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Sean Hern

COMPETING VALUES: TAKING A BROAD VIEW ON THE NARROWING CONSERVATION REGIME OF THE 1982 UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

SEAN HERN*

INTRODUCTION

"Conservation of the living resources" is a central paradigm of contemporary international agreements regarding the use of living resources of the ocean. It is employed as the common denominator upon which resource extraction is to proceed. For instance, article 61(2) of the United Nations Convention on the Law of the Sea (UNCLOS) states, "[t]he coastal state, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by

* Faculty of Law, University of British Columbia, Canada, sean_hern@yahoo.ca.

over-exploitation."[1]

While the principle of conservation looks rational and useful in print, it is a highly elusive concept to apply. Conservation policy relies on science to guide and justify its management strategies for the natural world, particularly the science of ecology. In theory, ecology is the unifying science which amalgamates aspects of many fields of study into a cohesive holistic understanding of the interrelationships that govern the natural world. In practice, however, ecology has provided no such understanding. The paradigm of slaughtering living creatures to extinction was a much simpler paradigm than one governed by resource policy rooted in the tumultuous science of ecology.

Considered as a whole, the provisions of UNCLOS relating to living resources establishes a regime of resource extraction in service of two objectives: 1) the maintenance of the global commercial markets for fish, and 2) the maximized use of the oceans for human food supply.[2] It is an agreement that places great faith in the combination of the limited sovereignty established by the Exclusive Economic Zone ("EEZ")[3] and in scientific competence to rescue the capitalist market from its inherent tendency to encourage the over-exploitation of resources in the interest of short-term gains. Whether this faith is warranted is highly questionable. This paper discusses and critiques the theoretical model of conservation established by UNCLOS. It asserts that a broad and contextual understanding of what the conservation scheme of UNCLOS is must underlie its refinement and interpretation.

In Part I, the paper begins with a discussion of the conservation scheme in general and then proceeds to examine its foundations in the property rights of the EEZ, and the principles of ecological science in general. Part II continues with an examination of the difficulties in ecological science when applied in the form of yield calculations. Part III considers the significance of the "precautionary principle" to the general scheme of conservation as represented in more recent international agreements. In Part IV, a discussion out-

1. United Nations Convention on the Law of the Sea, Dec. 10, 1982, U.N. Doc. A/CONF. 62/122, 21 I.L.M. 1245 (1982) [hereinafter UNCLOS].

2. *See id.* preamble (setting forth the objectives for establishing UNCLOS).

3. *See* discussion *infra* Part I.B (discussing the establishment of the EEZ).

lines some alternatives to the present regime of living resource management. This paper concludes that while UNCLOS is an important advance in the establishment of an international regime of living resource exploitation, future negotiations must release the value of conservation from the stranglehold of competing values in the accord.

I. BACKGROUND

A. THE CONSERVATION SCHEME OF UNCLOS

The conservation scheme of UNCLOS attempts to establish a framework for controlled fisheries exploitation. The control derives from three central concepts: 1) the establishment of limited sovereignty in the EEZ, 2) the duty to conserve the living resources within the EEZ, and 3) the duty to cooperate with other interested states to conserve stocks that do not live in the EEZ of only one state.

Concerning the first principle, establishment of limited sovereignty in the EEZ, it is important to note that the EEZ is a codified extension of property rights into territory that was formerly a commons. Sovereignty over the EEZ with respect to living resources includes the right of the coastal state to determine the allowable catch of the living resources in that area, to regulate the harvest of the allowable catch, and to harvest the entire amount of the allowable catch if it can.

The allowable catch is to be determined in accordance with the "maximum sustainable yield" (MSY) of the resource, a calculation which matches the harvest rate to an optimal rate of resource regeneration.[4] This policy aims to ensure that the allowable catch provides for "optimum utilization" without over-exploiting the resource.

Optimum utilization is a requirement of UNCLOS.[5] It is akin to freeway speed limits—the signs state the maximum, but there is also an unstated minimum speed limit that is essentially the same speed as the maximum. If optimum utilization of the total allowable catch

4. *See* UNCLOS, *supra* note 1, art. 61(3). Article 61(3) notes that, "Such measures shall also be designed to maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield . . . ."

5. *See id.* art. 62(1).

is not achieved by a coastal state, UNCLOS provides that the coastal state must grant rights of access to fishers of other states to catch the surplus. The consideration of a range of contextual factors such as the relative economies of the candidate states, and their historical use of the fisheries in question, determines which states are granted the rights of access to the surplus.

The second principle is the duty to conserve the living resources within the EEZ. This duty is performed in reliance on the "best scientific evidence available" to the state, and also in cooperation with all other states and competent international organizations. However, this duty cannot be observed to excess because there is the corresponding duty of optimal utilization via the MSY. Furthermore, the MSY is not simply a scientific calculation because it must be qualified by factors including the economic needs of coastal fishing communities and any special requirements of developing states.[6] Clearly, the duty of conservation is a challenging and difficult proposition, even in purely hypothetical terms.

