

# PACIFIC STUDIES

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## **FISHERIES DEVELOPMENT IN KIRIBATI: SUSTAINABILITY ISSUES IN A “MIRAB” ECONOMY**

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Fisheries development has long been recognized as a means of achieving greater economic independence for Pacific “microstates.” The Republic of Kiribati is particularly well endowed in marine resources, largely due to its extensive Exclusive Economic Zone (EEZ). However, the extraction of those resources rests mainly with distant-water fishing nations (DWFNs) who pay a license fee. This feature of a “MIRAB” economy, which encompasses elements of *migration*, *remittances*, *aid*, and *bureaucracy*, only marginally benefits Kiribati. Government has therefore looked to develop its own fishery industry and begun to focus on inshore fisheries and aquaculture projects to diversify Kiribati’s meager exports. In addition, commercial artisanal fishing is seen as a means of creating local employment. With increasing human populations, urban drift, more-efficient extractive technologies, and expanding market opportunities, conflicts over resource ownership may become more acute. Better resource management, together with the implementation of a remodeled marine tenure system, will need to take priority if fisheries development is to be sustainable.

“MICROSTATES,” such as the Republic of Kiribati in the Central Pacific (formerly the Gilbert Islands), present unique challenges to development planners. Size alone need not be a serious impediment to economic growth, as illustrated by Singapore’s financial success over the years, as well as other small nations that have achieved a relatively high standard of living (Easterly and Kraay 2000). Pacific island microstates, however, are not only constrained by limited size but also by a host of other environmental and geographical factors, including remoteness, geographical dispersion, vulnerability to natural disasters, and a highly limited internal market (Briguglio 1995; Shand 1980).

Perhaps relatively isolated and resource-poor atoll countries and territories best illustrate these limitations (Baaro 1993; Liew 1990). For the politically independent states of Kiribati and neighboring Tuvalu, for instance, external assistance does not match the amounts given to dependencies such as French Polynesia or even the U.S.-affiliated states in Micronesia, including the atolls comprising the Marshall Islands (Dahl 1996).

With few opportunities for economic expansion in view of their restricted size and natural resource availability, small labor forces, and low GDPs and thus restricted market size, small island nations have had the option to look outward by embracing the “MIRAB” approach to economic development by relying on *migration* (of factors of production), *remittances/aid* (financial transfers), and *bureaucracy* (nontradable production) (Bertram and Watters 1985). The MIRAB model of economic development highlights the importance, and as some would argue, the necessity, of such an approach to sustain the levels of expenditure. As Bertram succinctly put it: “In a MIRAB economy the indigenous population maximize their material well-being by means of globalization” (1999:345).

Despite current indications that the MIRAB model runs consistently, and apparently sustainably, ahead of local productive activity as measured by GDP, there is cause for concern regarding an overreliance on such a model in light of imminent changes in the global economy and the options that are available to microstates with different political status. Excessive reliance on external support and outlets for migration can no longer be considered secure in the medium to longer term, notably with cutbacks in foreign aid and changes in immigration policies linked to economic downturns in host countries that are attributed in large part to labor downsizing and increasing competitiveness as a result of globalization (see also Brown 1992; Cameron 1997; Gibson 1993; Hooper 2000:9–10; Laplagne, Treadgold, and Baldry 2001; Schoeffel 1996:23).

While recognizing the challenges posed by “smallness” to further economic expansion, successive governments in Kiribati have perceived marine-resources development, particularly living resources, as a means of attaining greater economic independence or self-reliance. An impressive number of feasibility studies attest to the importance of the fisheries sector (Gillett, Pelasio, and Kirschner 1991). With its vast Exclusive Economic Zone (EEZ), Kiribati has relied heavily on “rent” derived from fishing royalties, notably from East Asian countries, because of inadequate local infrastructure to exploit the fisheries sector efficiently. Thus, the MIRAB economy is being perpetuated, although fishing royalties, together with income from the Revenue Equalization Reserve Fund (RERF)—a legacy of phosphate mining on Banaba, which ceased in 1979—and payments made by the Japanese Space Agency on Christmas Is-

land (Kiritimati) in the Line Islands group, illustrate the positive side of a strategy that seeks to diversify “rent” opportunities. Assets from the RERF amount to US\$370 million, equal to 33 percent of Kiribati’s GDP. The RERF, fishing license revenues, and remittances make up almost half of Kiribati’s national income (Asian Development Bank 2000). More recently, however, the development of inshore exports and aquaculture has received growing attention.

This article provides an overview of the fisheries sector in Kiribati and its relationship to the country’s current MIRAB economy. Environmental impacts are addressed and strategies for sustainable development are explored.

### **Kiribati: Environmental and Economic Backgrounds**

Kiribati consists of thirty-three atolls and reef islands spread over an area exceeding five million square kilometers of ocean, straddling the equator between 4°43’ north and 11°25’ south and stretching between 169°32’ east and 150°14’ west. The total land area, however, only slightly exceeds eight hundred square kilometers (Figure 1).

The highly alkaline and calcareous and coarse-textured soils of Kiribati, like most of their counterparts on other atolls and reef islands, are among the poorest in the world (Small 1972). The islands’ small size, low elevation, and the porosity of the coral bedrock preclude surface streams. Instead, rainfall soaks through the porous surface soil to create a lens of often slightly brackish freshwater, hydrostatically floating on higher-density saltwater beneath it. Kiribati is located in the dry belt of the equatorial oceanic climate zone. Rainfall is extremely variable, both annually and between islands. The amount of rainfall is generally high north of the equator, gradually diminishing to low in the southern islands. The average for Tarawa, the administrative and commercial center in the Gilbert group, is close to two thousand millimeters per year (Burgess 1987).

Kiribati’s economy falls squarely within the MIRAB model, although some 80 percent of the people are engaged in subsistence production and the sale of primary products (AusAid 2001). The two sectors of primary production—agriculture and fisheries—differ in outputs, with fisheries exceeding local agriculture, with the exception of copra for export, because of environmental constraints.<sup>1</sup>

Fishing continues to occupy a prominent place in the life of most I-Kiribati (Gilbertese). Between six and eight hundred species of inshore and pelagic finfish are believed to exist (Guinther, Maragos, and Thaman 1992:9). Lagoon fishing involves both net and line capturing methods. Ocean fishing commonly focuses on Scombridae, notably skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*), as well as on flying fish (*Cypselurus melanopterus*). Spearing is also practiced on a number of species. Fishtraps

