The Spratly Islands: A Marine Park Alternative

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On March 14 1988, a long history of confrontation over the ownership of the Spratly Islands erupted into violence when gunfire was exchanged between Chinese and Vietnamese troops in the area. The following month, three Philippine fishing vessels were seized by the Malaysian Navy while fishing in a portion of the Spratlys claimed by the Philippines. The 49-person crew was not released until an appeal was made by President Corazon Aquino to Malaysian Prime Minister Mahathir Mohamad. Within the last year, calls have been made by politicians in the Philippines and elsewhere for an internationally arbitrated settlement of boundary disputes in the area. Meanwhile, plans are underway to intensify oil explorations in the area.

The Spratly Islands consist of some 600 coral reefs and associated structures scattered across an area north of Sabah and southern Palawan stretching for more than 300 nm. The structures which protrude above the sea surface at high tide include at least 26 islands and seven exposed "rocks". China, Taiwan, and Vietnam each claim all the offshore islands in the South China Sea, including the Spratlys. The Philippines claims most of the Spratlys and Malaysia claims islands in southern portions of the group. Historical claims include those by the Netherlands and France, and recently Brunei has joined the list. Ownership of the islands is of concern not only because of potential indigenous resources and strategic importance, but also because of the implications the islands have for the delineation of exclusive economic zones (EEZs) and similar boundaries throughout the South China Sea.

In comparison with nearshore marine ecosystems in the region, the Spratly Islands are relatively pristine. However, that will not be the case for long. At least four countries maintain significant military garrisons on the islands: the Philippines, Taiwan, Vietnam and Malaysia. The presence of idle troops is of concern because of their tendency to engage in environmentally damaging activities such as shooting turtles and seabirds, raiding nests, and fishing with explosives. More sporadic but substantial damage comes from occasional parties of blast fishers and coral-smashing muro-ami fishers from the Philippines. The Spratlys lie adjacent to major shipping lines for oil and even nuclear waste, which could be released in the event of an accident in these reef-studded waters. More than 200 ships pass through the area daily. A potentially greater threat comes in the form of possible oil spills emanating from nearby oil wells off western Palawan, Sabah, Sarawak, Brunei and the Natuna Islands.

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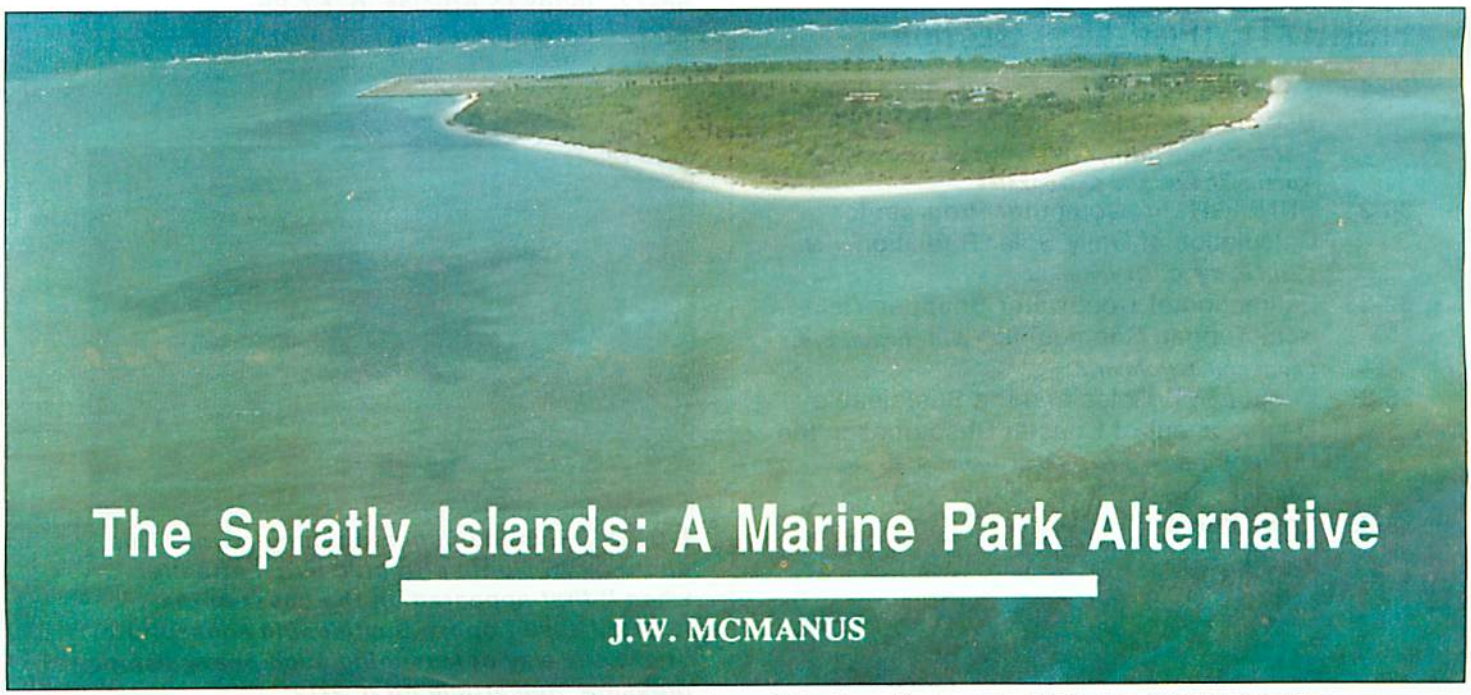
Most of the concern over the islands has centered on *potential* resources to be gained by extraction from the area. In reality, the most important long-term resources to be had from the Spratlys may be those which are already being used — the larvae of fish and invertebrates