The third principle guiding the UNCLOS conservation scheme is the duty of cooperation with other interested states to preserve stocks and sustain resources. This requirement includes the duty to exchange scientific and fisheries information,[7] and to coordinate the harvest of stocks straddling two or more EEZs[8] and the harvest of stocks of highly migratory species.[9] It can include bilateral cooperation as well as cooperation within regional organizations.

B. THE COMMONS, THE COMMON POOL, AND THE ENCLOSURE OF THE SEAS

The scheme of ocean management found in UNCLOS is problematic for reasons beyond the issues of cooperation and enforcement that typically accompany international agreements. In light of this, it is useful to consider the origins of the conservation ethic in order to establish a wider framework for the analysis of contemporary international efforts. To begin this analysis, the establishment of the EEZ

6. *Id.* art. 61(3).

7. *Id.* art. 61(5).

8. *Id.* art. 63.

9. UNCLOS, *supra* note 1, art. 64.

as a semi-sovereign enclosure must be considered in its historical context.

One of the oldest models of ocean resource management is the ancient order of "the commons." The commons were undivided territory belonging to the members of a local community as a whole. Traditionally, the commons were tracts of semi-wild lands that provided hunting and fishing grounds, seasonal pasture, and a wealth of seasonal forage for the local human inhabitants. The commons were not simply a pool of resources, but were traditional community institutions governed by rules of sharing that had developed over the long-term use of these areas.[10]

A second form of collective ownership is "open-access" or "common-pool" ownership, whereby living resources are open to exploitation by anyone. In the context of fisheries, this regime formed part of the "freedom of the seas" principle, which in turn formed the earliest principle of international oceans law. Garrett Hardin's influential essay, "The Tragedy of the Commons," addressed this model of common ownership.[11] Hardin explained how resources held in common became subject to over-harvesting by individuals acting in self-interest, with the justification that if one person did not take the resource for himself, someone else would take it. This theory is widely criticized for not distinguishing between the open-access model of common ownership and the traditional form of the commons.[12] His critics assert that it is only the open access model of common ownership that leads to the devastation of abundance.[13]

The distinguishing feature of the two versions of the commons is the presence of commercial markets for living resources extending beyond the bounds of the local community. The traditional commons is marked by common ownership within a largely subsistence econ-

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10. *See* GARY SNYDER, THE PRACTICE OF THE WILD 30 (1990) (noting that because "the commons" is traditional and local, it may be distinguished from today's public domain, which is comprised of land held by the central government).

11. *See generally* Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243 (1968) (predicting the eventual over-exploitation of all resources used in common).

12. *See* Lore M. Ruttan, *Closing the Commons: Co-operation for Gain or Restraint?*, 26 HUM. ECOLOGY 43 (1988) (describing the volley of criticism alleging that Hardin misused the term "commons" in his 1968 essay).

13. *See id.*; *see also* SNYDER, *supra* note 10, at 35.

omy, wherein over-harvesting a resource could bring no benefit to the harvesters and instead would furnish only the stench of rotting excess. On the other hand, open access regimes of common ownership operate in service of sizeable commercial markets, and are rooted in the concept of the unquenchable abundance of the resource. Although market prices could fluctuate, generally the greater the harvest, the larger the reward.[14] This pattern of exploitation was operative in the fur trade, the wild bird and egg markets of North America, and most of the world's fisheries. Under the regime of open access, species were slaughtered at rates far beyond their ability to reproduce, sometimes even to extinction. For example, the great auk of the Eastern seaboard of Canada, which appeared to be infinitely abundant to new world settlers in the 1600s, was extinct by 1844, having been slaughtered in service to the commercial markets for oil and eggs.[15] More commonly the harvest of the species occurs in conjunction with other pressures such as habitat loss, sporting activities and pollution, and conservation efforts begin with the collapse of the commercial viability of the resource.[16] The problem with open access regimes is that they originate in a perspective of the abundance of the natural world and are dismantled in a perspective of scarcity in the face of the collapse of the resource.

Hardin's confusion of the commons with open access common-pool ownership inspired many researchers to refute his claims of tragedy by documenting successful examples of resource management within a commons.[17] Academic articles abound from researchers studying villages or tribal territories that employ systems of communal resource management. The researchers attempt to show that traditional models of communal ownership can provide viable,

14. It is arguable that the presence of a commercial market is a primary cause of the breakdown of a traditional commons and its transformation into an open access regime.

15. *See* FARLEY MOWATT, SEA OF SLAUGHTER 39 (1984) (commenting that the adherence to an outmoded theory justifying the destruction of "worthless" species for the presumed good of others was an attitude repeatedly encountered).