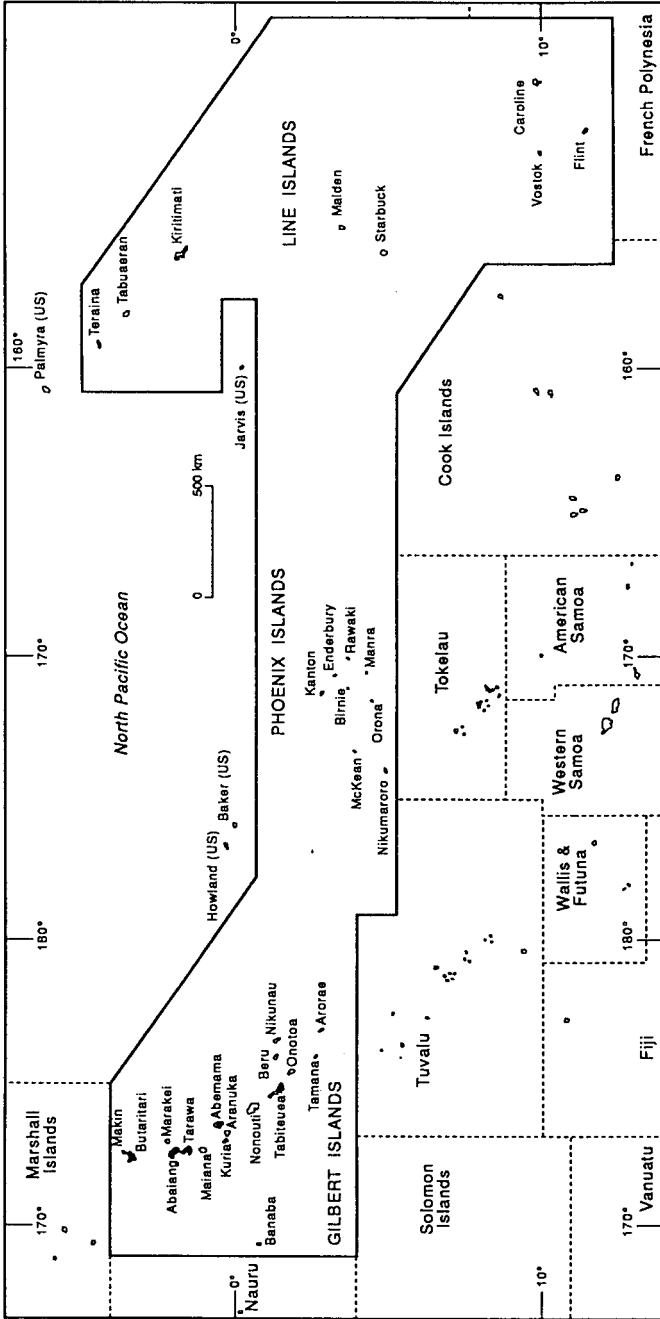


FIGURE 1. The Republic of Kiribati. (Reprinted by permission from Van Trease 1993:xix)

made from coral blocks are impressive architectural features at low tide, located on ocean-side reef flats and in passages. The traps may extend up to fifty meters in length and stand about one meter high. Traditionally, certain groups of people raised milkfish (*Chanos chanos*) in specially designed enclosures, normally located near the lagoon. A variety of marine invertebrates can also be found, including an estimated thousand or more species of mollusks.<sup>2</sup>

Kiribati was granted independence in 1979, shortly after the British exhausted phosphate deposits mined on Banaba. Since then copra and fish have remained the main source of foreign exchange earnings, but copra earnings have fluctuated widely in recent years (Shepherd 1999). Since independence, however, Kiribati has moved towards the MIRAB model of economic development by relying heavily on foreign aid and remittances by migrant workers.

### Assessing the MIRAB Economy

The population of urban South Tarawa has increased considerably because of internal migration (an urban growth rate of 2.2 percent per year), with nearly 40 percent of the total population—having reached close to 84,500 in 2000—concentrated on some sixteen square kilometers of land (Secretariat of the Pacific Community 2001; Ministry of Finance 2002) (Figure 2).<sup>3</sup> A large proportion of these migrants are supported by remittances sent by family members who work for the phosphate mine on Nauru and others who are engaged as merchant seamen. The remittances sent by the workers amount to more than US\$7 million a year (Bertram 1999:341). However, with the projected cessation of phosphate mining early in this century and advances in marine technology, it is expected that remittances will diminish with many workers returning home, increasing the pressure on local resources (Fleming and Hardaker 1995:89, 91; Macdonald 1998:62). Unlike other Pacific Islanders, such as Niueans or Tokelauans, who have New Zealand citizenship and thus can migrate freely to that country by virtue of their political status, I-Kiribati do not have this option. Foreign aid, another feature of the MIRAB economy, is likely to continue, albeit with diminishing resources as donors search for greater accountability and the strategic importance of the Pacific is reduced following the end of the cold war. The public sector remains a significant employer but is unable to absorb a growing number of young people, many of whom lack appropriate training, education, or experience. The agriculture and especially the fisheries sectors could provide alternative sources of livelihood for migrants. To support an increased population, though, new forms of sustainable land- and marine-use systems need to be worked out for production of both traditional and exotic crops, as well as fisheries products.

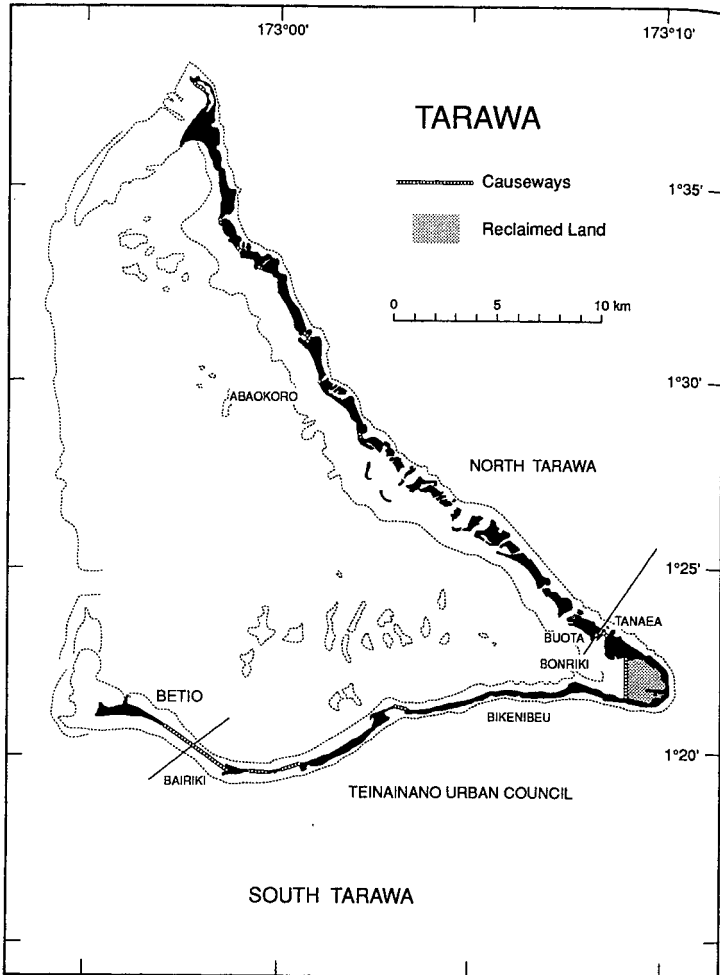


FIGURE 2. **Tarawa Atoll.** (Reprinted by permission from Van Trease 1993:126)

