THE PRECAUTIONARY PRINCIPLE AND THE BOOK OF PROVERBS: TOWARD AN ETHIC OF ECOLOGICAL PRUDENCE IN OCEAN MANAGEMENT

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Abstract
Recent catastrophes in environmental management, such as population collapses in oceanic fisheries, have led environmental activists and scholars to invoke the precautionary principle (PP). In its strong form, PP demands that no human-initiated change in an ecosystem be permitted unless it is certain it will do no harm; while, in its weak form, PP holds that if an action might be environmentally harmful, regulators may, on best evidence, limit human activities to avoid damaging ecosystem perturbations. Implementing PP, however, presents epistemological, logical and practical difficulties. This paper compares the function of PP to that of the Biblical Wisdom literature in encouraging ecological prudence, and argues that PP should be replaced by a series of guiding concepts, dealing with the limitations of ecological knowledge and the flaws in human character most likely to result in environmental disaster. The environmental cases analysed are from oceanic fisheries management.

Keywords: fisheries, precautionary principle, Bible, wisdom literature.

Introduction to the Precautionary Principle

Recent catastrophes in environmental management, such as contamination of drinking water with toxic chemicals and population collapses in oceanic fisheries, have led environmental activists and scholars in environmental policy and ethics to invoke the precautionary principle (PP). In its strong form, PP demands that no human-initiated change in an ecosystem be permitted unless it is certain it will do no harm; while, in its weak form, PP holds that where there is reason to believe that an action might be environmentally harmful, but this is not known with certainty, regulators may, on best evidence, limit human activities to avoid major or damaging system perturbations. (Morris 2000: 1-21) The weak PP may also be summarised as stating: "that lack of full certainty is not a justification for preventing an action that might be harmful." (ibid.) The purpose of PP is to encourage prudence in implementing technologies that may threaten human health and well-being and in initiating anthropogenic

changes in the earth's ecosystems. As the economist Julian Morris (2000 vi-xi) notes, however, the concept remains ill-defined when applied to environmental conflicts—neither the strong nor the weak definition "is philosophically sound and practical implementation often has harmful unintended consequences." Timothy O'Riordan and Andrew Jordan in an article in *Environmental Values* conclude that PP is "neither a well defined principle nor a stable concept" and call PP a "repository for a jumble of adventurous beliefs that challenge the status quo of political power, ideology and civil rights." (O'Riordan and Jordan 1995: 191-212). This paper compares the function of PP to that of the Biblical Wisdom literature in encouraging ecological prudence in oceanic fisheries management.

In human interaction with oceanic ecosystems, government agencies and environmental protection organisations have utilised PP as a justification for banning disposal of wastes at sea, limiting marine harvests, and establishing marine reserves. The British government, for example, released a Ministerial Declaration that held: "Accepting that in order to protect the North Sea from possibly damaging effects of the most dangerous substances, a precautionary approach is necessary which may require action to control inputs of such substances even before a casual link has been established by absolutely clear scientific evidence."[1] Under this weak form of PP, the British government then proceeded to ban all sewage sludge disposal in the North Sea, on the grounds that it was in all probability presenting a human health risk and damaging marine environments. This action ironically resulted in increased disposal on land—which may actually have increased human exposure to disease-causing organisms. (Morris 2000)

As a second example, several authors in *Freedom for the Seas in the 21st Century* invoke the precautionary principle in ocean governance.[2] Jon M. Van Dyke (1993: 13-22) states that: "a precautionary approach should be followed whereby a resource developer has the burden of demonstrating that the proposed activity will not unreasonably interfere with other ocean uses and will be conducted in an environmentally sound manner." W. Jackson Davis (1993: 147-170) uses a weak version of PP when he notes "The long time lag in the global life support system demand anticipatory (precautionary) rather than reactionary approaches." Catherine Floit (1993: 310-326) suggests extending the PP past its usual uses concerning pollution to other questions of marine resource management. All three employ PP as

a general concept without further explicit definition, while recognizing its conservative nature relative to economic development.

As a third example, Mark Carr and Peter Raimondi, both biologists, recently used PP to argue in favour of establishing marine reserves. They acknowledge that "traditional" fisheries management relying on "stock assessment, forecasting stock size, and catch adjustment" has failed to maintain stable or harvestable populations in many marine fisheries, due to "the great and unpredictable natural variability in year class strength and stock size . . . and by the logistical difficulties of estimating stock size, catch rates and population parameters." Properly placed and managed reserves would help to maintain fish and benthic (bottom) populations capable of dispersing into other areas. Since marine reserves are a relatively recent innovation, poorly designed reserves may not serve their intended function, and the best way to design marine reserves has not been determined, Carr and Raimondi (1999: 71-76) conclude that "incorporating the evaluation of design criteria into the final implementation of protected area networks . . . is the only prudent approach."

