The International Perspective of the Exclusive Economic Zone (EEZ)

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The Exclusive Economic Zone (EEZ), as recognized by the Law of the Sea, is a zone over which a country or state has special rights for better control over its maritime affairs. The Zone, in most cases, extends for 200 nautical miles (370 km) beyond the territorial waters of the country or state, which may be between 3 and 12 nautical miles from the coastline.

In 1930, the principle of the "freedom of the seas" defeated a conference of the League of Nations to extend national claims for protecting shore-side resources. In 1945, however, the United States extended its control unilaterally to cover all the natural resources of its continental shelf which extended to about 200 nautical miles, and within five years it was joined by the four nations on the western seaboard of South America to enable them, through the Santiago Declaration, to get control over the fisheries resources of the Humboldt Current. Within the next 20 years, about 66% of the nations had established territorial waters to 12 nautical miles, and 8% to 200 miles. Some 25% continued with the old 3 nautical miles.

Between 1956 and 1967, there were United Nations Conferences that tried to propose and establish a Law of the Sea. The first Conference at Geneva resulted in four treaties or conventions, although the breadth of the proposed territorial waters was not decided. The second, also at Geneva, failed to result in any international agreements, but a third initiated a conventional force that took 15 years to mature.

The Third Convention finally got underway in New York in 1973 and lasted until 1982. It defined limits for five baseline areas, namely:

- Internal waters, which the nation has all rights to use and to which no foreign vessels have rights,
- Territorial waters, which extend to 12 nautical miles with the coastal state free to set laws, regulate any use, and use any resource,
- Contiguous zone, 12 nautical miles beyond the territorial waters where laws can still be enforced,
- Exclusive economic zone, which extends for 200 nautical miles from the baseline, and provides the coastal nation with sole exploitation rights, and
- Archipelagic waters, which are both territorial waters and an exclusive economic zone that can be identified as part of a state's territory and territorial waters.

In this paper, the maritime affairs are confined to the exploration and permitted use of the fisheries resources and fish production within the EEZ of a country. This includes any economic, social, and environmental benefits. Despite the potential simplicity, however, of defining the EEZ of a nation or state, with or without any agreements with neighbors, the exact extent of an EEZ and its marine resources are a common source of conflict between them.

On the other hand, the interest of the international organizations is predominantly environmental, rather than economic or social. For example, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) has had risk assessment of marine aquaculture as one of its priorities. Both the International Council for the Exploration of the Seas (ICES) and the North Pacific Marine Science Organization (PICES) have working groups on aspects of marine aquaculture, most of which are environmental or ecological. International delegates to the 2004 FAO/Committee on Fisheries, Sub-committee on Aquaculture identified the preparation of guidelines for the ecological risk assessment of offshore aquaculture as a priority for members. The guidelines were published by Nash et al. (2005).

The Open Ocean or Non-Tidal Waters

Offshore waters and their living and non-living resources are owned by their respective coastal nation. Consequently, the coastal nation has to have control and management of their use. Coastal nations, however, may differ in their recognition of these resources.

Countries license individual fishing groups and register vessels to harvest natural and enhanced resources from public waters. Natural and enhanced resources include fish, crustaceans, mollusks, and seaweeds. In sum, the natural harvesting or stock recovery is paid by the private sector, and enhancement is paid for by the government at the appropriate level. The catching technology is then determined by the zoning of the habitat.

Marine Fishing

Governance is fundamental to fisheries, because it determines the manner to which power and influence are exercised over the management. Institutions also play a range of roles in fisheries governance and they affect whether or not fisheries can continue to provide economic, food security, and livelihood benefits.

Economic contributions of industrial-scale fisheries are visible and include exports and revenues from licensing. In contrast, the economic importance of a small-scale fishery may only be recognized if it collapses and the resulting costs of food substitution and unemployment are felt. Developing countries face decisions about how best to realize the potential of all their fisheries. For example, do they develop their own fishing industry, or allow foreign fleets to exploit their resources? Do they prioritize resource rent from industrial fisheries, or the socioeconomic benefits of smaller-scale fisheries? Competing demands for resources and access can lead to conflicts and overexploitation of fisheries, with negative impacts on food security. Management of fisheries that ensures their sustainability is essential to maintain their contributions to food security.

