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# Environmental Policy and Strategic Action: Tools for Decision Support in British Columbia

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## I. Introduction

Policy analysis as a distinct element in public decisions is a relatively new undertaking, probably no more than fifty years old (Meltsner, 1976; Wildavsky, 1979; Lindblom, 1980). Yet in this short lifetime, the policy sciences have undergone considerable evolution. Both theory and practice are increasingly challenged by fundamental shifts in our knowledge of and beliefs about natural systems, that is, how the non-human world "works", and in our understanding of and beliefs about human behaviour and the human institutions that structure interactions among ourselves and with natural systems (Norgaard,1994).

The purpose of this paper is to outline briefly the evolution of theory and practice in policy analysis; to explore the "changing world" of environmental problems and issues; and to derive from this discussion some brief checklists or guideposts for the day-to-day work of analysts attempting to provide a firm principled foundation for the exercise of political judgment and the implementation of public policy.

Two central themes emerge from a brief review of a broad and rapidly developing literature on the characteristics of natural systems and of the human institutions which have evolved to manage our activities in relation to the non-human world:

- There is irreducible uncertainty in our knowledge of systems structures and future states. Because of this uncertainty, we are forced away from "strategic planning" and towards adaptive management or "strategic action", guided by a strongly conservative precautionary principle and a concern for sustainability.

- There are many actors involved in formulating and implementing policy measures in our increasingly congested world, and many of our institutions are no longer adequate to deal with competition for and conflict over ecological resources. Public policy needs to focus on institutional design and redesign, and on incentive structures that achieve efficient, equitable (acceptable) and sustainable outcomes.

From the perspective of the policy analyst, the key point of this paper is that policy analysis involves both "substance" and "selling", and substance involves both allocation and acceptance. Analysts must achieve a balance between their roles as "policy technicians" and as "policy entrepreneurs". Further, policy analysts are increasingly called upon to exercise their skills both within their traditional field of activity, i.e. the organizations of government, and within the wider world of participatory public decision-making.

In the balance of this paper, Section II sketches the rational actor model (RAM) and introduces the analytical qualifications which stem from recognition of problems of bounded rationality, incremental decision structures, and similar limitations. Sections III and IV introduce the further problems which stem from recognition that we must deal with complex systems exhibiting irreducible uncertainty. These considerations all lead us toward the need for precautionary approaches and a posture of adaptive management in institutional systems which can learn (Section V).

Section VI then recognizes that there are many purposive (if not universally rational) actors in this complex world. All of them pursue their interests as they perceive them and--within the constraints of "appropriate" behaviour--attempt to insulate

themselves so far as possible from the consequences of others' actions, including government policy initiatives. In this world, distributional issues, property rights, and rules of conduct are paramount concerns, and negotiation toward cooperative outcomes is the prime imperative. The search for an acceptable outcome which can endure replaces the search for an "optimal" or even a "good" outcome.

Section VII focuses on the bureaucratic context in this world of many actors and emphasizes the entrepreneurial roles demanded of policy analysts if good ideas are to find expression in action. (These requirements might be phrased as a need to exercise the fashionable talent of "intrapreneurship", except that in this world of "Alternative Service Delivery", it is primarily through external agencies, not one's own organization, that action will be accomplished.)

At the conclusion of each relevant section of the paper, a list of checklists or "commandments" is suggested. The three sets of "commandments" together reflect the conclusion that the responsible policy analyst is condemned to wear three hats throughout the working day, all of which are neither black nor white, but coloured varying shades of grey. Thus, three corresponding sets of "commandments" are constructed as possible guidelines to help in switching from one to another.

I. The Instrumental (or Consequential) Hat: Responsible Policy Formulation (targetted on effectiveness). (Section V.E).

II. The Procedural (or Communicative) Hat: Participatory Policy Formulation(targetted on acceptance).(Section VI.B).

III. The Entrepreneurial Hat: Effective Policy Advocacy (targetted on adoption and compliance)(Section VII.B).

The paper concludes with two illustrative glimpses suggesting possible applications of themes and approaches reviewed in the paper:

1. Sustainability and the maintenance of natural capital

2. Fisheries Management.

## II. POLICY ANALYSIS: THE RATIONALITY PROJECT

### II.A. Policy science and the policy process

Until the post-World War II era, students of political life concentrated primarily on either the normative (moral) dimensions of government or the formal structures of political institutions. **Policy science**--as the application of a problem-solving approach to the activities of government--emerged only later, with its early formulations most closely associated with the work of Harold Lasswell (1956). Lasswell was the first theorist to divide the policy-making processes into a number of stages or steps, beginning with the collection of information about a particular policy issue and ending with evaluation of the results of the policy chosen to address the aims and goals of decision-makers (Howlett and Ramesh, 1995). Lasswell's depiction of the policy process was intended to be not only *descriptive* of how the process takes place, but *prescriptive* -- i.e., a recommendation as to how the process *should* take place.