Difficulties with the precautionary principle

Implementing PP, as noted above, presents epistemological, logical and practical difficulties. First, strong PP is "epistemologically absurd," (Morris 2000) especially if we assume the welfare of other species is a concern. Any human initiated change in an ecosystem is likely to cause harm to some individual organism. The fortunes of different species fluctuate in response to changes in physical environmental conditions initiated by a great variety of natural processes, ranging from solar flares, to shifts in ocean temperature, from volcanic eruptions to collisions with asteroids, so we find it difficult to establish the point at which change can be defined as "damage." In pragmatic terms, we have no way to prove that a new technology or environmental management strategy is completely harmless. We cannot completely "know" the earth's ecosystems, and therefore can never be completely certain of our impacts. The absolute construction of the strong PP ignores the prevalence of gradients of response, and of stochastic and chaotic processes in nature. In toxicology, "dose makes the poison." A small amount of salt or iodine in the human

diet is beneficial, while large doses may be lethal. A few boats harvesting a fish population could actually stimulate reproduction of the species, while an unrelenting assault by a large fleet might result in population collapse. The strong PP only recognizes thresholds and absolutes, rather than accommodating degrees of response. (Morris 2000, Wildavsky 2000)

A second problem is that humans learn by experimentation. PP discourages testing technologies and actions whose results may not be completely predictable. An absolute application of strong PP to environmental questions is very culturally, economically and scientifically limiting. If invoked as a duty, PP has such a broad mandate to prevent harm, it is impossible to fully execute. Aaron Wildavsky (2000: 22-45) notes that PP encourages us to move from "trial and error" to "trial without error," which is an extremely conservative way of approaching environmental risk. A strict application of PP would discourage many socially productive projects, and by discouraging experimentation, work against the common sense concept that "safety comes from use."

Although the weak PP presents fewer logical hazards, it can be politically questionable or difficult to implement. Julian Morris (2000) criticises the Earth Summit definition of weak PP on several grounds. The original states: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." This definition does not fully define "threat" or "serious damage," nor does it distinguish damage from mere change. Weak PP remains fraught with epistemological difficulties, since technically speaking all forms of environmental change are irreversible, and systems do not return to their previous states. In this version of PP, the concept of damage remains subjective, and the problem of scientifically uncertainty is naively ignored.

Many environmental uses of PP have treated it as an ethical norm or rule. This in itself runs contrary to the necessary recognition that we cannot completely know how ecological systems are going to respond to change. It also seemingly touts a form of ecological determinism, which is far too simplistic in a field of science lacking a general theory. (Schrader-Frechette and McCoy 1993) A last and very serious problem with PP is the chaotic function of natural ecosystems. Ocean fisheries, for example, are notoriously difficult to mathematically

model, and unexpected shifts in ocean temperature or currents may cause reproductive failures, or modifications in migration routes. Deciding *absolutely* to harvest or not to harvest is not the issue; rather deciding when, where and how much to harvest is.

Prudence and wisdom

It seems important to stand back from the academic arguments generated by the PP, and ask: what are environmentalists attempting to forward with this principle? The answer is prudence in initiating environmental change. The PP fails because it is inflexible and absolute in approaching human decision-making that is informed by multiple factors. The PP is encountering highly complex and variable ecological and social systems, which are difficult to predict, align and synchronise. The difficulty of regulating human exploitation of fluctuating or mobile natural resources, however, is not a product of the modern age, it is an ancient dilemma, long faced by hunters, herders, farmers and fishers who could dominate a natural ecosystem with bronze axes, hemp nets or goats.

The ability of pre-scientific cultures to manage and harvest natural resources in a sustainable manner over decades or even centuries often embarrasses less-effective, modern "scientific" resources planning. Not just Judaism and Christianity, but most of the world's religions, provide spiritual instruction and ethical guidance concerning prudent approaches to labour, household management, farming and other aspects of daily life. All the literate cultures of the ancient near east, for example, generated a didactic wisdom literature, intended to resolve ethical dilemmas, encourage economically productive lifestyles, build community and deepen the reader's (or hearer's) understanding of reality. These literatures incorporate numerous literary genres, such as collections of sayings, poems of thanksgiving, disputations, answered laments and satirical dialogues. In order to transfer cultural experience from generation to generation, religious teachers in pre-literate societies transmitted proverbs, wise sayings, and parables orally. (Murphy 1981: 3-12) Scribes later compiled these into organised collections. (Westermann 1995)

The Biblical Wisdom literature not only encompasses books that are primarily collections of saying such as Proverbs and Ecclesiastes,

but many scholars include Job, Canticles and even Esther and Ruth. The inclusion of ethical dialogues, such as those in Job, histories of ethically exemplary individuals, and poetry is typical of near eastern wisdom literature as a whole. The theme and basic structure of the Book of Job, for example, are found in Babylonian wisdom literature, such as the *Dialogue about Human Misery* (*Babylonian Theodicy*), which is a discussion between a sufferer and friend. (Murphy 1981: 10) This paper is based primarily on Proverbs, and to a lesser extent on Job, which are of different literary genres. Both books, however, provide reflection on human interactions with the natural world, and originate in traditions found from Egypt to Mesopotamia.