Aerial view of Pag-asa Island in the Spratly Islands. Photos courtesy of Ma. Ceres Doyo of the ***Philippine Sunday Inquirer.***

which the Spratlys apparently supply to heavily fished waters elsewhere around the South China Sea. These larvae may be the key to the simplest and most equitable solution to the Spratly Islands issue, the creation of an international marine reserve.

Supplying Regional Stocks: A Resource Savings Bank

The Southeast Asian seas annually yield approximately 7 million t of fisheries

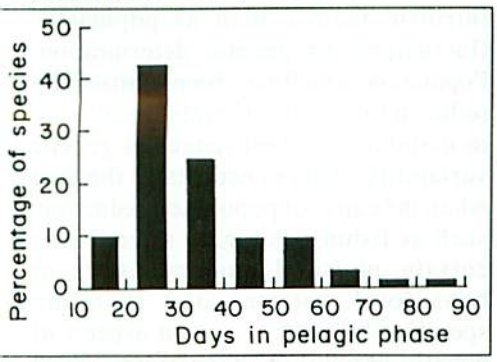


Fig. 1. ***Durations of the pelagic phase in 115 species of coral reef fishes from 22 families. Approximately one-half of the species settle out only after 1-3 months of pelagic existence.*** (Data from Brothers, E.B. and R. E. Thresher. 1985. Pelagic duration, dispersal, and the distribution of Indo-Pacific coral reef fishes. p. 53-69. *In* M.L. Reaka (ed.) The ecology of coral reefs. Symposia Series for Undersea Research, NOAA's Undersea Research Program 3(1).

produce worth more than US$6.5 billion. The ASEAN nations export nearly $1 billion worth of fish products annually. More significantly, fisheries contribute approximately 65% of the animal protein consumed in countries such as the Philippines, Malaysia and Indonesia, with the highest dependencies being found among the poorest coastal people. Areas adjacent to the Spratly Islands are particularly productive, such as the reef-studded waters of Sabah-Palawan which produces about 10,000 t of marine produce annually, valued at approximately $15 million.

Benthic marine organisms such as clams, corals, crabs, sea urchins and shrimp usually have planktonic or pelagic larval stages. The newly hatched young float or swim for periods ranging from a few minutes in some corals and sea squirts, to nine months for some lobsters. Most species have free-swimming larval stages of 2-4 weeks.

Coral reef fish species generally have pelagic larval, or sometimes juvenile, stages of from 9 to 100 days. Approximately one-half of the species have pelagic times of one month or more during which they swim in surface currents (Fig. 1). This behavior is assumed to have adaptive significance, probably related to avoiding predators on crowded reefs. The currents draw larvae away from the reef until they grow to more defensible sizes. It is strongly suspected, though never clearly demonstrated, that coral reef fish on some reefs spawn at times when currents and eddies will ensure a return of their young to the originating reef system. In such cases, natural variations in current patterns from year to year would cause a substantial number of larvae to be broadly dispersed. The longer the pelagic stage, the more likely this is to happen, and the more likely that the species is spread and maintained on larger geographic scales than those of single reefs.