## Fisheries

### *The Exclusive Economic Zone*

With an Exclusive Economic Zone (EEZ) covering 3.5 million square kilometers—the second largest in the world (Figure 3)—it is not surprising that the fisheries sector in Kiribati is seen as both a source of essential livelihood at the subsistence level and as a means of generating revenue by promoting

the country's seemingly vast store of marine resources (Thistlethwait and Votaw 1992:28–29). In an effort to exploit more fully its marine resources Kiribati, along with the South Pacific members of the Forum Fisheries Agency, the South Pacific Commission, and the Nauru Treaty Group, declared a two-hundred-mile Exclusive Economic Zone in 1979. For Kiribati (whose groups of islands are dispersed over considerable distances), the declaration of the EEZ called for systematic and improved surveillance and monitoring of fishing activities by the vessels of the distant-water fishing nations (DWFNs) in order to maximize income from licensing through an effective enforcement of the EEZ.

The licensing of foreign fishing vessels primarily through bilateral treaty arrangements contributes highly variable returns, which are largely affected by weather conditions, notably El Niño and its reverse, La Niña. For example, license fee revenues fell from A\$40.3 million in 1998 as the impact of El Niño was felt, to A\$31.8 million in 1999 during La Niña, to A\$17.2 million in 2000 (*National Development Strategies 2000*).<sup>4</sup> At any rate, some analysts consider benefits to be marginal. This opinion appears to be supported by Forum Fisheries Agency statistics showing that regional governments reap less than 4 percent of the value of the catch (Samou 1999:148).<sup>5</sup> Moreover, Kiribati lacks adequate onshore facilities to attract higher levels of tuna transshipment by foreign vessels. The EEZ is believed to contain potentially significant resources of manganese nodules and cobalt crusts on the seabed, but for the moment an economically viable operation has yet to emerge (Teiwaki 1988:119–140).

Kiribati is also seeking to develop its local fishing industry. To achieve this goal, important obstacles need to be surmounted, such as the cost and availability of fuel, distance to markets, and competition from efficient, capital-intensive distant-water fishing nations (Kearney 1980). Until recently, the domestic industrial fishery has been completely dominated by the government-owned Te Mautari Limited, established in 1981 to catch tuna by the pole-and-line method. The company had difficulties from the outset establishing a viable year-round fishery in the EEZ. The main problem is the variability in tuna abundance. This problem is compounded by difficulties in obtaining a reliable bait supply (Fairbairn 1992:22). In 1993 the government entered into a joint venture company with the Otoshiro Gyoko Company of Japan to establish the Kiribati and Otoshiro Fishing Company (KAO). KAO operates a 750-ton-carrying-capacity purse seine vessel purchased from the Japanese partner. One of the company's objectives is to provide training for I-Kiribati using the harvesting and marketing skills of the Japanese parent company. The tuna catch increased from 2,583 tons in 1997 to 4,080 tons in 1999 (Annual Report 1999).

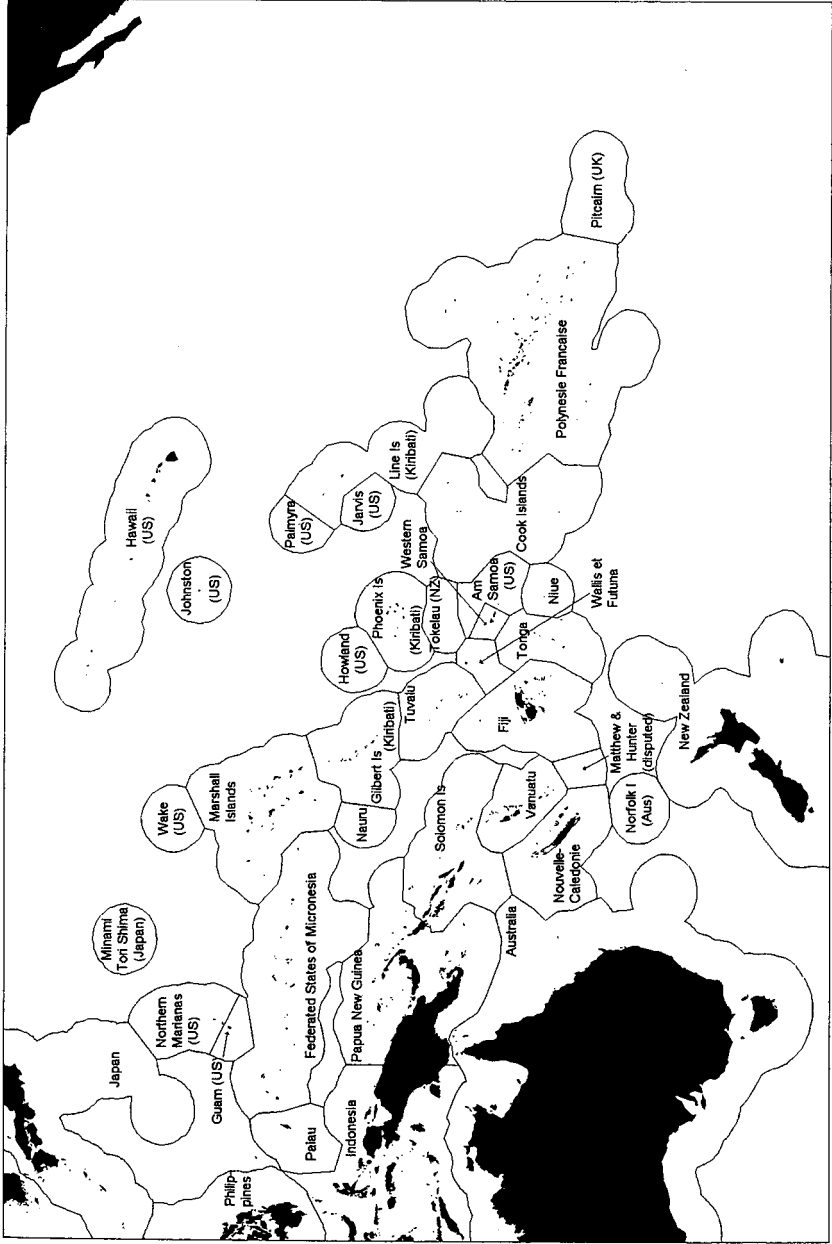


FIGURE 3. Pacific Islands two-hundred-mile Exclusive Economic Zones. (Reprinted by permission from Adams, Dalzell, and Esaroma 1999:370)



Kiritimati Marine Export Limited (KMEL), set up on Christmas Island in 1981, exports chilled fish, initially tuna and lobster, and more recently, bêche-de-mer, shark fin, aquarium fish, and deep-sea demersal fish. Despite limited air services to Honolulu, KMEL, unlike Te Mautari, has been operating quite successfully since its inception, grossing over A\$290,000 in 1998 (Annual Report 1999).