As a model for establishing an environmental ethos of prudence, we should note that the Biblical Wisdom literature is intended as mature advice and not as legislation. In the Torah, cultural norms such as the Ten Commandments are expressed as the Law and, for the ancient Hebrews, ignoring the Law resulted in explicit social sanctions. The Wisdom literature instead coaches the reader in correct social behaviour and on such matters as how to fairly and prudently conduct business, or how to choose a "godly" spouse. (Von Rad 1972) The literature describes the routes for avoiding life's most frequent stupid and devastating mistakes, and encourages behaviours balancing individual with community needs. Although this paper is intended as a Christian ethical reflection on environmental issues, it is valuable to ask, in historic terms, why the ancient Hebrew wisdom literature emphasised particular ethical strategies or values relative to human business ventures, including the environmental harvest inherent in farming.

Religious texts describing Wisdom indicate probable rather than absolute outcomes of thoughtful or caring action, or of foolish and socially indifferent behaviours. Hortatory or imperative proverbs are intended as general admonitions or warnings. Biblical wisdom tackles difficult philosophical issues by offering spiritual discussion of the capricious nature of the cosmos and the failure of righteous action always to result in personal safety and success. The Wisdom Literature assumes that life's decisions must be based on complex models, weighing several different interests or costs and benefits. Sound decision making also requires spiritual education, self-discipline, and good character. The natural world, as created by God, informs the wise, and becomes an important source of metaphor in books such as

Proverbs. Biblical scholar Gerhard von Rad (1972) concludes, in fact, that Psalms and Job depict Wisdom as "a personified entity immanent in creation."

Wisdom in fisheries management

Depletion of marine species via human harvest is an ancient issue, and many maritime cultures have established social regulations to prevent excesses such as gathering too many oysters. In recent decades collapse or severe population reduction of once productive fisheries has afflicted all the planet's major oceans. Business records, loss of small fishing ports, economic displacement of fishers, and scientific surveys of marine organisms all verify deterioration of key living ocean resources.[3] Not just vulnerable nearshore or freshwater fisheries have declined, but numerous open ocean fish populations have fallen below "biologically sustainable harvest." (Berrill 1997) Although pollution and the industrialisation and urbanisation of the world's coastlines are major sources of fisheries degradation, industrialisation of harvest, including deployment of deep-water trawl nets, drift nets, and factory ships. Today, "distant water fishing nations," such as Spain, France and Japan, dominate the industry, and if fish populations are depleted in one region, such as the northeast Atlantic, the fleets may just move further south or steam off to the Indian Ocean.[4] These practices often reduce the catch for fisheries utilising more limited technologies for capture and transport. Anthropologists, regional planners, cultural historians and members of fishing communities themselves have voiced great concern for the survival of many of the world's fishing cultures. Thus both natural and cultural diversity are at stake in oceanic fisheries management.[5]

If we begin to analyse the oceanic fisheries' case, from the perspective of distinguishing wise from foolish human behaviours, a perusal of Biblical concepts of wisdom suggests three major areas of concern. The first is how human knowledge of ecological processes is managed. Scientific experts and their models of fisheries structure and response to harvest have, more often than not, encouraged overharvest or have not anticipated population declines. Sources such as Proverbs and Job hold that the fear of God and an understanding of the limits of wisdom are basic to prudence in societal decision-

making. The second concern is the repeated pattern where new fisheries technology, or the economic development of industrialised fleets, supports such elevated levels of exploitation or so much peripheral damage to marine ecosystems, that productivity of a targeted fishery has radically declined or an ecologically related marine resource has been unintentionally depleted. Biblical wisdom expresses high concern for the impact of individual greed on the greater human society. Initiation of a business, trade or new form of resource harvest, should be executed slowly (rather than in a rush of competition) and with due regard both for the needs of one's neighbours and for the management of the resource itself. The third concern is the treatment of those who are technologically disadvantaged or who may not have the capital to buy a boat motor, much less a factory processing ship. Biblical wisdom instructs the wise householder not to drive the neighbours out of business. A community that is unable to share resources will soon divide into the rich and the poor, and social strife is bound to follow.