16. *See generally id.* (examining this pattern in relation to waterfowl, whales, mink, marten, otters and ermine, blue-fin tuna, Atlantic salmon, and many more).

17. *See* Feeny, Berkes, McCay and Acheson, *The Tradegy of the Commons: Twenty-Two Years Later*, 18 HUM. ECOLOGY 1 (1990) (citing dozens of studies that attempt to refute Hardin's thesis with reports of successful examples of communal resource management).

contemporary alternatives to the "tragedy" of the common pool. Some of these studies report successful communal ventures, whereas others are more ambivalent.[18]

Typical are reports from small coastal villages in Southeast Asia or Africa, which present versions of communal resource management and consider its applicability to the modern fisheries.[19] Lore Ruttan embarked on one such study of the common tenure system used on Kei Besar Island in eastern Indonesia, but noted some problems with the methodology.[20] The danger in such studies is that the researcher may interpret systems of common tenure as an example of sustainable development, although there may be no evidence of such intentions among the fishers. As Ruttan asserted, "true conservation is more likely to have evolved in societies where relatively high population densities [of the resource] are combined with limited opportunities to sell surplus produce . . . . [I]t is a mistake to assume that a 'conservation ethic' is universal among indigenous peoples."[21] Ruttan concluded that:

> we still lack a strong theoretical basis for understanding co-operation . . . . [W]e must explain why community members co-operate to sanction offenders when they themselves could free-ride on their own duties as enforcement agents. In addition, empirical support is needed to demonstrate that communal management systems actually do conserve resources.[22]

While traditional systems of resource use may provide some guidance as to how a modern industry might be sustained, the presence of the world market threatens the often delicate balance of the interests of the individual with those of the collective, and imposes a persistent temptation of short term gain for free-riders. For these reasons, strict application of traditional models for use in large-scale sustainable development within the commercial market is unrealistic, but

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18. For examples, see *infra* notes 19, 20, and 23 and accompanying text.

19. *See e.g.* Shanker Aswani, *Common Property Models of Sea Tenure*, 27 HUM. ECOLOGY 417, 449-50 (1999) (concluding that common property sea tenure can provide models for resource use and conservation, but it tends to be vulnerable to socioeconomic turmoil when incorporated into the commercial market).

20. *See* Ruttan, *supra* note 13, at 43-66.

21. *Id.* at 62.

22. *Id.* at 44.

they may be useful nonetheless in constructing alternative local use models that are incorporated within a larger regulatory framework.

Generally, the formation of the EEZ does not represent a displacement of a traditional commons. Rather, it represents the enclosure of a common-pool. It is in this context that the enclosure of the EEZ makes sense as a vehicle for conservation. It attempts to close off access to the common pool and burden the sovereigns of the new territories with the duty of conservation. For most of the world, the seas were no longer a true commons by the time of the signing of UNCLOS because they were utilized as a commercial fishery rather than a traditional subsistence fishery. The EEZ is replacing a common-pool free-for-all in the oceans that seemed guaranteed to empty the waters of all its abundance. To recognize this is also to recognize that the conservation project is so difficult because it is completely new.

There is no viable large scale precedent for commercially extracting a living resource within sustainable limits. It is not, however, without small scale precedents. For example, Taku Iida wrote of a Japanese fishing community that was faced with the collapse of its lucrative "kombu kelp" resource at the turn of the twentieth century.[23] In response to the resource collapse, the community developed a common ownership regime that has restored the kelp and manages its harvest at a sustainable level.[24] The kelp regeneration rates are monitored very closely, eligible fishers are tightly controlled, and yield is determined by considering the length of harvest, weight of the base of the kelp (the "kashira"), and the productivity per hour of the fishers in context of the tide level and wave height. This kind of system is exactly that to which a modern sustainable resource regime aspires; however, the kelp harvest is an unusual fishery in that the resource is measured easily and accurately and its market price is sufficiently high to support such intensive management efforts. For these reasons, the kelp harvest is a stellar example of sustainable resource management, but the murky science of the deep blue sea in-

23. *See* Taku Iida, *Communal Regulations in the Kombu Kelp Harvest*, 26 HUM. ECOLOGY 405, 405-23 (1998) (describing Kombu as a kind of seaweed growing in northern Japan, which comprises an important source of income for the local community because of its high price and its limited availability).

24. *See id.* at 410-13 (detailing the rules governing kombu harvest authorized by law and voluntarily agreed to by the harvesters themselves).

hibits its broader application.

C. THE SCIENCE OF ECOLOGY

The "management" scheme of UNCLOS bases the paradigm of optimum utilization and conservation upon a foundation of "the best scientific evidence available."[25] Many scientific fields are implicated in the understanding of the marine environment, and the science of ecology endeavours to integrate these various fields into a larger understanding of the whole. Successful resource management thus depends in large part on the success of the ecological enterprise.

