Many developing countries in South-East Asia are similarly vulnerable. For this reason, preserving arable land, protecting coastal and marine habitats and managing natural resources in a sustainable way may become intrinsic to conflict prevention.

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