Ecological wisdom

Biblical wisdom is not a monolithic form of dealing with life's challenges, but incorporates what an English speaker might term "understanding," "knowledge," "prudence," "planning," "correction," and "discipline."(Von Rad 1972: 53) The way you treat knowledge, and how you view yourself relative to knowledge are as important as what you know. All reliable wisdom begins with an understanding that humans are not completely in control of the cosmos, nor are we omniscient. Wisdom is not innately imparted to us, but must be pursued. Further, as von Rad emphasises, the Bible states repeatedly that wisdom is rooted in "fear of God." The term "fear" might be better translated as a combination of "respect for," "commitment to," and "knowledge about" God. Originally it probably meant "religious," but through time Proverbs 1:7, for example, declares: "The fear of Yahweh is the beginning of knowledge; fools despise wisdom and discipline." Proverbs 15:33 instructs: "The fear of Yahweh is training for wisdom, and before honour comes humility."[6] Also implicit in Biblical wisdom is the concept that "there is no knowledge which does not, before long, throw the one who seeks the knowledge back

upon the question of his self-knowledge and his self-understanding." (Von Rad 1972: 67)

Understanding the limits of human wisdom is so central to Biblical ideas of wisdom and prudence, that in *Wisdom in Israel*, Gerhard von Rad dedicates an entire chapter to this theme. Proverbs 26:12, for example, admonishes against pride in knowledge by asking: "Do you see a man who thinks he is wise? There is more hope for a fool than for him." Proverbs 28:26 instructs: "He who trusts in himself is a fool, but he who walks in wisdom escapes." The Book of Job repeatedly stresses human impotence in completely grasping the intentions and actions of God. Job 5:9 describes a deity "who does great things which are unsearchable, wonders without number . . ." while Job 36: 26 points out that "God is great so we cannot grasp it; the number of his years is unfathomable." (Von Rad 1972: 65-73) At the end of the Book of Job, God's long discourse from the whirlwind draws several examples of human limitation from nature. H.H. Rowley (1983: 241) notes that the very fact that God is speaking from a raging storm emphasises human inability to control or completely dominate the power of the chaotic forces inherent in the created order.

God's challenges to Job's self-knowledge and self-perception include maritime and aquatic imagery. In Job 38: 8-11, God asks:

> Who pent up the sea behind closed doors
> when it lept tumultuous out of the womb,
> when I wrapped it in a robe of mist
> and made black clouds its swaddling bands;
> when I marked the bounds it was not to cross
> and made it fast with a bolted gate?
> come thus far, I said, and no farther:
> here your proud waves shall break.

In Job 38: 16, God asks: "Have you journeyed all the way to the sources of the sea, or walked where the Abyss is deepest?"[7] If contemporary ecological science, out of foolishness, were to reply—we have submersibles and visit the deep trenches, the God of the Whirlwind could expand the questions to: Can you stop a hurricane, or sail the oceans of the distant galaxies?

The Book of Job argues that "wisdom" in nature came originally from God, and that humans have no analogous ability to instil pattern in nature. In Job 38:36, God asks: "Who gave the ibis wisdom and endowed the cock with foreknowledge?" reflecting the relationship

between the appearance of the ibis and the flooding of the Nile, and the cocks announcement of the arriving dawn. God also challenges Job to replace or imitate divine providence, when God inquires:

> Do you find a prey for the lioness
> and satisfy the hunger of her whelps
> when they crouch in their dens
> and lurk in their lairs?
> Who makes provision for the raven
> when his squabs cry out to God
> and crane their necks in hunger? (Job 38:39-41)

At the end of God's speeches, including the lengthy descriptions of the wondrous creatures Behemoth and Leviathan, Job replies to God:

> I know that you are all-powerful:
> what you conceive, you can perform.
> I am the man who obscured your designs
> with my empty-headed words.
> I have been holding forth on matters I cannot understand,
> on marvels beyond me and my knowledge. (Job 42:2-3)

The reader might wonder why God's discourse emphasises Creation, while Job's issue is the meaning of human suffering. Both questions, however, concern the organisation of Creation, and logic and justice of it all. Job's sorrows originated in social and natural disasters. The Sabeans took his oxen and donkeys, the Caldeans stole his camels, fire from the sky killed his sheep (lightning?), and a mighty wind from the desert blew down his son's house, killing all his children. The series of unplanned events picks off his servants until one messenger is left. Satan then afflicts Job with skin disease. The ancient audience, constantly threatened by drought, storms, cattle raiders, and plagues, would have easily identified with Job. God argues, by using examples from the natural world, designs and intentions beyond human comprehension, and divine purpose in Creation never intended to fill immediate human needs.