Although the term "ecology" did not appear in print until 1866, the idea of ecology in the sense of "a point of view that sought to describe all of the living organisms of the Earth as an interacting whole" can be traced back to the early Eighteenth Century.[26] It arose in the context of Enlightenment rationalism and the emerging and powerful capitalist economy founded on principles of private property, organized labor, and the commercial market.

In his study of the history of ecology, Donald Worster identifies two basic, contradictory paradigms for understanding the natural world. One paradigm views nature as a machine, to be picked apart, subjugated and understood.[27] The opposing paradigm is one that comprehends nature as a soul, or spirit or life-force shrouded in sacred mystery.[28] These paradigms (and reactions to them) continue to influence and inform contemporary ecological projects be they large or small.

Reading UNCLOS articles 61 and 62 as a whole in the context of the rest of the agreement, the "science" of ecology that is summoned by UNCLOS is one that is capable of providing a comprehensive, predictive model of the way in which the living resources of the

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25. UNCLOS, *supra* note 1, art. 61(2).

26. *See* DONALD WORSTER, NATURE'S ECONOMY, A HISTORY OF ECOLOGICAL IDEAS 37 (2d ed. 1994) (noting that throughout the Eighteenth Century, the idea of ecology stood for the grand organization and government of life on earth—the rational ordering of all material resources in an interacting whole).

27. *Id.* at 40 (referencing the works of Newton, Descartes, Bacon, and George Cheyne).

28. *Id.* at 81-83 (referencing the works of Thomas More, Thoreau, Goethe, Schelling, and Wordsworth).

ocean interact and interdepend in their environments.[29] Implicit to this model of understanding is the larger project of determining the "value of nature" to human society. Such a value would then be factored in with other policy objectives so that a balance can be struck between "nature" and human enterprise.

It is the characterization of the "value of nature" that attracts the competing paradigms of ecology. Some branches of the science search for the map of the machine and call for "hard science" to rigorously establish a predictable reality. Other branches of the science step back from the scientific method and attempt to perceive larger processes at play. One of the troubles with ecology has been that at each turn, the "new ecology" has the slippery habit of being revealed as another view of the observers, rather than the ammassing of substantial empirical knowledge of the observed natural world.

Ecology has endeavored to answer questions such as, is the natural world a place of order, or one of chaos? Did its members evolve, or were they created? If they evolved, did they do so competitively or cooperatively? If there is an evolutionary pattern, are humans at the top of a hierarchical pyramid, nestled within a "web of life," or simply set apart from nature? Are humans rulers, stewards, or members of the natural world? If the natural world is ordered, is it a battle, a progression, a system, a love-in, or all one big organism? Is the ecology of the Earth in crisis? Is the Earth sick like an organism, or broken like a machine?

None of these questions have produced any definitive answers. There remains a general consensus that humans evolved from other creatures, although how and why this was done remains a mystery. Darwin's theory of the survival of the fittest has endured in the popular mind, but is highly criticized and contested by ecologists.[30] Darwin's theory of a competitive battle of subsistence was suplanted by Frederic Clement's "climax theory," which characterized the natural world as "communities" engaged in a linear progression toward a mature state of equilibrium called "climax."[31] The climax the-

29. *See generally* UNCLOS, *supra* note 1, arts. 61-62.

30. *See generally* CAYLEY, *supra* note 28 (noting that Darwin's work has been struggled with, modified, affirmed, and repudiated by many generations and schools of ecological thought).

31. *See* WORSTER, *supra* note 26, at 210 (explaining how Clement insisted on

ory was replaced with the "ecosystem theory," a model of energy flows and systems theory drawn from thermodynamic theories of physics.[32] The ecosystem model was later merged into a model of "spaceship earth": a holistic biomechanical ecosystem that also possessed bioregenerative powers.[33] The spaceship model was contested by a concept of the Earth's ecology as one living being, or "Gaia," which sustained life because it was in essence a life form itself.[34] Post-Gaia theories posited the natural world as ultimately one of chaos in which there was no progression, equilibrium, or point.[35] Post-modern ecology has refuted "neo Darwinists" and the chaos theorists with a unifying theory that expresses the relationship of patterning to that of chaos as a theory of "propensities" of natural phenomena.[36]

In charting the turbulent ecological discipline, Donald Worster noticed that ecology, like all other sciences and disciplines, is historically relative.[37] While framed in a language of rationality and objectivity, ecology implies the social and intellectual context of the scientist, rather than an external "reality." This analysis of science is not a novel proposition of Worster's, but his work is the best sustained analysis of the science of ecology from this angle. The Christian naturalists such as Carl Linnaeus and Gilbert White saw in "nature" the divine and gentle ordering of the Christian God, each

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the notion that the natural landscape must eventually reach a vaguely final climax stage after a steady flow toward stability).

32. *See id.* at 301-04 (describing how A.G. Tansley, an Oxford botanist, rejected Clement's "climax theory" and embraced the view that nature was a composite of strictly physical entities organized into a mechanical system).