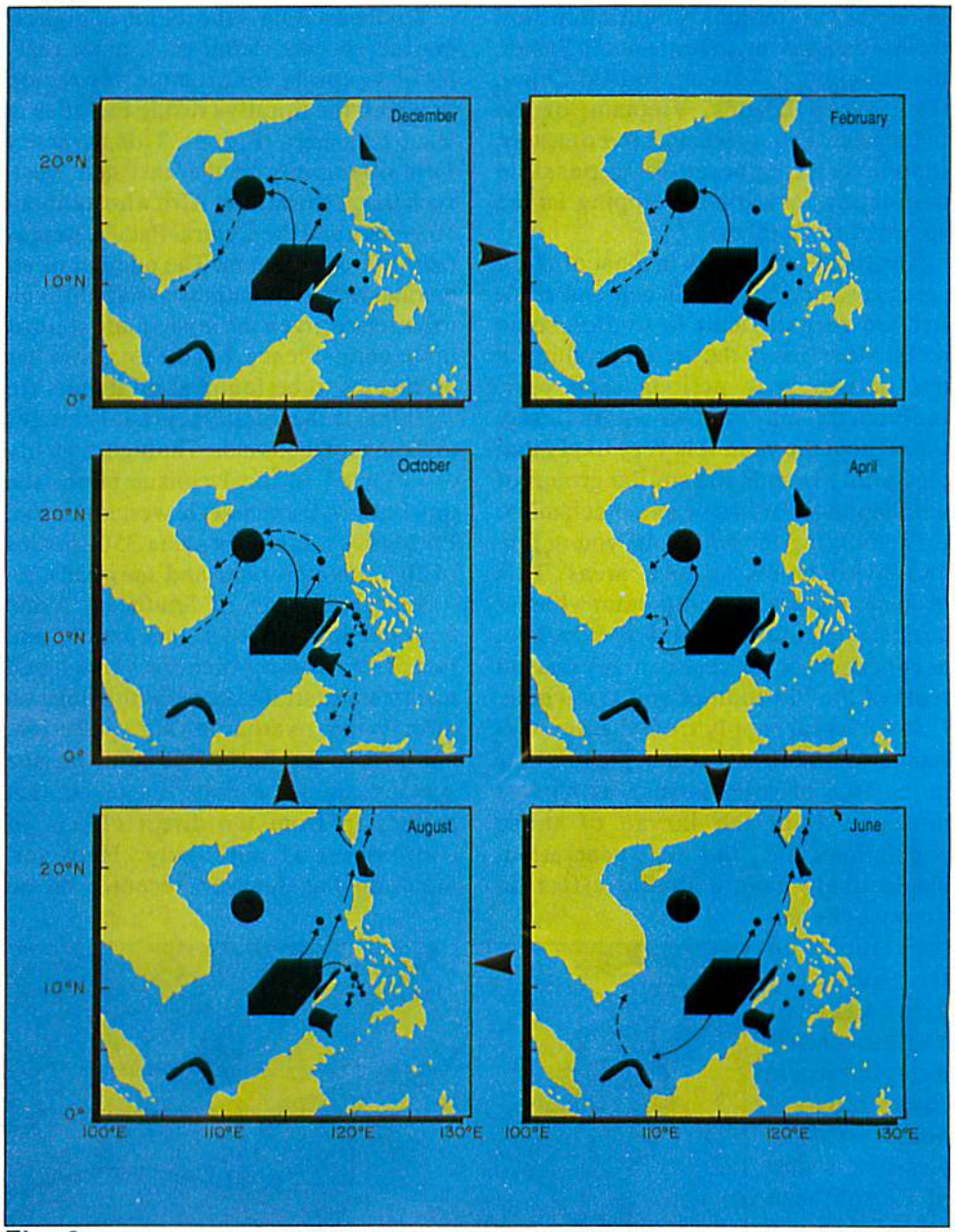


Fig. 2. ***Passive dispersal routes for slow-developing fish and invertebrate larvae from the Spratly Islands (black). Solid arrows indicate dispersal within one month, dashed arrows are for two months. Grey areas are selected reef banks. The large circle encloses the Paracell Islands and Macclesfield Bank. The arch covers the Natuna Islands. Note that oil spills in the Spratly Islands would tend to follow similar routes.***

The South China Sea is subject to monsoonal wind patterns which shift semiannually from origins in the northeast to origins in the southwest. This results in a complex system of surface currents, many of which completely reverse during the year. Although the currents are not completely understood, we can make some predictions about where young organisms from the Spratlys might end up after spending one or two months in prevailing currents at various times of the year. Fig. 2 shows that larvae maturing in one or two months would often find themselves having to settle out in Sabah, the Philippines, Taiwan, coastal China, the Paracell Islands, Vietnam, or the Indonesian Natuna Islands. Even eastern Indonesia is apparently a possible destination for slow-developing larvae spawned in October.