William P. Brown (1996: 97) suggests that God's speech to Job utilises its diversity of natural imagery to emphasise wildness and that "the animal kingdom is no kingdom at all; it is ordered anarchy." God's description of creation is "no static world governed by fixed laws," nor is it the "orderly world of the Priestly Creation account, which methodically unfolds hierarchically and culminates with the establishment of human authority over creation." This a "discovered world" where "each species is an indispensable thread

woven into the colourful fabric of life." The best human understanding cannot grasp the complexity of God's world, nor can human sovereignty be absolute.

A second important characteristic of wisdom as a form of problem solving is that wisdom is neither philosophy nor is it science, nor can these forms of knowledge replace wisdom. Claus Westerman (1995: 137) notes that western philosophy is dualistic and separates the material and the spiritual realms. This split is inconsistent with wisdom "since both the material and spiritual dimensions are equally a part of creation and thus given equal worth." Further, philosophy employs esoteric language, and is largely a pursuit of the elite, while wisdom is accessible to farmers and trades people. Westermann also suggests that science is not wisdom, and as modern culture continues to "manufacture" science, wisdom is actually declining. He proposes that wisdom can counteract abuse of science when he concludes: "The overestimation of the sciences and the underestimation of wisdom are capable of doing considerable damage. Behind this scientific overestimation stands an overestimation of the human mind. Opposing this is the critical appraisal of human potential to inherent wisdom, where opportunity is afforded to address human limits." (Westermann 1995: 136)

Despite its "unscientific nature" wisdom is obtained by a continuing search for knowledge. Wisdom, then, can be understood as a process of search and pursuit rather than finding a few basic laws or rules, which resolve all possible cases. Wisdom arises from the community practice of observing the relationship between actions and outcomes, and from understanding the limits of human knowledge. According to James Crenshaw (1998: 50) The Book of Proverbs is specifically a "search for knowledge, for the aim of many attempts to grasp reality seems to be about the acquisition of sufficient understanding about nature and human beings to enable persons to live wisely and well."

Science and fisheries management

Through a diversity of academic critiques, historians, philosophers and conservation biologists have recently attacked the way fisheries science has influenced the development of new fisheries, has advised the managers of long established fisheries, has deployed technology,

and has encouraged new economic and political strategies. Taylor (1999), for example, in *Making Salmon*, takes the fisheries biologists who established the extensive hatchery system in the Pacific Northwest to task for damaging entire native runs while they attempted to manufacture sustainable populations of fish in the face of industrial harvesting and processing technologies. Jim Lichatowich (1999) contrasts historic-production oriented fisheries scientists with the new generation of conservation biologists who presumably will not make the same mistakes because they are concerned with evolutionary and genetic processes and are not market driven. Both of these analyses subtly contrast "unnatural" management such as constructing hatcheries, with the healthier "natural" strategies of maintaining the "wild" subspecies and races of fish.

A return to the 19th and early 20th century fisheries literature uncovers, however, a wide array of scientific difficulties with the "limits of ecological knowledge." Fisheries science has often trusted its own inherently limited "wisdom" far too much. A few of the more serious problems are:

(1) Confusing science and magic (the scientist as not discerning wisdom from foolishness). Early scientific fisheries investigations often cite very specific numbers, such as tons of catch, to the last pound or ton. Since some of these figures might in reality be plus a hundred and fifty percent or minus sixty percent, the extra digits (such as reporting 123,456 pounds of cod) are claims of knowledge far past any possible degree of accuracy. Not only is there no reason not to believe that the vast majority of these catch assessments are biased, much of the quantitative data used to advise fisheries managers historically came from "non-scientific" sources such as sales reported at markets. More recently, the fashion for ecological population modelling has resulted in the application of models based on very limited sampling sizes and sequences to determining optimal harvest levels. Since the models themselves are not robust in the face of environmental fluctuations, they can actually encourage, rather than prevent, overharvesting of fish. The concept of predicting a specific "optimal" harvest in chaotic ocean mega-ecosystems is "foolishness", since it is based in scientists assuming they know the mind of God, and the exact pattern of El Ninos for the next century.

(2) Disparaging folk observation and the wisdom of others (the scientist as ignoring the wise). Although fishermen can be non-objective or may deny that fisheries are declining because they have an economic stake in the harvest, there are several sad cases of scientists not listening to the voice of experience. Many commercial fishermen, particularly those who fished with lines, protested when the steamer and the otter trawl were first introduced to New England. Otter trawls use doors to hold the mouth of the net open. The extra weight of the doors or beams can keep the net dragging along the bottom, which increases the efficiency of capturing bottom-dwelling fish. Experienced commercial fishers complained that the trawls ran over lines, destroyed the productive regions of the bottom and captured far too many small or juvenile individuals.