33. *See id.* at 369-71 (stating that Earth's environmental situation is dire, for human beings have neither the possibility of fleeing the planet nor the knowledge adequate to repair the ecological problems).

34. *See id.* at 378-87 (explaining that approximately thirty million species work together to control the chemistry of the planet to their natural advantage).

35. *See id.* at 405-12 (warning that under the chaos theory, distant, invisible, miniscule events that may be happening presently might change the very structure of plant and animal life).

36. *See* ROBERT ULANOWICZ, ECOLOGY, THE ASCENDANT PERSPECTIVE 38 (1997) (commenting on the efforts to provide a theory well grounded in historical knowledge, while fitting into current ecological thinking).

37. *See* WORSTER, *supra* note 26 (noting that the study of "ecology" is rooted in political, economic, religious perspectives on nature).

creature set in its own place for eternity.[38] In Darwin's case, the origin of species in the paradigm of "survival of the fittest" was suspiciously similar to the ethos of laissez-faire capitalism of nineteenth century England.[39] Likewise, Eugene Odum, writing in 1950s and 1960s America, found nature to be very much like the post-war capitalist economy—a nature of producers and consumers, interacting in developing degrees of efficiency, all measurable by the quantification of a kind of gross product called "biomass." [40]

Instability in the empirical enterprise of ecology is hand in hand with the efforts of ecology to find solid ground for a "normative basis for policy"[41] (*i.e.*, the "value of nature") upon which the industrial age confidently can proceed. Each scientific theory of ecology arises within, and is to varying degrees informed by, the ethical implications of its propositions. Likewise, each philosophical position is justified by selected scientific findings. If this were not problematic enough, the constant pressure of an impending ecological crisis of potentially cataclysmic proportions adds a quality of desperation to the search for ecological truth and a conciliation of human society with the natural world.

To some degree, the science of ecology has always been driven by an ever-present notion of ecological crisis, predicting that the present relationship of humans to the natural world is leading to a future of monumental misery and scarcity. Thomas Malthus' 1798 "Essay on Population" was a particularly notable example of a work generating an air of urgency to the ecological project.[42] Malthus posited human

38. *See* CAYLEY, *supra* note 28, at 4-12 (articulating the eighteenth century Christian naturalist perspective that it is possible to understand God's reasons for creating the world by studying his creations). Worster's historical analysis also implies many of the developments made in the philosophy of science, from Thomas Kuhn to the work of post-structuralist philosophers such as Mary Hesse.

39. *See id.* at 148. (describing Darwin's encounters with 1840s London before he retreated to the quietude of the village Down in Kent).

40. *See id.* at 128 (describing nature as essentially based on the flow of energy from the sun, through the plants, up through animals, which recylces itself constantly).

41. *See* K.S. SHRADER-FRECHETTE AND E.D. MCCOY, METHOD IN ECOLOGY 8 (1993) (noting that, in attempting to develop a predictive general theory, ecologists must not only explain and predict a factual state of affairs, but also help policymakers describe and defend that state as somehow healthy or normative).

42. T. R. MALTHUS, AN ESSAY ON POPULATION (University of Cambridge

food production as following an arithmetic growth pattern, while human population grew exponentially. From this basic problem, he calculated that, "[i]n two centuries the population would be to the means of subsistence 256 to 9; in three centuries, as 4096 to 13, and in two thousand years, the difference would be almost incalculable."[43]

Despite the problematic nature of this theory,[44] it remained highly influential in early ecological thinking, most notably in Darwin's.[45] Environmental crisis has been a familiar headline in the latter half of the Twentieth Century and will remain so in the Twenty-first century. Desertification, global warming, ozone depletion, soil erosion, pesticide overload, and mass extinctions are but some of the modern beacons of ecological crisis. Somewhere within the search for a sustainable relationship of human enterprise with "nature," the science of ecology proceeds. As Freshette-Schrader and McCoy remark, ecological theories

> are implicitly prescriptive because certain normative goals are built into specifying what is 'natural' or 'healthy' for the environment. In other words, because ecology is goal directed in the way that medicine is, for example, it faces more complex epistemological and ethical problems . . . in attempting to develop a predictive general theory.[46]

II. ECOLOGY APPLIED: YIELDS

Despite the failure of the biological and ecological sciences to establish general predictive models of the natural world, the efforts of conservation and fisheries biologists nevertheless have been relied upon to guide the exploitation of living resources. The biological and ecological sciences have been relied on to estimate the populations of the various creatures of the EEZ, their regenerative rates, and a basic

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Press ed., 1992) (1803).

43. *Id.* at 19.

44. Most notably, Malthus' predictive calculations failed to account for potential variations in the birth rates, which fall dramatically, and may even become negative growth, with industrial development. Mathus also failed to foresee the degree of yield increases that mechanized agriculture achieved in industrialized nations.