Since Lasswell, there have been numerous variations on this theme. Most are similar in their basic elements, however, with a typical formulation of the policy process being as follows:

1. Problem definition

2. Formulation of goals or objectives

3. Selection of criteria for choice among alternative ways of achieving policy goals

4. Generation of alternatives

5. Construction of models of the causal processes that relate policy alternatives to specific outcomes - that is, that predict the empirical results of chosen alternatives. Or, in yet other words, models that calculate the consequences of pursuing any one selected policy option

6. Policy implementation, monitoring and evaluation.

This process is normally considered to be on-going, iterative and cyclical; through formal or informal evaluation processes, the results of implementation inform the re-definition of the problem, which alters the formulation of policy goals, and so on.

The so-called rational model of policy-making:

> ... is rooted in enlightenment rationalism and positivism, schools of thought which seek to develop detached, scientific knowledge to improve human conditions. They are based on the belief that society's problems ought to be solved in a "scientific" or "rational" manner by gathering all relevant information on the problems and alternative solutions to them, and then selecting the best alternative.(Howlett and Ramesh, 1995:140)

In conventional policy analysis, the dominant criterion for selecting among alternatives is that of "efficiency", based on the proposition that resources should not be wasted--that is, that alternatives should be selected so as to achieve maximum social well-being (or "welfare") relative to their cost. The choice of economic efficiency as the prevailing criterion for policy choice reflects the position of micro-economic analysis and applied social

welfare theory as the dominant disciplines of policy analysis and, in particular, their underlying assumption that individual preferences are what count in assessing outcomes. This emphasis on economic efficiency (which should be roughly translated as 'effectiveness' in the language of the evaluation literature) is based on the simple proposition that if scarce resources can be reallocated in such a way to make some people (feel) better off, while leaving all others no worse off, then they should be so re-allocated. Frequent reliance in policy analysis on more technical assessment of least cost alternatives to resolving well-defined problems also finds its origins in systems analysis and operations research, techniques developed by and for industry and the military in the post-World War II period (Quade,1982). A number of criticisms can be(and have been) been levelled at adoption of efficiency as the dominant criterion in policy selection and decision-making (see, for example, Sagoff, 1988; von Weizsacker,1994).

### II.B. Comprehensive rationality, limited rationality, or irrationality?

Conventional policy analysis has been criticized on a number of grounds relating to both its assumptions of "rationality" and its dominant criterion for policy selection.

Almost from its inception, the full-blown "comprehensive" rational model was criticized as being overly ambitious and unrealistic. Beginning in the 1950's Herbert Simon (1954, 1957) argued that decision-makers are incapable, simply because of cognitive limitations, of considering all possible options or of anticipating all possible consequences of alternative courses of action. He argued further that decision-makers generally choose among a small group of options according to political or

ideological criteria, rather than efficiency. Instead of seeking "optimal" solutions, they select, rather, the first alternative that meets the criteria which decision-makers adopt. In Simon's terms, decision-makers "satisfice" rather than optimize.

In 1959, Charles Lindblom proposed a profoundly influential description of an "incremental" process of public decision-making which replaced a rigorous, thorough, examination of alternative ways of achieving pre-established goals with a model based on successive limited comparisons, that is, a trial and error approach that generally selects among a limited number of options, any of which differs only marginally from the status quo. In Lindblom's view, policy making is a practical exercise focused on the problems at hand; it neither attempts, nor can it succeed, in articulating long-term goals or establishing clear priorities (Pal,1992; Howlett and Ramesh,1995).

As an obvious alternative to the deadlock between rational and incremental models, Amitai Etzioni (1967) put forward a *mixed scanning* model which incorporated both "day to day" incrementalism and occasional fundamental policy shifts.