William C. Harrington, publishing in 1932 in *Transactions of the American Fisheries Society* reports that fishers resisted when steam-powered trawlers came on the scene in 1905 in New England and ". . . the controversy over the degree of destruction wrought by the otter trawlers on the fishing banks has continued to the present times." Harrington, however, disparaged concerns for benthic invertebrates and non-commercial species from casual observations on the deck of fishing vessels, where he observed crustaceans and molluscs going through the nets with little change. He concluded: "The small amount of this material retained in the trawl is thrown overboard from the ship when the decks are cleared after each haul, the uninjured members to resume their life as before, and any crushed scallops, mussels, etc. to be eaten by fishes or by animals on which the fishes feed. The small amount of captured material should, therefore, be little if any diverted from the function it would have discharged had it remained unmolested on the sea floor." (Harrington 1932: 57-63) Harrington also disagreed with a second criticism that "the destruction of great numbers of undersized fish has been substantiated by practically every observer connected with the fishery." Citing surveys, he projected that the loss of small haddock was in the hundreds or thousands and was therefore, "inconspicuous as to pass with little notice." (ibid.)

Now, almost a hundred years after the original "folk" protest, a growing corpus of scientific articles agrees with the line fishers' observations that trawling damages fishing banks, disturbs shallow nursery areas, and limits the diversity of benthic ecosystems. Harrington

used a few sample trawls and personal observations to justify the continuation of "dragging," which now is recognised as a potential element in fisheries collapse. Other examples of disregarding experienced counsel include Thomas Henry Huxley, as the chairman of a British Royal Commission established in 1863, investigating fishers' claims that "trawlers overfished the stocks, landed poor quality fish, and damaged the gear of the line and driftmen." (Robinson 1996: 49) Huxley believed that sea fishes were so prolific their populations could not be depleted, so it is no surprise his commission found no significant damage caused by trawling, and therefore did nothing to curtail it. (Robinson, ibid). One hundred and thirty years later, the Canadian government delayed response to near-shore commercial fishers who observed alarming cod population declines close to the Canadian coast. These observations should have warned government-sponsored science that the off-shore "cod population crash" of the 1990s was inevitable. This catastrophe resulted in the complete closure of ground fishing over much of the western north Atlantic banks. And as a last example, in 1928, W.J. Calderwood, an inspector for Scottish fisheries attending a meeting about the potential problems for salmon encountering high dams in North America, not only predicted that high dams had to be treated as insurmountable to salmon, but he also commented: "It is not at all clear to me that the fry will get down and there is little use breeding landlocked salmon."[8] Today downstream migration of salmon fry and smolts through dams continues to reduce survival and to modify the date when young salmon arrive at sea.

(3) Projecting observations or experimental data taken at one scale or in a limited environment to another or utilising limited sequences of observations to predict the behaviour of ecological populations over years or decades. Many early fisheries experiments were conducted at hatcheries or in single streams or lakes. Almost nothing was known, until recently, about the behaviour of migratory fish in the open ocean. Yet, beginning in the early 20th century scientists constructed predictive models of fish population fluctuations, often based on one or two locales and a year or two of surveys. The result has been major population collapses, such the Peruvian anchoveta fishery, which naturally declines in El Nino years—something that was not known when scientific estimates of optimal harvest first

became available, and diesel powered vessels attempted to harvest as many anchoveta as possible, regardless of ocean conditions.

Prudence in managing variable systems

Biblical wisdom assumes that humans learn by trial and error. From a wisdom perspective, a major root of ocean fisheries collapse is the speed with which new gear or new initiatives are deployed and the general managerial impatience displayed by the scientific models. Fisheries science, in fact, has been purposefully imprudent, and has promised to provide quick answers to questions or problems that folk fishers would (supposedly) take decades to solve.

Unlike PP, which would prevent utilisation of new technology that might damage resources, wisdom recommends beginning such ventures slowly, and with due caution. For wisdom the solution is not inaction, but restraint. A superficial reading of the Book of Proverbs might catch the rejection of idleness and the value of diligence, and assume that the harder one fished, the wiser one would be. We tend to read: "Go to the ant, O sluggard; consider her ways and be wise." (Prov. 6:6) or "A son who gathers in summer is prudent, but a son who sleeps in harvest brings shame." (Prov. 10:5) The assumption might be that harvesting fish as fast as possible is the best way to manage fisheries. Wisdom, however, requires balance.