45. *See* CAYLEY, *supra* note 28, at 149.

46. SHRADER-FRECHETTE & MCCOY, *supra* note 41, at 38.

understanding of the interactions between the species. The collation of such data is then employed in the calculation of the yield. As mentioned previously, this is a much more complicated process than the old method of simply going out and catching as much as possible for the highest dollar return as possible. MSY is the yield standard adopted by the international community, and it is highly contentious.

The concept of MSY represents the combination of the dual goals of resource extraction to supply the commercial market and ensuring the utilization of food sources of the sea to service the needs of the less-developed states. When a fishery is first exploited, the yields of the fishery initially increase. The accepted reason for this phenomena is that initially the older, larger fish, who were consuming much of the resources but not growing very fast, are caught. As the older fish are caught, the faster-growing younger fish have more to eat and the quantity of fish that can be caught increases, up to the point where the amount caught is equal to the regenerative rates of the stock. This point of equilibrium is the MSY.[47]

The problems with this hypothetical model of yield are many. First, the determination of the populations of fish is uncertain at the best of times. As Gulland states:

> [t]hough there may . . . be some degree of certainty regarding the average catch with a given level of effort, this is often not so for the catch in any particular year. Many fish stocks fluctuate for reasons quite independent of fishing, especially due to changes in the recruitment. For such stocks it is not useful to talk about sustainable yield in the strictest sense.[48]

Second, as David Ehrenfield explains, the attractive simplicity of the MSY model is unrealistic:

> there are many species of fish and other kinds of animals and plants upon which the fish ultimately depend, all of which are interacting, and this interaction, this complexity makes it impossible to deal with a fishery as if it were composed of just one species. So in fact, when you manage one species, another one that's valuable may go down, or things that are hap-

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47. *See* CAYLEY, *supra* note 28, at 185 (noting that this theory was put forth by the Canadian fisheries biologist Philip Larkin).

48. J.A. Gulland, *The Concept of Maximum Sustainable Yield and Fishery Management,* FAO FISHERIES TECHNICAL PAPER (Food and Agricultural Organization of the United Nations, Rome) No. 70, 1968, at 4.

> pening with the second fishery may affect plans for the first one."[49]

These natural complexities are further confused by the very human enterprise that demands to understand them. Over-fishing, marine pollution, habitat loss, introduction of foreign species, atmospheric and climate change are all variables to be considered. For example, there is a continuing change in the composition of the catch with a greater proportion of lower value species being caught. Lawrence Juda notes that, "[i]n a number of instances, over-fishing appears to have contributed to 'biomass flips,' in which dominant species have dropped to low levels and are replaced in the ecosystem structure by other species with consequent cascading effects on the whole natural system."[50]

An ecologist framed the problems in more reassuring language:

> The growing awareness that biomass yields are being influenced by multiple but differing driving forces in marine ecosystems around the globe has accelerated efforts to broaden research strategies to encompass the effects of food change dynamics, environmental perturbations, and pollution on living marine resources from an ecosystem perspective.[51]

However, despite the scientific jargon, it is hard to be confident that anyone knows what's going on down there. These pitfalls of the MSY model, combined with the problems of enforcement of quotas and the problem of by-catch, have led to a number of well-publicized collapses of fisheries.[52] This critique is not intended to discredit the achievements of fisheries scientists, or to devalue their efforts in understanding the ecologies of the oceans. Rather, it is to assert that their difficult science is not the firmament that the plain text of UNCLOS imagines.

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49. CAYLEY, *supra* note 28, at 186.

50. LAWRENCE JUDA, INTERNATIONAL LAW AND OCEAN USE MANAGEMENT 287 (1996).

51. Kenneth Sherman, *The Large Marine Ecosystem Concept*, 1 ECOLOGICAL APPLICATIONS 349, 350 (1991).

52. *See* David Wallace, *Keynote Address: Optimum Sustainable Yield*, *in* OPTIMUM SUSTAINABLE YIELD AS A CONCEPT IN FISHERIES MANAGEMENT 7 (Phillip M. Roedel ed. 1975) (explaining that many fish stocks in the Northwest Atlantic are in trouble due to the uncertainty of data combined with inadequate institutional mechanisms to act on what data there is).