While criticizing many of the claims of the rational model, Simon, Lindblom and Etzioni still remained within a framework which presumed generally rational autonomous actors who identify problems and then search for solutions. In the 1970's, March and Olsen first proposed a model of public decision-making which rejected even the limited rationality admitted by previous critics. This so-called *garbage can model* is based, not on notions of causality or distinctions between means and ends, but rather on the more-or-less accidental conjunction of problems, solutions, decision-makers and decision-making opportunities. In this view, decisions are not the results of intentional action directed to the resolution of

problems. Rather, solutions--or more precisely the people with "solutions" they wish to promote--look for problems as well as vice versa; and many "solutions" may wait for years in the political wilderness until the right "window" opens up for the problem to be identified, at the right time, by the right decision-maker. *Garbage can models* and their variants substitute entrepreneurship and the ability to recognize and capitalize on decision opportunities in place of data gathering, careful analysis and clear priorities as the qualities most necessary for the effective decision maker. In fact, *garbage can models* place in question whether there **any** meaningful criteria for a "good" policy decision.

In later work, March and Olsen (1984 and 1989) focus on the impacts of *institutions*, that is the sets of rules (organizations, expectations, procedures, strategies and conventions) that structure political activity, on the decision-making process. Unlike advocates of rational decision-making models, proponents of the "new institutionalism" argue that

> ... preferences and meanings develop in politics, as in the rest of life, through a combination of education, indoctrination and experience. ... Although self-interest undoubtedly permeates politics, action is often based more on discovering the normatively appropriate behaviour than on calculating the return expected from alternative choices. As a result, political behaviour, like other behaviour, can be described in terms of duties, obligations, roles, and rules. (March and Olsen, 1984:739,744)

The notion that the outcomes of decisions can be changed by changing the *rules* that govern how such decisions are made underlies the rapidly expanding field of study concerning the reform of institutions for environmental and resource policy-making. This literature is discussed in Section VI.C. of this paper.

## III. Public Policy in a Changing World

Increased questioning of rational models of public decision-making and of conventional approaches to policy analysis has occurred in conjunction with, or possibly because of, changing perceptions of the world in which decisions must be made.

### III.A. New hazards

The products and processes of new and expanded technologies have resulted in many new human-induced hazards of unprecedented scale, including noxious chemical wastes, acid rain, climatic change, the potential impacts of biotechnology, and hazards of nuclear power production and nuclear waste. Risk assessment (what is a risk? How serious is it?) and risk response (what should we do?) have become increasingly problematic in a climate of uncertainty and conflicting perceptions and concerns, and vastly enhanced capacity to analyze our physical environment and detect the presence of potential toxic substances (NAPA, 1995). In this respect, the world seems to have become a more dangerous place, although a growing backlash against attempts to regulate exposure to these perceived risks is evident (Breyer,1993; Wildavsky, 1980)

### III.B. Limits to growth

In the years since World War II, the world has experienced rapid population increases, particularly in the "South", increasing industrial activity and consumption in the "North", and an overall expansion of economic activity in an increasingly integrated global economy. All of these developments have placed increasing demands on the natural environment as a source of materials for production and consumption, and as a sink for the disposal of wastes. As is discussed in section V.A., in the face of these developments, environmental and ecological economists seek ways of assigning

appropriate "prices" to environmental goods and services and of determining the degree to which the use of market mechanisms can achieve *social* goals of sustainability, despite the physical problems of increasing scale (Pearce et al, 1989).

### III.C. New metaphors for nature

As Botkin (1990:32-33) notes, the science of ecology - the study of the relationship between human beings and their environment - developed primarily in the 20th century as a "child of the machine age" and relied, until recently, on "mechanical metaphors, machine models...and the physical sciences for theory, mathematical approaches, concepts (and) models." In the past two decades, however, conceptions of "nature as a machine", i.e. of nature as a predictable system tending to stability and equilibrium, have been replaced by a concept of nature as a complex system exhibiting randomness, uncertainty and "surprises" as inherent qualities. This change of metaphor has been accompanied by an increasing suspicion of the promises of science and technology to "fix" problems and improve human well-being. Alternative formulations - "Nature Resilient"; "Nature Evolving" (Holling, 1994) - have led to new formulations of appropriate resource and environmental management strategies, broadly termed "adaptive management". These strategies are discussed below in section V.B.