According to Proverbs, one should work hard, while not being hasty or careless. Proverbs 2:15 states: "The plans of the diligent bring abundance, but whoever is hasty suffers want." Proverbs explicitly admonishes the person entering a new business or opening a resource to exploitation to move slowly and with discretion. The message is repeated, in varying forms, for example:

> Prov. 14:8 "The wisdom of the prudent man is to consider the way."
> Prov. 29:11 "A wise man is able to hold himself back."
> Prov. 10:14 "Wise men store up knowledge"
> Prov. 14:14 "The prudent man considers his steps."
> Prov. 22:3 "The prudent person sees danger coming and takes refuge."

Prudence can cope with chaos (to the degree to which coping with chaos is possible). Prudence attempts to determine risk and variation in system behaviour.

The Wisdom literature emphasises recognition of divinely ordained

times. Proverbs 20:21 combines the theme of patience with a sense of when to engage in business by admonishing: "An estate quickly acquired in the beginning will not be blessed in the end." But wisdom warns that taking too much is in fact dangerous. Prov. 25:16 instructs: "If you have found honey, eat only enough for you, lest you be sated with it and vomit it." A similar teaching in Prov. 13:11 states: "Wealth gotten hastily will dwindle; but those who gather little by little will increase it." Prov. 28:8 reinforces the theme by warning: "The miser is in a hurry to get rich and does not know that loss is sure to come." In the wisdom tradition, greed is the destruction of business ventures, and one's own resources. Ellen Davis (2000, 116-118) suggests the wisdom of Proverbs "means looking for nonexploitative means to achieve our own well-being, recognizing that the well being of every creature is ultimately bound up together."

The original audience for Proverbs was not priests or scribes, but farmers or tradespeople. The concept of wisdom extends to paying attention to one's fields and herds. In the chaotic environment of seasonal rains, changing forage availability, disease, predators and reproductive risk, the herder must be constantly vigilant. Proverbs 27:23-27 advises:

> Know well the condition of your flocks,
> and give attention to your herds;
> for riches do not last for ever;
> and does a crown endure to all generations?
> When the grass is gone, and the new growth appears,
> and the herbage of the mountains is gathered,
> the lambs will proved your clothing,
> and the goats the price of a field;
> there will be enough goats milk for your food,
> for the food of your household
> and maintenance for your maidens.

One could translate this into advice for commercial fishermen: "Know well the condition of your stocks, and give attention to your fisheries . . .". Protecting the economic value of renewable ocean resources requires constant information gathering, and repeated assessment of the state of the resource. In addition, "a righteous man cares for the needs of his animal" ("has regard for the life of his beast" RSV) (Prov. 12:10). Proverbs points out the created order cannot withstand human carelessness and evil. If humans act against the teachings of Wisdom, who was with God from the beginning, they will

destroy the creation on which they are dependent. The righteous fisher, therefore, understands and considers the needs of the fish.

Biblical wisdom is, of course, related to that of surrounding cultures, including that of Egypt. The Book of Proverbs, however, seems to accommodate the relatively unpredictable rains and winds of Palestine. The cautious farmer will not plant more than he can care for. The prudent herder will expand her flock slowly, and therefore, will be less likely to encounter a drought year, when her herds starve and overgraze. These farmers are much like the fishing fleet encountering El Nino. If the fleet takes too many breeding fish in the face of the warm currents, the fishery will collapse—just like the herd stocked by greed.

Respect for community

A last Biblical issue is the maintenance of the interests of all community members. Proverbs repeatedly speaks for the protection of widows and those with few resources. The motive is not some form of random or abstract charity to generate disconnected righteousness, but rather the concept that the fate of all community members is integrally linked. This effect may be seen in fisheries in the fate of the inshore versus the off-shore cod fisheries, in the Northwestern Atlantic. The offshore fisheries, such as those on the Grand Banks, were still economic when the inshore fisheries, such as those off Newfoundland, were collapsing. The inshore fishers were primarily smaller operators utilising traps and smaller nets, while the offshore fisheries had larger craft and higher capital operations. When the inshore fishers complained that their share of the fish was disappearing, the national governments and larger offshore operations involved paid little attention and continued to over-harvest. The two sectors of the fishery were integrally linked, however, because the cod spawn inshore. The result was the complete collapse of both inshore and offshore fishing. If everyone had listened when the small vessel owners began to warn of population decline, and if the offshore fleet had been more willing to share the fish, a major collapse might have been averted.