In a summary of papers by the Fisheries Management Science Programme (2005), fishing can be a full time engagement, a part of a mixed fishing-farming livestock, or a seasonal fall-back. Although fishers are often poor, the cash income generated by the sale of the fish can give them access to basic goods and services such as education, health, and other assets. Fisheries can reduce economic and food vulnerability, but they are themselves vulnerable to external influences such as environmental degradation and climate change. To implement effective management, decision makers have to recognize the roles and importance of fisheries to livelihoods, and ensure fisheries are sustainable.

Fisheries systems are therefore complex and dynamic, and fisheries management institutions must take account of a range of information types, as well as changing policy priorities in the sector. Many institutions, however, face severe human and financial constraints and there is a great need for capacity development and improved governance, particularly in developing countries.

Marine Ranching

Marine ranching is the licensing of individuals and groups to plant, manage, and harvest resources from public waters in which they have been raised, released, and subsequently recovered. The private sector pays for all activities and assumes all the risks.

Implementing an effective marine ranching program requires not only the regular release of numbers of aquatic animals and plants but also actions that take into account their biological, ecological, and genetic needs (Bartley 2002). These actions may be the creation of artificial habitats, improvement of coastal areas, and even removal of predators. They may also include releasing fish trained to respond to specific feeds and remain in one area. On the other hand, an effective marine ranching program can increase employment in the local industry and create an efficient production activity.

Of course, in the short term, the national or regional planning of marine ranching programs requires more research information on the economic, environmental, and social effects. Research strategies may include, among many others, studies on the effects of carrying capacity and stock densities that can impact survival and growth; the composition and diversity as a result of release density and exposure; and studies on genetic interactions between sea-ranching strains and local stocks. In the long term, the strategies are specific for the studies of various species individually or in association, but they also include collections of background information to provide a valuable basis for future evaluations of the environmental and ecological effects of sea ranching.

The difficulties of undertaking the majority of discussions of sea ranching recognize undertaking activities which are certainly about the sea ranchers rights, and have a number of environmental and ecological considerations.

Marine ranching and hatchery production of early life stages of fish and shellfish are important management tools. For example, these may be to rebuild a fishery like the red sea bream (*Pagrus major*) fishery in Japan or the orange roughy (*Hoplostethus atlanticus*) in Australia; to maintain a fishery in the face of habitat degradation or loss like the sturgeon (*Acipenser* spp.) fishery in the Caspian Sea or flatfish in the North Sea; to increase the value of a fishery like the chum salmon (*Oncorhynchus keta*) enhancement in Japan; or to create new fisheries like the striped bass (*Morone saxatilis*) in western North America.

Marine Farming

Marine farming is the licensing of individuals and groups to plant, manage, and harvest a resource from private waters. Private waters are areas of public waters that can be identified and leased for private use that is designated and limited. The private sector also pays for all activities, and assumes all the risk.

The demands for more seafood in the marketplace are fuelled in part by the changing scenes in traditional marine capture fisheries and the onset of modern aquaculture, which began just over a century ago. For the most part, early aquaculture activities began as extensive systems in coastal ponds for subsistence, relying on little more than stock enhancement and transplants. These made some contributions, but there were no real advances until the 1940s and 1950s, when some

modern semi-intensive and intensive systems were successful for marine fish with the raising of brine shrimp in the hatchery.

Current efforts in aquatic farming development have been increasingly progressive for many years, and have risen to an order of 35% – 45%. The diversity of the cultured species, however, has been very limited and certain production very biased. For example, in addition to the freshwater fish in Asian countries, the dominant species of fish (salmonids) are anadromous. The dominant marine species are prawns, shrimps, oysters, and clams – and not marine finfish species.

Apart from these early and successful practices, the costs of modern marine fish culture are distinctly high. A good aquaculture site is a balance of selected EEZ waters that are good to access, together with a land-based site to provide all the necessary services. These include, for example, the storage of resources, such as vessels, fuel, and feed ingredients, and operational investments, such as labor, food disposition, and energy. A minimum number of industrial subsidies is required, such as coastal rentals, or the exposure to a number of environmental risks, such as areas for pollution or grounds for schooling whales.