### *Inshore Exports and Aquaculture*

The exploitation of Kiribati's EEZ for accrued benefit to the people of this island nation highlights the need for improved technology, skills, information, and financial resources. Dolman (1990) argued that for small-island developing countries the twelve nautical miles, formerly recognized as marking the territorial boundary of an island or coastal nation, are generally preferable to two hundred nautical miles of biologically unproductive waters and highly migratory species. He further stated that the goal should be in terms of saving foreign exchange rather than generating it, and to reduce dependence rather than seeking a place in a highly competitive market.

Kiribati has acknowledged that inshore and aquaculture development and the promotion of artisanal fishing could bring about economic improvement while lessening dependence on foreign aid. The government has reported increases in marine-product exports (Table 1). In addition to fish, the specialized aquarium-fish market fetched almost A\$1 million in 1998. Other important fisheries products include seaweed (with earnings exceeding A\$500,000 dollars in 1998) and bêche-de-mer (close to A\$500,000 during the same period) (Ministry of Finance 1998).

Plans are underway to produce and market black pearls by smallholders on the outer islands and to develop a sustainable baitfish industry based on milkfish on South Tarawa (Ministry of Natural Resources Development 2001; *National Development Strategies 2000*).

The trade in aquarium or pet fish (Figure 4) was initiated on South Tarawa during the 1980s but was subsequently moved to Christmas Island because of its proximity to market centers in Honolulu. Interest from the private sector in this lucrative trade has been growing since its establishment on Christmas Island (Annual Report 1999).

Seaweed is another high-value niche product (Figure 5), inevitably subjected to world price fluctuations and destruction by bad weather. Seaweed farming provides the major raw material for carrageenans (water-soluble gums), which have widespread applications such as in processed foods, textiles, air fresheners, and pharmaceuticals. As an aquaculture project, seaweed farming has already proven its value in the Pacific (South 1993). In Indone-

TABLE 1. Value of Fisheries Exports by Commodity: 1987-1998 (A\$1,000)

Commodity	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fish	823	1,606	2,600	964	277	363	513	263	266	211	110	1,058
Aquarium fish	0	0	0	0	336	258	533	551	817	639	698	932
Shark fins	16	18	42	32	24	118	123	175	659	194	94	129
Seaweed	62	15	85	723	676	286	217	297	176	382	373	626
Bêche-de-mer	0	0	0	0	0	0	685	764	379	769	268	493

Source: Ministry of Finance 1998.

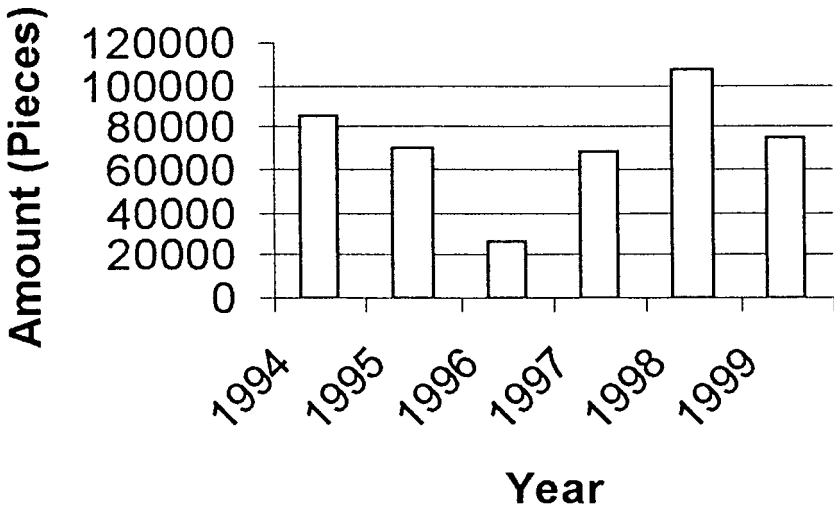


FIGURE 4. **Pet-fish export.** (Courtesy Fisheries Division, Tarawa)

sia and the Philippines the seaweed trade has accelerated socioeconomic growth and development, and created a number of related economic activities for various communities. An example of this is ecotourism, whereby divers and visitors are able to observe the unique techniques associated with this type of farming (Dahoklory and Hatta 1996).

Seaweed farming suits the developing economies and subsistence communities of the Pacific Islands for a number of reasons apart from their having favorable environmental conditions. The low level of technology and investment required to initiate and maintain a harvesting operation enables cash-strapped rural communities to take part in an income-generating activity. Furthermore, the family-based nature of seaweed farming is appropriate within the context of rural subsistence communities, as family and group cooperation is often emphasized in daily activities. The low environmental impact associated with seaweed farming, desirable under any circumstance, is particularly advantageous in the relatively fragile environments of the Pacific Islands, where environmental standards and regulations are not always enforced. Lastly, the compatibility of this particular type of aquaculture with traditional uses of the inshore environment renders it appealing to many communities who have been relying on their inshore resources for generations.

In addition to the economic and social benefits of seaweed cultivation, several positive environmental effects are associated with this type of activity. For

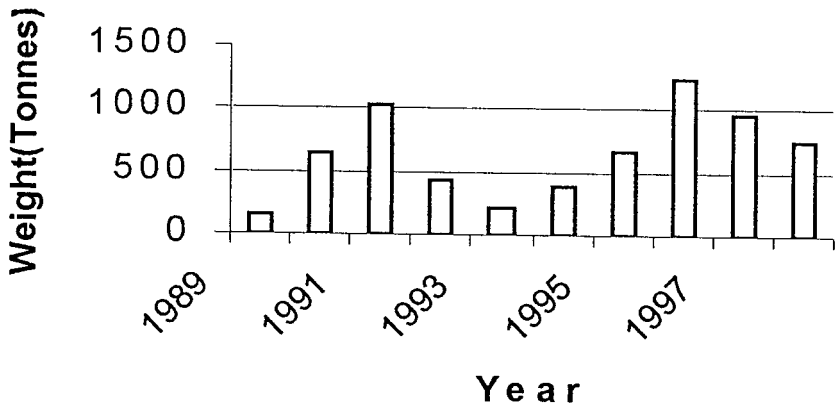


FIGURE 5. **Seaweed production.** (Courtesy Fisheries Division, Tarawa)

example, seaweed is cultivated within reef systems, which has the effect of enhancing ecological and primary productivity levels. Also, farms can act as nutrient sinks, thereby protecting the environment from the effects of nutrient overload. Similar to mangroves and seagrasses, seaweed farms support and develop fish stocks and can play the role of nurseries for juvenile marine organisms.