### III.D. Decision-making in a congested world

#### a) Demands for participation in decision-making

In a "full world" (Daly and Cobb, 1990), more problems become collectivized and defined as public problems than in an "empty" world. Collective problems demand collective solutions. But at the same time as governments are being asked to address a growing range of problems--many of them unprecedented in complexity and severity-

-governance itself is under attack. The legitimacy of representative democratic institutions is questioned, as are the integrity and ability of both elected and appointed officials. Demands for "public participation", "consensus processes", and "shared decision-making" join with demands for the incorporation of indigenous knowledge and "citizen science" in public decision-making. As is discussed in Section V.E., the last decade has seen an unprecedented flowering of participatory processes for public decision-making. The purpose, scope, and limitations of such processes--and their validity as substitutes for institutions of representative democracy--remain, however, subjects of much debate.

**b) Demands for diminishing resources**

In a "full world", increasing competition for the increasingly scarce and valuable resources of the global commons has accelerated conflict among those who perceive that their rights and expectations are being damaged by other parties to the competition. In a congested world, distinctions between "private" and "public goods" become blurred, as private property becomes increasingly subject to public regulation, and public property becomes increasingly subject to private appropriations. In the absence of frontier areas where those without property can still find "free" (i.e. unpriced) resources, society is faced with the need to better specify property rights for all resources in order to minimize social conflict over access to such resources and to avoid the resulting "tragic" (Hardin, 1968) outcomes for the resources themselves (and for the community of all those who rely or will rely upon them, directly or indirectly). The process of specifying rights is, however, itself fraught with conflict, as those who now benefit from access to the commons understandably resist the loss of current privileges (perhaps through imposition of increased charges by the public owner for access to the resource) and the

disappointment of future expectations. Further, in an increasingly integrated global economy, benefits and costs flow through increasingly complex and indirect channels. Identifying the actual impact on ecological resources, or the "ecological footprint" (Rees and Wackernagel, 1995) becomes increasingly difficult. Problems of defining and re-defining property rights in the global commons are discussed further in Section V.C, and no doubt represent the key preoccupation that will confront analysts in the coming years (O'Riordan and Jager, 1995).

## IV. POLICY ANALYSIS AND ENVIRONMENTAL ISSUES

Most significant environmental problems embody the very characteristics that make the application of conventional analytical techniques so problematic, and which have brought conventional policy analysis and public decision-making processes into disrepute in many circles. Most significant environmental concerns are characterized by varying degrees of:

- complexity,
- uncertainty,
- irreversibility, and
- conflict.

In short, many environmental problems are not susceptible to conventional analysis because:

1. We do not have the cognitive capacity to understand them completely (or at least sufficiently) because they are too *complex;*
2. They may not be susceptible to understanding, in the sense of their being predictable and controllable, because they are characterized by *irreducible uncertainty* (randomness, chaos);
3. We cannot rely on conventional risk assessment and evaluation, i.e. calculations of expected value, because, if we are wrong, the damage may be catastrophic or *irreversible*, or both; further, conventional decision analysis serves an individual acting according to his or

her own preferences, not an agent attempting to act in the interests of a collectivity from which informed consent cannot be presumed.

4. Externalities of limited significance in an economy centred on fabrication and industrial activity are overwhelmed by externalities dominating a "full world" in which the harvesting of renewable common pool resources and natural capital, and the safeguarding of common waste sinks, are key features of human activity;

5. For this reason, the nature and causes of the problems themselves are subject to a great deal of debate and **conflict**. There is often little or no agreement as to what a "good" solution would be. As noted above, the criterion of economic efficiency is seen as highly suspect as a basis for choice.

All of this being so, is there any prospect for informed decision-making? If there are no "right answers" are there at least "good answers", and practicable methods for seeking them out? Can analysts be anything more than skilled entrepreneurs, working opportunistically to advance the interests of their particular clients, or their own careers? In short, can we save any of the analytical baby while siphoning off some of the rationalist bathwater?

## V. Approaches to Responsible Policy Formation

As the preceding short discussion suggests, new approaches are needed to both the science and the institutional design surrounding decision-making in respect of environmental and resource management. In the past twenty years, several new currents have emerged in a wide range of literature, much of it multi-disciplinary in character and concerned with the problems of bridging science, public understanding and policy-making (Gunderson et al, 1995). This section attempts to to trace some of the major themes in this varied literature.