As previously mentioned, a further problem in the MSY principle used in UNCLOS is that it is not a pure application of the principle. Rather, the agreement allows for the factoring in of "economic needs of coastal fishing communities and the special requirements of developing states."[53] There are some other yield models in fisheries management that were considered in the discussions leading up to UNCLOS. The foremost of these was "maximum economic yield" (MEY), sometimes called "optimum sustainable yield." Under such a regime, the resource is fished to the point of maximum economic return when measured against the expense of the fishing operations. This yield model would forgo the policy of maximizing food production and be guided solely by the policy of maximizing economic value. In most cases, proponents assert, the level of yield in an MEY regime would be less than the MSY, because the expense of the fishing effort to harvest right up to the MSY is often more than it is worth in dollar amounts. Therefore, this last bit of under-valued effort could be used more profitably elsewhere in the economy.[54]

One of the problems, however, of using an MEY standard is that whenever the value of a fishery goes up (as it does when the resource becomes more scarce), or the standard of living of the fishing people goes down, the MEY becomes equivalent to the MSY. Consequently, all the problems associated with the latter resurface. In a pure MEY system it would not be uncommon for the MEY to support pervasive over-fishing where the value of the resource rises, and/or the economic situation of the fishers deteriorates such that even the smallest yields could provide viable economic reward.[55]

III. PRECAUTIONARY PRINCIPLE

The precautionary principle represents a significant new direction

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53. UNCLOS, *supra* note 1, art. 61(3).

54. *See MEY of Exploited Fisheries*, *in* THE FUTURE OF INTERNATIONAL FISHERIES MANAGEMENT 165 (H. Gary Knight ed., 1975).

55. Consider, for example, the situation in the Caspian Sea sturgeon fishery where the fish populations have plummetted, but pressures on them have increased due to a combination of record market prices and a destitute regional population who engage in widespread poaching to support themselves. *See Russia's Roe Woes,* WASH. POST, June 9, 1997; *see also Caspian Sturgeon Threatened by Pollution, Poachers,* N.Y. TIMES, Sept. 21, 2000.

in international fisheries management.[56] Lawrence Juda describes the principle as follows: "that where implications of an action are not clearly understood, greater weight should be given to caution, with the burden of proof moved from those who seek to protect the environment to those who maintain that some ocean use or activity is not harmful."[57] Clearly, there are some practical difficulties with the implementation of such a principle. In a field where the science is unstable and the stakes high, the potential for manipulation of the concept is great. Some criticize the principle as being too vague to serve as a regulatory standard for risk assessment.[58] Others suggest that the principle is value-laden with western environmentalism and may be perceived as a form of cultural imperialism.[59] The precautionary principle also is hampered by the scientific uncertainty it is designed to address because, despite the shifted burden, policy makers who seek to employ precaution usually need some evidence of unsustainability or collapse in order to legitimize the precaution to the local fishers.[60]

Whatever its ultimate utility, the precautionary principle represents an important conceptual modification to the management regime set out in UNCLOS, acknowledging that scientific understanding of the oceans has not progressed at the expected rate. While the principle does not doubt the ability of science to eke out eventually the ocean's secrets and provide firm predictive models upon which sustainable

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56. *See generally* United Nations, *Agreement for the Implementation of the Provisions of the Convention Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish- Criteria for Maximum Economic Yield of an Internationally Exploited Fishery* (seeking to ensure the long-term conservation and sustainable use of the straddling fish stocks and highly migratory fish stocks), *available at* http://un.org/Depts/los/losconv1.htm.

57. JUDA, *supra* note 50, at 289.

58. *See* John M. MacDonald, *Appreciating the Precautionary Principle as an Ethical Evolution in Ocean Management*, 26 OCEAN DEV. & INT'L L. 255, 257 (1995) (arguing that the precautionary principle reflects not so much a risk assessment based on scientific modeling, but rather a risk assessment based on value choices).

59. *See id.* (commenting that recognition of the precautionary principle as a doctrine that is value-laden adds to its complexity and elusive character).

60. *See id.* 272-74 (remarking that extension of the precautionary principle into fisheries management threatens its potential as a broad policy tool in marine management).

resource extraction can proceed, it does attempt to buy science a little time. In essence the precautionary principle allows for a kind of temporary buffer to be established between the MSY and the requirement of optimum utilization. Besides this, however, there is little real change to the general regime of resource exploitation, because the concept provides that once science catches up, extraction of the resource will proceed according to the MSY.

IV. ALTERNATIVES

This paper has endeavored thus far to show how the regime established by UNCLOS is a monumental foray into a very difficult and uncharted area of international resource management. While the management regime developed in UNCLOS is understandable in the historical context in which it was formed, like all international agreements, it must be interpreted not as the final word on ocean management, but as the new ground zero upon which further negotiations and discussions proceed. While striving to make the regime of UNCLOS work, it must be remembered that UNCLOS represents but one means of balancing the three objectives of food for the masses, products for the global commercial markets, and conservation of the resources.