The local fish stocks in most of these areas are very heavily fished and adult fish are very difficult to find on some reefs. Most fish in the area reproduce in one or two peak periods each year. Individuals may spawn sporadically throughout the year. It is very likely that the Spratly Islands and similar groups of uninhabited reefs serve as a mechanism for stabilizing the supply of young fish and invertebrates to these areas. This becomes increasingly important wherein coastal populations of adult fish decline, as appears to be the case in many coastal reefs of the Philippines and elsewhere.

If the larval supply from the Spratlys serves to stabilize certain populations in the face of stresses such as harvest pressure, then the larvae of those populations, i.e., the next generation, would likely have a similar effect on downstream populations on the following generation. These secondary dispersals would cover most of Southeast Asia, plus some islands of southern Japan.

The waters are known breeding grounds for tuna fish, which migrate into nearby fishing areas to support an important export market. Thus, the Spratly Island area could be considered a "savings bank" where commercially important fish and invertebrates (as capital) are saved from overharvest (albeit unintentionally for now), and supply a constant flow of larvae (as interest) to areas of depletion.

Stabilizing Genetic Diversity: Long-Term, High Yield

Southeast Asia is the region of highest marine species richness. Among reef-building corals, for example, the region in which the Spratlys reside includes at least 70 genera (Fig. 3). This diversity falls off rapidly to the east and west, such that Central East Africa hosts about 50 genera and the Central Pacific ranges from 50 to 10 genera. The number of all marine species in Southeast Asia is difficult to estimate given the inadequate state of taxonomic science, but the total number of species to be found at all depths (to 1,800 m) in the Spratlys certainly ranges to the tens of thousands. The high diversity is reflected in local consumption: the tiny Bolinao fish market in western Luzon, Philippines, involves some 350 species of fish, invertebrates and seaweeds.

Several species of Southeast Asian marine birds, reptiles, mammals, and possibly some inshore fish and invertebrates are threatened with extinction directly by overharvesting, pollution, and loss of habitat. Most other marine species are so widely dispersed that extinction from the direct effects of overharvest is not likely. However, attention has focused recently on an indirect effect of harvest pressure which may be of concern. It is becoming increasingly clear that a species which appears to be adequately protected can become extinct for reasons related to declining genetic variability. The minimal size of a population which can be considered to be "safe" from extinction varies substantially among species. "Safety" here includes protection from a variety of fairly unpredictable events such as outbreaks of predators or pathogens, or natural catastrophes, as well as from intrinsic factors such as population fluctuations or genetic deterioration. Populations which have been substantially reduced from natural levels are unlikely to maintain constant ranges of genetic variability. This is especially the case when the cause of population reduction, such as fishing, is highly selective for certain physical characteristics or behavioral patterns and therefore specifically reduces certain aspects of genetic variability. Populations which approach the "Maximum Sustainable Yield (MSY)" are generally already reduced by about one-half of natural levels. Populations of many harvested fish in the Philippines and adjacent areas have been reduced significantly below this level. The same may be true for harvested invertebrates, about which less is known.

An interesting conceptual problem arises when one considers the dynamics of genetic exchange among marine organisms with substantial pelagic stages and strongly directional currents. In order for a population to adapt genetically to local conditions, the genes of the population must somehow be returned to that locality.