Two species of seaweed, *Eucheuma alcareszii* and *Eucheuma spinosum*, were introduced to Kiribati in 1977 from the Philippines. *Eucheuma alcareszii* was found to thrive better under local conditions (Annual Report 1999). A government-owned company, Atoll Seaweed Company (now in private hands as Kiribati Atoll Seaweed Company), was established to deal with seaweed commercial activities. Fanning Island (Tabuaeran) in the Line Islands group and Abaiang, close to Tarawa, have emerged as the major producers subsequent to failures of pilot projects on the main atoll. The main cause for those failures was competition with other uses of the lagoon shoreline, particularly shellfish collecting by a growing number of urban migrants (Schoeffel 1996:80). In the early 1990s some two thousand smallholders, or near half the population on Abaiang, were growing seaweed (Tikai 1993:171). Seaweed production for the Gilberts in general has declined significantly, however, from a high of 1,019 tonnes in 1991 to a mere 12.2 tonnes in 2001 (Atoll Seaweed 2001). The increasing frequency of westerly winds associated with El Niño has in effect discouraged many households from further investment in an activity considered high risk in an essentially risk-averse subsistence environment (Neemia-Mackenzie 1998). Additional research into varieties of seaweed that are more weather resistant, together with better monitoring of

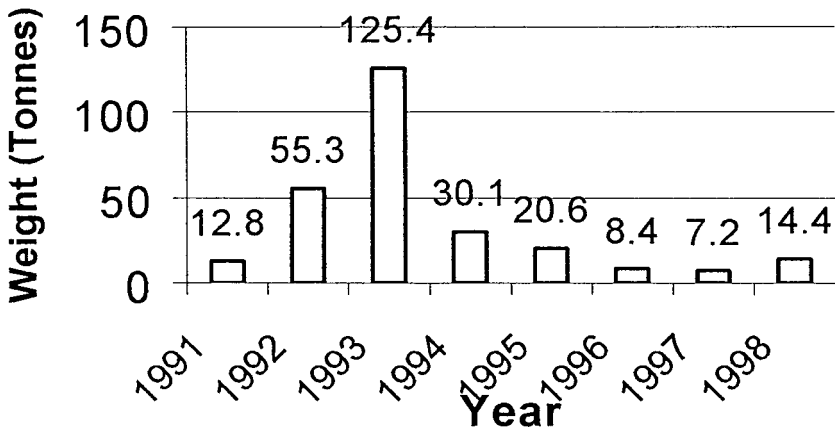


FIGURE 6. **Bêche-de-mer export trend.** (Courtesy Fisheries Division, Tarawa)

suitable growing sites, are being considered. Despite the difficulties, seaweed farming can contribute substantially more income to smallholders than copra production. A farmer can produce several crops a year, yielding close to 25 tonnes of dry seaweed per hectare with minimal capital. While seaweed is still regarded as an export crop, there is potential to include it in the local diet, particularly in efforts to reverse vitamin A deficiency and other vitamin and micronutrient intake problems (Schaumberg, O'Connor, and Semba 1996; Thaman 1988).<sup>6</sup>

Trade in bêche-de-mer or sea cucumber (holothurians), which was one of the first export products from Kiribati after European contact, reached a peak of 125 tonnes in 1993, dipping to less than 15 tonnes in 1998 (Figure 6). This drop is due to overexploitation (Annual Report 1999). Of the thirteen species that have been identified, four are considered to be of high value for the Asian market.

The production of black pearls derived from the black-lipped pearl oyster (*Pinctada margaritifera*) is one of the most recent aquaculture projects in Kiribati. For well over a hundred years, there has been growing interest in the production of cultivated pearls. Before the introduction of grafting techniques, pearls were harvested from natural stocks. Because natural pearls are extremely rare (one oyster per every thousand contains a pearl), the price of pearl was quite high. The 1930s saw the collapse of the natural-pearl market, due to the death of much wild stock from overharvesting. The lack of pearl and increasing demand gave rise to grafting and the establishment of pearl farms. Japan was the first to establish farms and develop grafting tech-

niques. Pearls are second in popularity to diamonds among precious gems and Japan is the leading buyer to date (Sims 1993).

Cultured black pearls have become the most important export commodity among marine products in French Polynesia and the Cook Islands (Macpherson 2000; Rapaport 1995). This has led to concerns over possible declining profitability, perturbation of lagoon ecosystems, and growing tenure disputes.

The feasibility of producing and marketing black pearls in Kiribati has been the focus of considerable research and development. Research trials and pilot operations have been successfully carried out. Within the next few years, the Ministry of Natural Resources Development is expected to complete a feasibility study and business plan for privately operated enterprises. The department will then begin implementing a strategy for transferring the technology and business approach to the private sector (*National Development Strategies* 2000). Given past experiences in French Polynesia and the Cooks, it is hoped that Kiribati will learn from previous mistakes.

The need for aquaculture of baitfish based on milkfish has been recognized in view of low wild bait stocks. Cultured baitfishes would be exported primarily to support the licensed foreign longline tuna fleet. Part of the output would also be sold on the Tarawa market. One problem faced in this connection is the infestation of fishponds with a predator, the introduced Malayan mosquito fish or tilapia (*Oreochromis* spp.) (*National Development Strategies* 2000). To assist the local population in its protein requirements a visiting consultant introduced tilapia, which resulted in the destruction of the milkfish in most ponds. As tilapia is neither eaten nor appreciated because of its non-salty taste, it is considered to be a serious pest.

### *Artisanal Fishing*

Artisanal fishing possesses several features that contrast with industrial operations. The latter are capital-intensive, using large vessels and sophisticated gear, and the catch is usually processed using elaborate facilities mainly for export. Artisanal fishing is capital-unintensive but labor-intensive, using small vessels and relatively simple gear, with little or no processing of the catch. In the case of commercial artisanal fishing, marine products are sold in local markets, whereas in subsistence artisanal fishing the catch is retained for household consumption or given away. In the Pacific, though, separating artisanal fishery production into commercial and subsistence operations is difficult because most communities sell part of their catch (Adams, Dalzell, and Ledua 1999). However, the U.N. Food and Agriculture Organization reports that the nearshore commercial fish catch in Kiribati is principally made up of reef and

deep-slope fish (54 percent), mollusks (25 percent), and pelagic species (21 percent) (FAO 1998).