## V.A. Sustainability: Pious hope or guide to action?

Having been popularized by the Bruntland Commission as a global policy objective, the concept of "sustainable development" has been seized on by a broad range of actors in the business community as well as the environmental policy community despite (or perhaps because of) its vagueness:

> To environmentalists it offers the promise of sustainability; to industry it offers the promise of continued economic development that was frighteningly absent from the "limits to growth" concept popular in the early 1970's. (Hoberg, 1993:317).

Environmental and ecological economists have, however, attempted to define "sustainability" and to determine the necessary conditions for an economy to be sustainable (Daly and Cobb, 1990; Costanza, 1991; Pezzey, 1989; Pearce and Turner,1990; Jacobs,1993). All of these approaches accept that there is *some level* of economic activity beyond which the quality of stocks and services of environmental resources cannot be sustained (Pearce and Turner, 1990). In other words, there are biophysical "limits to growth"; the challenge of defining sustainability is to determine what those limits are (O'Riordan and Jager, 1995).

Pezzey (1989) proposed four possible definitions of sustainable development:

1. Non-declining consumption through time
2. Non-declining utility through time
3. A non-declining stock of total capital (natural and human-made) through time
4. A non-declining stock of natural capital through time.

The environmental and ecological economics literature generally supports Definition 4 - a non-declining stock of natural capital through time - as the appropriate criterion for sustainability. It

is argued that:

1. many functions of the environment are unique, and cannot be duplicated by human products, particularly life support services such as climatic regulation, geochemical and hydrological cycling, ecosystem maintenance, and so on;

2. losses of natural capital may be irreversible. If a car or factory is destroyed, it can be replaced; a species made extinct cannot be brought back to life (at least with present or foreseeable knowledge of genetic codes);

3. we are to a large extent ignorant about the functioning of the biosphere, and about the effects of additional degradation. We ought, therefore, to adopt a "precautionary" attitude toward further losses of natural capital;

4. we cannot measure degrees of substitutability because human-made and natural capital lack a common metric. Natural capital cannot be adequately measured by monetary valuation and other widely accepted methods of valuation have yet to be established (Jacobs, 1993).

Attempts to overcome problems of measurement and comparability have led to the search for supplements or alternatives to conventional cost-benefit analysis, including:

1. attempts to create or replicate markets for unpriced environmental goods and services. These techniques include hedonic pricing, travel cost methods, and contingent valuation;

2. inclusion of physical measures to supplement economic analyses. Multiple Accounts Analysis, for example, attempts to provide information on social and environmental implications of various land and resource use scenarios, without reducing these measures to dollar figures that are then incorporated into CBA "bottom lines";

3. development of an alternative metric, frequently measures based on production or consumption of energy (Costanza et al, 1989);

4. requirements that any loss of natural capital be compensated by its replacement through a "shadow project".

All of these approaches are problematic, and are complicated by questions of appropriate scale of analysis. However, although they may not permit designation of an absolute level of natural capital required to satisfy the criterion of sustainability, they may offer *guidelines for comparison of alternative policy proposals*. For example, elements of the operational definition of sustainability offered by Daly and Cobb (1990), although absolutist in nature, might be adapted as a guide for comparisons of effectiveness in achieving progress toward sustainability:

1. Human scale must be limited within the carrying capacity of the remaining natural capital.

2. Technological progress should be efficiency-increasing rather than throughput increasing.

3. Harvesting rates of renewable natural resources should not exceed regeneration rates.

4. Waste emissions should not exceed the assimilative capacity of the environment.

5. Non-renewable resources should be exploited, but at a rate equal to the creation of renewable substitutes.

If, as is suggested by Simon and others, we are incapable of identifying all possible strategies and of selecting an *optimum* strategy, then what we require may be guidelines for measuring the *relative* desirability of various options, coupled with the creation of more or less arbitrary constraints on further loss of natural capital, until we can assess the impacts of degradative activities. Policy development as *experimentation* and *learning* is discussed in

the next section of this paper.

**V.B. Adaptive management and the precautionary principle**

Clark (1980:303) observes that, having recognized that we cannot successfully avoid, fully understand, confidently predict or permanently control the world around us (including the behaviour of other human beings), our challenge is that of "coping confidently, effectively, and creatively with the surprising world around us. The fundamental question is...how to increase our risk-taking abilities." Clark's recommendations for "adaptive designs" for coping with an uncertain environment are developed in the work of Walters, Lee, Holling and others. As defined by Lee (1993:53), adaptive management

> ... applies the concept of experimentation to the design and implementation of natural-resource and environmental policies. An adaptive policy is one that is designed from the outset to test clearly formulated hypotheses about the behaviour of an ecosystem being changed by human use.