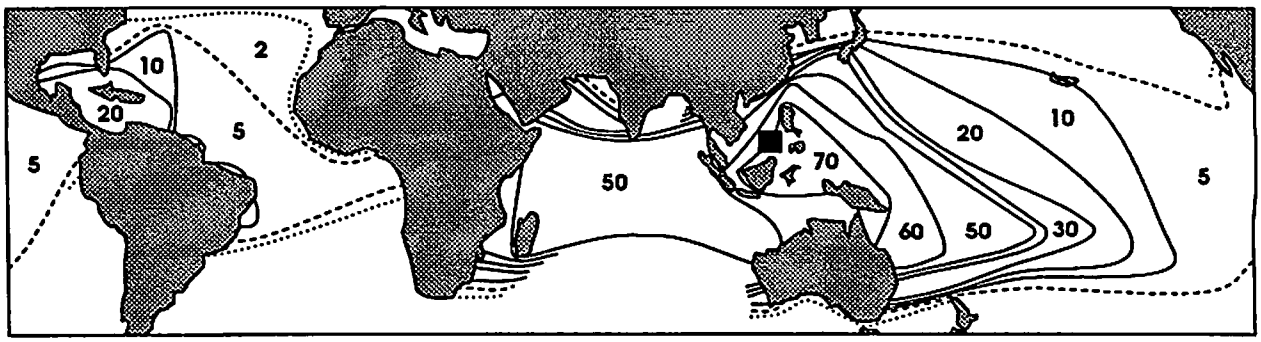


Fig. 3. ***Numbers of reef-building coral genera worldwide. The Spratly Islands (black square) fall in the region of highest diversity. The same holds true for most marine taxa.*** (Based on a figure by J.E.N. Veron in Corals of Australia and the IndoPacific, Australia Institute of Marine Science, Townsville, Australia.)

A population of organisms in which all progeny are swept downstream, and which is supplied only by progeny from upstream, can never adapt genetically to local conditions, for instance, to develop the behavior patterns necessary to find suitable breeding grounds. However, a chain of population centers in the form of a semi-closed loop could permit such adaptation at the geographic scale of the loop. This could well be the case in the South China Sea, where genetic feedback is likely to be possible to an area such as the Spratlys within two or three generations for many species. For example, larvae may pass from the Spratlys to the Paracell Islands in one generation, to Vietnam and the Natura Islands in the next, and back to the Spratlys in the third generation. Hence, the adaptability of some species to future environmental changes could be seriously impaired if the larval exchange system were to be disrupted.

A logical management approach would be to provide for a network of reserves in the area which could "feed" each other with larvae. An excellent place to start would be the Spratlys, because of their "strategic" location with respect to larval dispersal, and because no group of truly indigenous people is yet dependent upon its local marine populations for food.

Drilling: Short-Term, High-Risk

One of the major concerns prolonging the debate over ownership of the Spratly Island area is the possibility of oil. It is by no means certain that oil exists in the area in quantities large enough that extraction will be economically feasible. However, if ownership were to be clearly established, it may be assumed that oil exploration in the area would take place on a substantial scale. Oil drilling poses a substantial threat to the wildlife of the Spratlys.

Generally speaking, the deeper the water, the more expensive the drilling operation. This creates a strong incentive to construct oil rigs in shallow-water reef environments. The shallower the water, the more environmentally damaging the operation is likely to be.

In oil exploration, the drill must pass through layers of sediment containing fluids of various viscosities. In order to prevent an upward rush of these fluids which might delay the operation or even topple the rig (a "blow-out"), fluids known as "drilling muds" are injected into the hole, with viscosities comparable to those expected in the sedimentary fluids. The drilling muds also serve to lubricate and to flush out rock cuttings made during drilling. The cuttings and mud are discarded into the water, and the plume of mud can sometimes be visible downstream for more than a kilometer. These and other discharges can result in thousands of barrels of mud being released in a few hours.

Gas and oil blowouts are more serious. Most occur during development drilling operations, and last from 15 minutes to one day, sometimes longer. Human error has been a factor in most blow-outs. However, the situation is often exacerbated by natural factors, such as hurricanes, earthquakes, or large waves. The South China Sea has the most volcanoes of any area of comparable size in the world. Earthquakes, typhoons and tsunamis ("tidal" waves) are major concerns. Thus, regardless of what safety measures are taken, there is a reasonable probability that serious accidents would occur sometime within a few years following oil discovery, and considerable damage to the wildlife of the Spratlys would ensue.

An International Reserve: Timely Investment

It is apparent that the settlement of boundary disputes in the Spratly Islands could be settled only after incredibly complex and unusually fruitful negotiations among at least six countries.