In contrast to agriculture, nearshore fishing throughout Kiribati is vigorously pursued. Despite growing urbanization the vast majority of I-Kiribati households obtain the bulk of their protein from various marine organisms found on both lagoon and ocean sides. In fact, the proportion of fresh fisheries resources caught and locally consumed ranks among the highest in the Pacific region. Annual fish consumption per capita is estimated to be around 185 kilograms, among the highest in the world (Gillett and Lightfoot 2001:58). The abundance of edible marine life (largely attributed to the equatorial upwelling of nutrient-rich waters) and household priorities in spending limited cash on foods not locally produced (such as rice, flour, and tea) should allow people to be self-sufficient in terms of protein. However, despite the wide availability of local marine products, undernutrition related to protein deficiency was found in 7 percent of preschool children and 69 percent of pregnant women (WHO 1998).

The author carried out research pertaining to artisanal fishing over the course of several years. Local communities engaged in subsistence and commercial exploitation of marine mollusks were investigated between 1993 and 1998. More recently a general assessment of artisanal fishing on urban South Tarawa was made to measure the degree of dependency on imported meat products, particularly tinned fish. Some of the results will be discussed in further detail below.

The Outer Island Fisheries Project was initially established with the goal of developing commercial fisheries on the outer islands and providing a steady supply of fish to Tarawa. Two cold-storage facilities were set up, on Butaritari and Abemama, to assist the development of commercial fisheries on these atolls, concentrating on tuna and using Te Mautari Limited as the market outlet for catches. Following the closure of these centers, others opened on Abaiang, Aranuka, Kuria, and Nikunau. To more cost-effectively supply both the export and the South Tarawa markets, the project and Te Mautari were integrated. Now called the Foundation for Integration of Fisheries, the current targets are reef fish together with tuna (Annual Report 1999; *National Development Strategies* 2000).

Storage facilities and transport between the outer islands and Tarawa need improvement to create incentives for artisanal fishers to sell greater volumes (Neemia and Thaman 1993). Kiribati's outer islands differ little from other remote islands in being marginalized in relative terms. The benefits of technological investments in transport such as the development of the container and of cellular-container vessels, as well as air connections, clearly favor core

areas to a much greater degree than the peripheries (Brookfield 1980; Ward 1999:25–26). Another area of concern is postharvest handling of fish and other marine products (Novaczech and Chamberlain 2001). In addition to the possibility of causing ciguatera poisoning (Tebano and MacCarthy 1991), which directly affects exports as well as domestic sales of live reef food fish, it was determined that the handling of fish after capture caused serious health risks. For example, the sale of ungutted fish is ubiquitous on Tarawa. There is a belief that ungutted fish is preferable for reasons of aesthetics and flavor, but little awareness of the relationship of gut and gill bacteria to spoilage. The problem is compounded by improper use of limited ice supplies. Novaczech and Chamberlain report that up to 1.5 percent of the population is sent to hospital with fish poisoning every year and rates may be as high as 7 percent on certain islands (2001), although it is not clear how many cases can be attributed to ciguatera versus illness by spoilage.

Whereas tuna jerky for export requires major investments in packaging, labeling, quality testing, quality control, and promotion, small-scale production for domestic markets may be a more attractive venture. Solar-dried products appear to be technically and financially feasible for outer-island producers. One issue that has hindered previous efforts in Kiribati is the cost and availability of construction materials on outer islands. If project funding is used to finance initial infrastructure development, profitability and management must be sufficient to ensure that the equipment can be repaired and replaced as needed.

### **Environmental Impacts**

#### *Mollusk Harvesting*

A substantial rise in mollusk consumption has occurred on South Tarawa. This phenomenon is linked to changes in water circulation when causeways were built in the 1960s, encouraging the establishment of certain species, and to increased fertilization by sewage-driven nutrients. Filter feeders exposed to contaminated water may thus become agents of gastrointestinal diseases. With expanding urbanization and accompanying internal migration from the outer islands to the capital, there has been a growing demand for cheap, easily gathered resources such as mollusks. While bacterial pollution from overcrowding has ensured for a time the proliferation of filter feeders such as *Anadara* cockles (*Anadara uropigimelana*), yearly harvest of these bivalves has been estimated at close to fourteen hundred tons, causing concerns about resource sustainability (Paulay 2001). Between 1993 and 1994 the roadside sale of *Anadara* was putting pressure on Tarawa stocks that were once relatively well protected. Divers possessing goggles and any floating device from a small canoe to a rubber inner tube could collect large quantities of bivalves on a



daily basis and sell their catch in rice sacks holding up to thirty-four kilograms of mollusks. A move by shellfish gatherers from the intertidal sand flats and seagrass beds to deeper sections of the lagoon was triggered by declining abundance and size of existing stocks closer to shore (Thomas 2001a). Blasting of Maiana's leeward reef may have contributed to the recent disappearance of *Anadara* in certain areas. Changes in water circulation associated with strong currents may have disturbed the nutrient-rich substratum inhabited by these bivalves and washed away larvae (Tebano 1990:55–56).

The strombid gastropod *Strombus luhuanus* is fast becoming the dominant molluscan species in Tarawa Lagoon. This perhaps is a consequence of the demise of many reefs linked to changes in sedimentation and because of gathering pressure on the preferred *Anadara*. Like other strombids, this gastropod is an herbivore and feeds on algae attached to hard strata. It often occurs in large colonies. Commercial artisanal exploitation also occurs on Tarawa. Unlike *Anadara* and other bivalves, gastropods are usually epibenthic, thus facilitating their detection on the surface of sediments. As is often the case, gatherers make no distinction between large and small shells, collecting all those that are visible. The annual harvest is estimated at four hundred tons (Paulay 2001). The high variability of species density may reflect increasing gathering pressure but could also be attributed to patchy distribution, perhaps linked to the snail's high mobility. Nevertheless, a small average shell length for *Strombus luhuanus* found in Tarawa sand flats ( $M = 42.9$  mm,  $SD = 4.9$ ,  $N = 206$ ) may indicate harvesting pressure (Thomas 2001a).

Stocks of giant clams (Tridacnidae) have been greatly affected throughout the Pacific by poaching by foreign vessels (Dawson 1988). In addition, heavy exploitation to satisfy domestic consumption has led to the virtual demise of the largest species (*Tridacna gigas*) around Tarawa, while stocks on the outer islands were described as low (Munro 1986). There had been plans to culture giant clams for seeding on the outer islands and for restocking Tarawa Lagoon (Annual Report 1994), but it would appear there was no follow-up to this project.

In Kiribati, as in various other Pacific localities, small specimens (less than 40 cm) of *Tridacna gigas* and *Hippopus hippopus* are occasionally carried to shallow lagoon reef flats or deposited in passes adjacent to settlements. They are allowed to grow in place until ready for consumption. Like fish traps and areas used for seaweed farming, giant-clam "gardens" are the property of individual households, whereas the reef flat on both lagoon and ocean sides is now regarded as common property. Because of pilferage in populated areas, traditional giant-clam aquaculture is currently confined to relatively isolated areas, such as the islets of the leeward reef. The "gardens" are disappearing from the Kiribati seascape, however, in large part because of the erosion of

customary marine tenure. Owners are now less inclined to continue to care for giant clams in designated lagoon sections or to invest in maintaining large fish traps (Thomas 2001a).