As elaborated by Gunderson, Holling and Light (1995:9), implementing adaptive policy management requires:

- integrated policies, not piecemeal ones;
- flexible, adaptive policies, not rigid locked-in ones;
- monitoring designed as a part of active interventions to achieve understanding and to identify remedial response, not monitoring for monitoring's sake;
- investments in eclectic science, not just in controlled science;
- citizen involvement and partnership to build "civic science", not public information programs to inform passively.

. a concern with maintaining the resilience of systems, that is,

their capacity to absorb shocks and continue to function. The goal of resilience should replace the (unattainable) goals of stability and equilibrium.

Implementing adaptive management requires redefinition of the role of science in the policy process. Bromley (1991), Lee (1993), Schrader-Frechette (1991) and others note that scientific uncertainty is frequently used by those who benefit from current (generally resource exploitative) activities as an argument for "doing nothing" until better information is forthcoming. As a result of the pre-occupation of scientists with avoiding so-called Type I errors (false positives or errors of commission), the probability and potential costs of Type II errors (false negatives) are neglected. Where the status quo situation is that of presumptively degradative activities (as is often the case), waiting for scientific certainty may involve delaying action until irreversible damage has occurred. In such cases, the "precautionary principle" counsels us to require that, where there is a high probability that negative impacts cannot be detected at a level and within a time frame that would permit effective action to prevent or reverse such impacts, the burden of proof should be shifted from demonstrating that activities do have effects detrimental to the environment to demonstrating that they **do not** (Peterman, 1990). (It is perhaps appropriate to emphasize that Canada has signed on to a number of commitments that demand respect for such a precautionary approach. A growing body of opinion considers these international commitments as binding constraints on resource management efforts, including policies of sub-national jurisdictions. It seems evident that Canadians collectively are falling far short of meeting the obligations they have assumed.)

## V.C. The tragedy of the unmanaged commons: getting the incentives right

The conventional prescriptions for avoiding what Hardin (1968) described as the "tragedy of the commons" have been state regulation ("Leviathan") or allocation of private property rights. A third type of resource management regime, variously referred to as "self-governance of common pool resources" (Ostrom, 1990), "territorial use rights" (Rettig, Berkes and Pinkerton, 1989), "folk management" (Pinkerton, in Dyer and McGoodwin, 1994), "common or communal property rights" (Grima and Berkes, 1989) or simply "indigenous or traditional" resource management systems (Osherenko, 1988), has received increasing attention since the mid-1970s, mainly by anthropologists, and latterly by political scientists and students of institutional economics. These arrangements involve neither private property, nor a resource free-for-all. They represent, rather a

> well-defined set of institutional arrangements concerning who may make use of a resource, who may not make use of a resource, and the rules governing how the accepted users shall conduct themselves.
> (Bromley, 1985, quoted in Grima and Berkes, 1989:37).

Elinor Ostrom and her collaborators (1990, 1992) have made considerable progress toward the development of a theoretical understanding of self-governance of common pool resources (CPR's) as a "third way" of avoiding the tragedy of the commons. In this literature, "rules" (institutions) are the basic unit of analysis because:

> Institutions shape the patterns of human interactions and the results that individuals achieve.... Institutions shape human behaviour through their impact on incentives (which are) the positive and negative changes in outcomes that individuals perceive as likely to result from particularl actions taken within a set of working rules, combined with the relevant individual, physical, and social variables that also impinge on outcomes. (Ostrom, 1992:24)

Incentives are often financial, but may also be concerned with social approval or disapproval, shame, feelings of pride or prestige, and "belongingness". Frequently, it is these non-monetary incentives, such as an individual's concern that he or she be considered trustworthy or "moral" (Frank, 1988), that powerfully influence an individual's willingness to refrain from opportunistic behaviour, even when this is ulikely to be detected by other resource users.

Many of the institutional arrangements which lead to effective management of common property rely on clear specification of property rights, albeit rights which may be held by a group (community) rather than by individuals or corporations. In post-industrial societies as in others, there are many instances of licenses, permits and other rights to use publicly owned resources that fall short of fully specified property rights. In such cases (where resources users obtain access to publicly owned resources through permit or licensing arrangements), it is common for users to claim that they are doing only what they are told or allowed to do. When damage results--fisheries collapse or clear-cut hillsides wash into creeks--the finger of blame can be pointed at the regulators (generally the government) rather than at the resource users themselves.