Proverbs 28:25 concludes: "A greedy man stirs up strife, but whoever trusts in Yahweh will prosper." Proverbs 21:6 warns against dishonest recording of harvests by admonishing: "Acquiring riches by

falsehood is a fleeting vapour and a snare of death." While Proverbs 28:27 summarises the inability of the offshore fishers to protect inshore interests by noting: "The one giving to the poor will not lack, but the one closing his eyes to them will receive many curses."[9]

Conclusion—chaos and prudence

The PP bases decision-making on a single principle, and explicitly avoids process. Wisdom utilises balanced pairs of admonitions, and explicitly encourages process. Wisdom is both the development of experience and a series of "systems tests." The slow initiation of farming or business ventures prevents overexploitation and over extension, allowing adaptation to fluctuating environmental conditions. Caution about the depth of human knowledge and understanding prevents the treatment of the Creation as a large supermarket, there to exploit.

Scientific fisheries management has, far too frequently, been overconfident of its knowledge and, in practice, devoid of wisdom. Humans have assumed they could model poorly known fish populations on two or three years' worth of data. Scientists have repeatedly rejected folk knowledge and even the experience of other experts. New fisheries, technologies and economic enterprises have been developed quickly, without monitoring adequate to determine the impacts of the initiatives. Time and time again, exploitation has progressed without "knowing the stocks." When small vessel owners and inshore fishers have begged for help, as local fish populations plummeted, the corporate sector and large vessel owners have rationalised their own continued excessive exploitation, until there were no fish left for anyone.

Our social context for fisheries science also inhibits "fisheries wisdom." Much marine research, supported by the public coffers, is mandated science. Mandated science often forwards economic goals, such as fisheries development, which ecological reality may or may not support for the long term. Public or Congressional demands for answers can push mandated science into dangerously premature recommendations concerning policy, or force it to expected outcomes. The scribes who compiled Proverbs would shake their heads—mandated science is too speedy and too pre-directed to respond to Wisdom.

Rather than use the PP, a better way to manage fisheries is to prevent a sudden surge of new entrants into fisheries that remain healthy and productive. Any increase in fishing pressure should be executed slowly, so that it proceeds over decades, not over seasons. This will allow the fishery time to adjust to long-term ocean cycles and fluctuations such as the El Nino. All fishing quotas should be gear specific, and changes in fishing methods should only be generally incorporated into a fishery after long and careful evaluation for *all* ecosystem impacts. Quotas and harvest regulations still usually do not accommodate the damage done by the harvest technologies themselves. If new gear is developed, it should be deployed slowly and the impacts studied. In chaotic or partially known systems, slow and careful avoids catastrophe. Direct care for the stocks is necessary, and fishing methods that kill young fish or seriously disrupt food chains should be banned.

The Biblical concepts of prudence were developed to guide farmers in environments highly variable in rainfall and resource availability. The less predictable the system—either due to inherent stochasticity or due to lack of human knowledge, the more important prudence becomes. If wise farmers should be prudent, then wise fishers, even more so.

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Notes

1. SICNPS 1987. Ministerial Declaration of the Second Conference on the Protection of the North Sea, cited in Morris, "Defining the precautionary principle".
2. See Van Dyke, Jon M., Durwood Zaelke, and Grant Hewison (1993).
3. For further information, see the following: National Research Council 1995.

Understanding Marine Biodiversity: A Research Agenda for the Nation. Washington, D.C.: National Academy Press; Norse, Eliot 1993. *Global Marine Biological Diversity: A Strategy for Building Conservation into Decision Making.* Washington, D.C.: Island Press; and Le Sann, A. 1998. *A Livelihood from Fishing: Globalization and Sustainable Fisheries Policies.* London: Intermediate Technology Publications.

4. See, for further information FAO Fisheries Department 1997. *Review of the State of World Fishery Resources: Marine Fisheries*. Circular No. 920 FIRM/C920; and D. Hinrichsen (1998) *Coastal Waters of the World: Trends, Threats and Strategies* Washington, DC: Island Press.

5. See, amongst others: Cordell, J. (ed.) 1989. *A Sea of Small Boats.* Cambridge, MA: Cultural Survival, Inc.; McEvoy, Arthur 1986. *The Fisherman's Problem: Ecology and Law in the California Fisheries, 1850-1980.* New York: Cambridge University Press; and McGoodwin, James 1990. *Crisis in the World's Fisheries: People, Problems and Policies.* Syracuse: Syracuse University Press.

6. See Von Rad 1972: 65-73. Note that the Biblical translations here are from this volume and are based on a conversion from German to English in the SCM Press version of von Rad's work.

7. Biblical translations from Jones, Alexander (ed.) 1968. *The Jerusalem Bible.* Garden City: Double Day and Co.

8. Calderwood's conclusion was made in a symposium led by John N. Cobb in 1928, published in "High dams and fish", *Transactions of the American Fisheries Society* 58: 154-160.

9. Biblical translations in this and the following paragraph from the Revised Standard Version.

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