A smaller and more abundant species, *Tridacna maxima*, is taken from the outer islands and is the target for supporting a domestic commercial fishery. Fisheries statistics are incomplete, as many of the exploited mollusks (preserved by salting) are carried as personal consignment by boat mainly from Abaiang to be sold on Tarawa.

### *Fishing on South Tarawa*

Concern over the condition of Tarawa Lagoon is not limited to slow-moving animals such as bêche-de-mer and shellfish. Some reef fish are also threatened. Even juvenile tuna species spend part of their life cycles close to shore before migrating out to sea, and thus are subjected to the same kind of pressures as more sedentary reef fish. The government continues to worry about the lack of an effective management plan for inshore marine resources. Lagoon and reef areas are witnessing increasing levels of pollution, primarily from human and animal waste, as well as a decline of a host of organisms as a result of overfishing. A steady increase in the population of South Tarawa and in the availability of outboard motorboats and gill nets has significantly contributed to increased effort and total catch. Catching efficiency has also increased substantially with the introduction of gill nets that are more than one kilometer long. The splash fishing method (*te ororo*), whereby fishermen drive fish into long gill nets by splashing the surface of the water with iron bars, may be particularly efficient. During the past two decades, however, several lagoon fish, such as bonefish (*Albula glossodonta*) and spangled emperor (*Lethrinus nebulosus*), have been reduced in number (Beets 2001; Tikai 1993:170). Fish stock declines can also be attributed to the obstruction of spawning migration routes by causeways, notably in the case of bonefish (Abbott and Yeeting 1995). While many fishers were keenly aware of the changes affecting inshore resources, though not necessarily the underlying causes, they were for the most part unwilling to take action—an example of the “tragedy of the commons” (Hardin 1968), whereby fishers fear that if one were to reduce his or her catch, others would take that catch instead (Phillips 1995).

One interesting comment noted during recent work came from a Fisheries Division officer who stated that several stocks have made a comeback, with the notable exception of giant clams (Tooti Tekinaiti, personal communication, 2001). This may relate to erratic recruitment pulses (high spatiotemporal variability in recruitment) among distant fish and shellfish populations with a larval stage of sufficient duration to allow dispersal over long distances be-

fore settlement into an exploited area (Sale 1980; Tebano and Paulay 2001). Nevertheless, a rapidly expanding human population and increasing commercialization of inshore environments could create more serious problems over the long term.

To gauge the extent of fishing activities on South Tarawa, a sample of thirty-five households was randomly selected for interview (Thomas 2002). Twenty of these households pursued small-scale farming as their main economic activity rather than fishing.<sup>7</sup> With a single exception, however, all households carried out some form of fishing. Forty percent of the households sold fish or shellfish or both. Over 60 percent of households bought fresh fish at least occasionally. All respondents preferred the taste of fresh fish to tinned fish but occasionally purchased the latter. For the smallholder farmers and for those individuals earning regular wages, fishing was not done regularly (i.e., at least four days a week) (Annual Report 1999). Other reasons given for purchasing tinned fish included inclement weather, lack of money to purchase fuel for those owning a boat, catching inadequate quantities of fresh fish, and “feeling lazy.”

Eight kinds of shellfish and four other invertebrates were cited as having been gathered in a week for all households combined. In addition, thirty-two fish species caught from both lagoon and ocean sides were recorded. Table 2 lists the most frequently collected fish and invertebrates. Sample size may account for the differences noted between the present survey and the survey carried out by the Fisheries Division in November 1999, which was based on interviews of 931 households. The Fisheries survey showed that flying fish and tuna species represented more than 50 percent of the total catches (Annual Report 1999).<sup>8</sup> Seasonal availability of species could also explain those differences.

### Sustainable Development

Literally volumes have been written on the topic of sustainable development. Yet the concept remains elusive. As Overton remarked, sustainable development means different things to different interest groups. Referring to the Pacific Islands, he identified two noteworthy perspectives that had been previously neglected, namely, the *local* and *social* perspectives. The local perspective is often regarded as subordinate to the global, while the social perspective remains “a junior partner in the sustainable development coalition” (Overton 1999:1). As discussed earlier, Pacific island microstates offer specific development challenges, and although they are not poor by the usual standards of world poverty, they are nonetheless vulnerable to policies largely dictated by external forces. More often than not, these policies tend to ignore social structures and needs, even though they may support ecological or eco-

TABLE 2. **Fish and Invertebrate Species Gathered by more than Five Households over a One-Week Period**

English Name	Scientific Name	Frequency Occurrence
Burnt-end ark	<i>Anadara uropigimelana</i>	22
Mojarras	<i>Gerres</i> spp.	20
Strawberry conch	<i>Strombus luhuanus</i>	19
Red-margined sea perch	<i>Lutjanus vaigiensis</i>	17
Pacific asaphis	<i>Asaphis violascens</i>	15
Pectinate venus	<i>Gafrarium pectinatum</i>	12
Blue-fin trevally	<i>Caranx melampygu</i>	10
Bonefish	<i>Albula glossodonta</i>	10
Orange-striped emperor	<i>Lethrinus obsoletus</i>	9
Mullet	<i>Valamugil engeli</i>	8
Paddle-tail	<i>Lutjanus gibbus</i>	8
Rabbit-faced spinefoot	<i>Siganus rostratus</i>	6

Source: Thomas 2002.

conomic sustainability. The lack of attention to the problems and issues of sustainable societies is reminiscent of Chambers's call (1983) to focus more on a social approach that places the rural poor and their basic needs first, and thus address broader welfare issues and community empowerment. This locally based and mostly small-scale approach enables the kind of development that does not jeopardize the environment and that uses and modifies ecosystems, without harming them, to improve economic and social well-being. In short, "such a strategy aims to achieve not just environmental sustainability but also the sustainability of just and equitable societies" (Overton 1999:7). In theory at least, societies leading a sustainable existence, without poverty or injustice, should cause minimal environmental damage (Aiken 1994).

Fisheries in Kiribati highlight the opportunities and challenges facing this sector of the economy. As noted earlier, marine-resources development should provide greater economic independence without necessarily eliminating the MIRAB component. The MIRAB economy may in fact become a permanent fixture according to a U.S. General Accounting Office report, stating that most international donors are skeptical that economic self-sufficiency is an attainable objective for the majority of island countries (*Marshall Islands Journal* 2001). Nevertheless, policy makers both locally and abroad recognize that free-spending days are over and that some efforts should be directed towards economic growth based on natural-resources exploitation. Microstates have few options as far as their agricultural sectors are concerned. The only

primary industry that appears to provide real economic advantages remains the fisheries sector. Encouraging economic growth and development to support rapidly growing, increasingly urbanized populations with changing needs, wants, and aspirations without jeopardizing the ability of future generations to meet their goals is a major challenge facing Kiribati and other nations seeking to develop their fisheries.