The long-term outlet for the production of seafood in the EEZ is encouraging, but there is no question that it requires a great deal of expensive effort because of the innumerable details and the logistics of movement and management. Nonetheless, many solutions have already been found. For example, utilizable offshore waters of the EEZ are greatly different from nearshore waters and they require monitoring of dissolved inorganic nutrients, total volatile solids, the redox potential, and soluble hydrogen sulfide. All four can be quickly measured on any day, and cheaply. In offshore waters, many technological solutions are now being found, including the increased reduction in the dealing with residual drugs and the overuse of feed.

Positive Development Themes

The environmental and ecological elements in the topic of Offshore Aquaculture are very important but need not dominate any workshop programs. The following is proposed as a list of topics for discussion:

- Concepts and species
- Legal and business issues
- Research and development
- Environmental and ecological risks
- International case studies

Concepts and Species

This section can be an introductory overview of what constitutes offshore aquaculture. It can include stock enhancement (e.g., harvest and grow out young fish, such as tuna) or it can be true culture from start to finish.

It is interesting to get the perspective of a representative of an international organization (e.g., the Food and Agriculture Organization of the United Nations, FAO), an imaginative fisheries manager, or fisheries scientist to conceptualize on how far offshore aquaculture might complement or compete with commercial fishing. The session could be extended further if the offshore concepts were divided into the views of both fishing and shell-fishing industries. This session can be a broad-ranging but strong opening lead to all discussion, which would then be followed sensibly by the legal and business issues.

Legal and Business Issues

The second section illustrates the legal rights of a business to operate and have protection offshore. There are the issues of the jurisdiction of immediate coastal waters and waters further offshore (vis-à-vis large countries like Australia, Canada, and the United States, all with powerful states and provinces), and the rights to have possession of species being farmed, which for commercial fishermen might be illegal and/or undersized, harvesting out of season, etc. – in other words, control by sets of laws that were framed for another industry altogether.

In Japan, Yokoyama (2003) established indicators as criteria for the Law to ensure sustainable aquaculture production, and MARAQUA in Europe (Read et al. 2001) described the processes adopted by partnerships when reviewing current practices in relation to licensing, regulations, and monitoring procedures.

Research and Development

Obviously, offshore aquaculture is still very much in embryo, and therefore, a great deal of research and development is taking place all over the world. This could be easily summarized, say, on a continental basis (Asia, Australasia, Europe and Scandinavia, and the United States), or on a marine basis (Atlantic, North and South Pacific, Mediterranean).

That being said, the research and development topic could be usefully divided into two areas: (a) biological engineering and (b) biology (species and husbandry).

Nonetheless, substantial progress has been made with the research and development of some marine fishes and their environments, and there are successful reports by Mazzola et al. (1999) for the western Mediterranean, by Angel et al. (2002) in the Red Sea, and by Karakassis (2001) in the Mediterranean. Similarly, there are encouraging reports on effluent conditions in papers by Nordvarg and Johansson (2002), Islam (2005), and Desa et al. (2005).

Environmental and Ecological Risks

Together with the Modelling-Ongrowing fish farm-Monitoring (MOM) papers (Ervik et al. 1997; Hansen et al. 2001), the collection summarized the findings of five topic groups established to analyze the scientific and socioeconomic basis of current environmental practice in marine aquaculture and it identified the key recommendations for the best environmental practices in relation to marine aquaculture.

Rogers and Greenaway (2005), for example, reviewed the suite of marine ecosystem indicators currently in use or under development in the U.K. to support the major national and international biodiversity and ecosystem policies. They criticized the lack of indicators for the pressure of human activities on the environment, or the socioeconomic response to the pressures.

An in-depth and realistic view of what might be the environmental risks of open ocean aquaculture would be useful. According to Nash et al. (2005), of the 10 principal risks, the two most important were increased organic and inorganic loading. Other risks of lesser importance were residual heavy metals, residual therapeutants, transmission of disease organisms, and interactions with wild fish populations following escape. Further down the list were two interactions with marine wildlife, and marine habitat. The lowest ranked risks were harvesting of juveniles for grow-out and the increased harvest of industrial fisheries for fish meal and fish oils for manufacturing feed, both of which were judged not to be aquaculture issues but fisheries managers' issues.

International Case Studies

The session can finish with international case studies given by individuals who have been trying to implement commercial offshore aquaculture, all the problems that they can identify, the good things, and their forecasted projections.

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