It is helpful to frame these three values in the language of "use," "exchange," and "conservation." Consider, for example, a fish. The value of the fish as food is its "use value," whereby the utility of the fish is expressed as nourishment by simply eating it. On the other hand, the value of the fish as a product for the commercial market is in its "exchange value," the trading of the fish as a commodity with its value expressed in dollars. Finally, the value of conserving the fish resides somewhere between its "inherent value" as a living thing and the value of making sure that our children's children will be able to catch, eat, or sell such a fish (the latter being the utilitarian value of "sustainability").[61] Extending these categories to management regimes, it can be seen that the fullest expression of the use value of a fishery is in a fishery of subsistence, wherein the fish are caught and locally eaten. The fullest expression of exchange value is in the commercial fishery utilizing the most efficient means of gathering

61. *See* KARL MARX, CAPITAL pt. 1 (1906) (using the terms "use value" and "exchange value" to express the duplicitous economic nature of a thing).

the maximum catch to sell for cash. The fullest expression of the conservation value is a ban on all harvesting of the species.

The combination of MSY with optimum sustainable yield that UNCLOS provides is one way to effect a balance of the three values, but, as discussed above, it relies on precise scientific calculation which at present is far beyond the capacity of present day ecological science. In essence, the regime of UNCLOS is technocratic in that its success envisions a kind of scientific *deus ex machina* to rescue the oceans from human bumbling over how much is too much. While the value of conservation is recognized in principle by UNCLOS, the effect of scientific uncertainty is that conservation is compromised in favor of use and exchange values. It is not surprising that conservation is the value compromised, given the foundation of resource extraction in a perspective of abundance where conservation as a value was inconceivable. However, in the present day perspective of resource scarcity, wherein use and exchange values are dependent on the sustainability of the resource, compromising the value of conservation is not an intelligent choice.

The precautionary principle presents one means of temporarily reconfiguring the balance of values established by UNCLOS, but it retains the monolithic vision of a global commercial fishery that may not be of service to future generations of resource managers.

A better alternative is to free sovereigns of the obligation of optimum utilization. For example, if the requirement of optimum utilization were removed, some regions would receive much higher exchange value on their living resources if they scrapped their subsidized commercial fisheries and created an EEZ that was usable only as a sports fishery. The result would be the marketing of the under-exploited fishery's "abundance" as a scarce resource in an overfished world. A tax on the profits of such operations could be paid to a United Nations redistributive body in lieu of optimum utilization and the money distributed to undernourished peoples. Other options could include a fishery of subsistence combined with eco-tourism or the use of fish farms in service of commercial needs, while the wild stocks remained available as a fishery of subsistence for local and indigenous populations.

These options may be criticized for supporting the interests of the northern countries to diversify their economic interests because, un-

like some poor southern countries, rich countries do not need the resources to sustain the lives of their people. From this perspective, optimum utilization is the voice of the poor. In a capitalist global economy, however, optimum utilization is in effect a plea for charity. The technologies of modern fishing operations are not prohibitively expensive, so it is very unlikely that many countries are unable to extract its living resources to the point of MSY. Furthermore, fishing communities, even in northern countries, are generally economically stressed and are unwilling to share their already scarce resources. The scenario of anther nation's fleet harvesting the uncaught surplus in a coastal country's EEZ is an unlikely one indeed. The poor nations of the world need more than charity and they too can benefit from a restructuring of the conservation regime of UNCLOS. There are ways to provide for local and regional balancing of the competing values of living ocean resources and at the same time manintain a denominator of equal reward, if not equal access. To maintain the status quo, however, and leave the value of conservation and the potential for real sustainability crushed between the MSY and optimum utilization is a course plotted to the detriment of all peoples, rich and poor.

To be successfully implemented, conservation is a policy which must be embraced and enacted at the local and regional levels in conjunction with industries, governments, and peoples. It is not a policy that is effected merely by ordinance in an international accord. However, it is imperative that the accord which umbrellas over local and regional efforts for conservation does not itself stifle or curtail those efforts. In its present formulation, UNCLOS does just that and future agreements must unlock conservation from its rhetorical, philosophical, and practical containment between the MSY and optimum yield requirements. This paper is an argument to move the conservation regime in UNCLOS from its present foundation on uncertain science to the firmer ground of common sense.

CONCLUSION

Articles 61 and 62 of the UNCLOS establish a regime of living resource exploitation that is laudable and important and problematic. While it introduces conservation as an essential component of the management regime, it pins this value beneath the principles of op-

timum utilization and an impure form of MSY. The only chance for the value of conservation rests in the accuracy of ecological science to establish predictive models of resource populations and regeneration rates, a task that the uncertain science is at this point ill-equipped to execute. While the management regime established by UNCLOS is an important first step in consensus building, future agreements will have to place the value of conservation paramount to the competing values of commercial market sales and subsistence in order for the fisheries to survive. If the diversity of the world's ocean regions can be matched with an international scheme of management that accepts and accomodates diverse schemes to effect the duty of conservation, therein may lie viable alternative systems to that of UNCLOS. Securing conservation and sustainability of the ocean's living resources holds the promise of allowing ecologists the continued opportunity to explore how the human world can be reconciled with the non-human. Perhaps we will one day look back on words like "management," "extraction," "nature," and "resource" as historical artifacts of a relationship of earthly creatures long since reconciled.