In regards to its EEZ, to protect and preserve the marine environment, Kiribati needs to go beyond the task of assessing the life cycles of commercially significant tuna stocks and move towards a better understanding of the ecological system where fisheries take place (Kawaley 1999). On Tarawa, where the population density is greatest, the utilization of the reef flats and lagoonal areas will increase, leading to greater pressure on existing stocks. It is hoped that with the expansion of aquaculture projects on the outer islands, such as seaweed and black-pearl farming, Kiribati will not only benefit financially but also reverse or at least slow down the in-migration to South Tarawa.

One cannot help but notice that the definition of sustainable development by the government has changed over the years. During the Tabai years of government, which led Kiribati to political independence, the need for self-reliance “to achieve environmentally sustainable development and better quality of life in Kiribati” directed many of the policies (Morrison n.d.). By contrast the later Tito administration made sustainable economic growth and the development of the private sector its priority (*National Development Strategies* 2000:2). Although some may argue that this is a matter of nuance rather than substance, there is real concern that the newer policies may not place enough emphasis on ecological and social sustainability.

Kiribati presents a paradox of an eroding customary marine tenure along with a culture still firmly holding on to traditional values and closely tied to subsistence activities.<sup>9</sup> Up until the 1940s the colonial administration allowed customary marine tenure to prevail for all resources taken from lagoon and ocean sides. The Native Lands Commission subsequently recognized only certain rights. These rights include ownership of fish traps, seawalls, accretions, reclaimed land, and fishponds (Teiwaki 1988:40). The registration of these rights is usually made in the name of the male head of a descent group, who has customary obligation towards other members. However, the law did not specify this social requirement. In all other cases an open-access regime has resulted in overexploitation under conditions of high human-population density, including urban drift, more-efficient extractive technologies, and expanding market opportunities.

Pacific communities have been impacted in different ways by colonial regimes with their policies of open access and freedom of the seas. As shown

by Aswani in work on customary marine tenure in New Georgia, Solomon Islands, autochthonous as well as external factors may contribute to the fluidity of territorial claims to reef and lagoonal environments (1999). Ethno-historical data demonstrate that different forms of marine tenure are the products of specific circumstances involving population movements and shifting alliances. However, no one would dispute that ever since Western incursion in the Pacific local processes increasingly have become intertwined with external politics. In this age of relentless globalization, Pacific communities have witnessed a decline in traditional authority, and the social mechanisms governing customary marine tenure in particular appeared to have suffered more than institutions underpinning access to land resources (Thomas 2001b). In some cases chiefly authority, as in Fiji (Veitayaki 1995:79–80; 2000), has helped preserve control over customary ownership of rights to fishing grounds, in marked contrast to the relatively egalitarian Kiribati society. In other circumstances conflicts pitting local authority against foreign interests, as in Marovo Lagoon in the Solomons (Hviding 1996, 1997), have in fact strengthened claims to customary marine tenure.

Despite efforts to establish wildlife sanctuaries in the Line and Phoenix Islands, there are at the moment no marine protected areas and no protected areas of any type in the Gilbert group where the vast majority of I-Kiribati live. The islands in the Line and Phoenix groups are widely scattered and mostly uninhabited, making it difficult to monitor activities that could have detrimental effects on the environment, including illegal fishing or even the disturbance created by a single careless yachtsman.

In the early 1990s, a major interdisciplinary environmental survey of Tarawa Lagoon (Abbott and Garcia 1995) resulted in a series of reports and a proposal to put into place a Tarawa Management Council. To date, however, no significant progress has been made on the implementation of the full council proposal. The Environment Act, which came into effect in 1999, gave responsibility to the Environment and Conservation Division of the Ministry of Environment and Social Development for carrying out community awareness and education programs “on both the manner in which the Act will apply to new developments, and more broadly in terms of the importance of protecting Kiribati’s water, land and associated eco-systems” (*National Development Strategies* 2000:66).

Although one should recognize the role of government in coordinating management projects, it has been shown time and again that “top-down” approaches that exclude community participation will not be effective. By acknowledging that the national government’s enforcement capabilities remain inadequate, a possible solution may lie in a polycentric system to “common-pool” resources monitoring. Local users would retain authority to create at

least some of the regulations by virtue of their acquaintance with local knowledge and the redundancy and the rapidity of a trial-by-error learning process. Larger governmental units, on the other hand, would act to protect the rights of all citizens and to oversee appropriate exercises of authority with smaller units of government (Kunatuba 1994; Ostrom 1990).

There seems to be a consensus that sustainability will need to rest on a remodeled form of marine tenure (Johannes and Yeeting 2001; Tebano 2000), but it is not yet clear how to operationalize this idea.<sup>10</sup> Perhaps a combination of approaches could provide a blueprint for action, stressing: (1) fishers need to pursue activities generating income that could simultaneously provide a means to ensure the long-term use of selected high-value resources (e.g., aquaculture projects), (2) the strengthening of cooperative ventures, and (3) the judicious application of traditional ecological knowledge as an instrument for resource management (Thomas 2001b). It is important to bear in mind that any new proposal will meet resistance from individual fishing entrepreneurs and even government representatives. Having had free access to most of the lagoon and burdened by financial commitments to repay loans to buy the equipment needed to efficiently extract lagoon resources, some people will see unfair constraints on their short-term financial prospects. Additionally, the resurrection of customary marine tenure—even in remodeled form—is bound to generate or reactivate disputes concerning who has what traditional rights within bounded areas.

There is room for optimism, nevertheless, notably with precedents set by island councils (under the Local Government Act 1984) to adopt by-laws to protect fish and invertebrates, thus leading to community efforts to prohibit fishing practices in certain areas, at certain times, and in relation to types of fish and gear (Miria-Tairea 1995:15; Ruddle 1994:90–94). For instance, island councils on Tamana and Arorae have imposed restrictions on the use of gas lanterns to catch flying fish (Onorio 1985). On North Tarawa local residents have recently chased off outsiders gathering shellfish for commercial purposes (Johannes and Yeeting 2001). On South Tarawa the challenge will certainly be greater because many people who live there are not traditional landowners. Government will therefore have to play a larger role in managing resources near urban centers. In short, three elements will need to be addressed if sustainability is to be achieved. First is the lack of designated rights over resources use, resulting in “open access.” Second is the lack of enforcement of rights, both of government-created rights, for example, on lands leased by government from traditional owners, and of traditional rights, such as those pertaining to marine resources. The third element is the adoption of technology within existing rights that allows intensive exploitation of resources, such as outboard motors (Hunt 1996).