An alternative is to ignore the Spratlys altogether in negotiations of EEZs and national boundaries. This has essentially been the case in recent history, and it could continue to be so as long as all countries agree not to pursue their claims of ownership among the Spratlys. By turning the Spratlys into a neutral, international marine park, all claimants could continue to benefit from the living resources emanating from the area, and a host of potential conflicts could be avoided. Also to be avoided are the many tens of millions of dollars currently being spent each year on maintaining garrisons of troops to guard against each other. There are several international agreements which could serve as precedents for such a development. Two such agreements are the Antarctic Treaty and the Torres Strait Treaty.

The Antarctic Treaty was conceptualized in 1957 after 18 months of very successful international scientific cooperation in the study of Antarctica during the International Geophysical Year. The treaty was conceived as a way to perpetuate such fruitful cooperation. At the time, there were a multitude of nations with potential claims to the resources of the continent. Some minor armed conflicts and property destruction had occurred. The treaty, enacted in 1961, included a moratorium on claims of resources. The provisions of the treaty are highly relevant to a possible Spratly agreement (Table 1). The emphasis on international cooperation in science has paid off

Table 1. Selected provisions of the Antarctic Treaty pertinent to a possible Spratly Island Treaty. (From the Encyclopedia Britannica, 15th edition, 1986.)

Article	Provision
I.	Peaceful use of Antarctica.
II.	International cooperation and freedom of scientific investigation.
III.	Free exchange of plans, scientific results, and personnel.
IV.	Nonrenunciation of prior claims; prohibition of new claims and citation of any activities during the treaty term as a basis for past or future claims.
V.	Prohibition of nuclear explosions or waste disposal.
VII.	Open inspection of any nation's Antarctic operations by any other nation.
XI.	Referral of disputes to the International Court of Justice if they cannot be settled peacefully through negotiation or arbitration.
XII.	Review of the treaty after 30 years upon request of any contracting party.

Beach in Pag-asa Island (note tar balls on the sand).

remarkably, such that a substantial part of what is currently known about global processes has arisen from international collaborative programs in Antarctica.

The Torres Strait Treaty between Australia and Papua New Guinea is very detailed and includes provisions specifically designed to protect a region of islands and reefs from overexploitation and damage. The agreement contains provisions that neither country will attempt to extend its boundaries in specific regions.

Philippine soldiers return a sea turtle to the sea.

A Management Scenario: Investing Wisely

A possible treaty for the Spratlys might follow the leads of the Antarctic Treaty and the Torres Strait Treaty in calling for a truce to ownership aspirations for a definite period, such as fifty years, with an option for review and indefinite renewal. A possible management strategy might include five elements: 1) an international management board; 2) a contracted research and management institution; 3) a private surveillance force; 4) tourism facilities; 5) research facilities and programs.

The claimant countries would probably each require representation on a pooled management board. It would be particularly fruitful if this board included scientists, and carried the extra function of planning for international collaboration on research programs in the area. The actual management of the reserve would involve research and monitoring activities in order to head off possible deterioration from such things as regional oil spills, or diminishing supplies of larvae from other areas. An international research organization might be contracted to oversee management and related studies. An enforcement team would be necessary to prevent poaching and other violations of management regulations. Such a team could serve a secondary role as a regional air-sea rescue squad, which would be of tremendous humanitarian value in this region of reef-studded sea lanes. The team could also perform a role in environmental protection by providing advanced warning on the approach of oil slicks from passing or grounded ships, and by assisting with and coordinating oil containment and clean-up operations.

Most of the funds for management operations could come from the consortium of claimant nations and others that would benefit from having peace and security in the region. However, some form of well-regulated tourism might generate additional income, and help to maintain public awareness and hence longevity of the agreement. Designated reefs could serve as diving spots for cruise vessels based in peripheral countries, thus boosting the regional tourist trade. A similar system covering the Great Barrier Reef in Australia earns A$1.4 billion/year in tourist revenues. Finally, research facilities could be established, such that the international community could benefit from the vital ecological and management information to be gathered at such an anomalously pristine site amid highly diverse waters. The development of a field research training program for marine science graduate students would further address critical needs of the region and enhance the value of the reserve as an international asset.

Summary: An Equitable Savings Approach

The primary benefactors of the "Spratly Resource Savings Bank" appear to be the low-income fishing families living along the coast of the South China Sea. National interests are currently being served as well, in terms of a widely distributed and critical food supply. The task of protecting that system would involve a substantial effort and a high degree of cooperation among several nations. However, the complexity and costs would be small in comparison with those of the Antarctic program.

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