The need to define or redefine property rights in natural resources rarely appears on policy agendas before problems of overuse and abuse have become so obvious and extreme that even the most optimistic users and regulators can no longer deny that "something needs to be done". What needs to be done generally involves reducing the number of resource users. The usual response to this proposition is demands from the affected users for "compensation". Often, however, legally compensable claims are found to be very limited.

Schwindt (1992:148), for example, after describing at length the complex system of private interests in public forest resources, recommends that:

> No compensation be paid for forest tenure values that reflect uncollected resource rents. Compensation should be limited to harm done to investments made on the expectation of secure harvesting rights.

In the case of fisheries resource interests, Huestis (1992:13) notes that:

> While the courts have slowly come to attribute commercial fishing licenses with a proprietary nature in limited circumstances, the fact that licenses are subject to the Minister's absolute discretion respecting the renewal thereof suggests judicial denial of compensable resource interest status to commercial fishing licenses. The courts, to date, have shown a tendency in dealing with fisheries resource cases to view the refusal to re-issue licenses under the *Fisheries Act* as "regulation" of the resource as opposed to the acquisition or "taking" of the resource interest.

Therefore, although the debate over disappointed expectations of continuing access to resources is often couched in the language of "compensation", for practical and policy purposes, the actual question - again a central question in coming years - is one of:

> 1. cushioning the transition from an over-subscribed resource system to one in which there is a reasonable investment of human and financial resources;
>
> 2. re-defining private and public interests in the resource system such that the problems that result from current property and management regimes can be minimized in future.

As Schwindt notes (1992:3-4):

> ... compensation for taken property rights is but one, small component of an overall policy to mitigate the negative effects of economic and social change, and, in the process, facilitate that change...government must

> consider the effects of resource withdrawals upon other groups such as employees, dependent businesses, and local communities (many of them small and resource based). And it must frame policies to ameliorate harm done. In many cases, this means assisting in the redeployment of human resources through retraining, local investment incentives, and in some cases, relocation subsidies. *Choosing to ignore those who have no legal claim to compensation is no solution because, if resources needlessly are idled, particularly human resources, society ultimately will bear the cost one way or another* (emphasis added).

**V.D. Co-management, community and the commons**

Research in the management of common pool resources is highly relevant to current experiments in "cooperative management" or "co-management" of natural resources and the environment. To the extent that "co-management" is not used as simply a popular euphemism for "consultation", its proponents generally mean by the term, some combination of "state" and "community" resource management regimes. In complex, post-industrial societies, however, most traditional management arrangements have long since been eroded or have disappeared, and the circumstances in which such regimes could spontaneously re-appear are notably absent (see Ostrom, 1990). Decision-makers (and communities) must ask themselves, therefore, what sorts of institutional arrangements could be established that would *duplicate* or substitute for the conditions under which responsible local resource management regimes would naturally arise? In other words, *how can new institutional arrangements create the appropriate incentives for participants to use resources conservatively and efficiently? (And can these arrangements work on a large scale?)*

The *minimal* conditions for successfully community/co-management appear to be as follows:

1. It is clearly understood *who* has rights to use resources. In other words, the question of *exclusion or eligiblity* is resolved.

2. It is clearly understood *which* resources (e.g. resources in which geographical area) are governed by the management regime. The problem of *boundaries* is resolved.

3. Costs and benefits are, to the greatest extent possible, internal to the management regime. In other words, external subsidies and bailouts are minimized, as are externalities arising from mis-use or over-consumption. Resource users have security in their access to benefits, but are also liable for costs of mismanagement.

4. Each user suffers (and perceives himself or herself to be suffering) if others damage or over-use the resource or the resource system; thus each user is motivated to monitor fellow participants.

5. External authorities provide necessary standard setting, audit, conflict resolution and enforcement action for the management regime as a whole, although they do not monitor or license individual participants. The conditions under which management authority is granted are clear, as are the conditions under which community management arrangements can be terminated.

6. The entity responsible for the management regime is legally constituted, accountable to and representative of, its constituents.

The first two of these conditions are almost certainly the most challenging, as they require difficult political decisions on the part of senior governments. Since most natural resource pools are now over-subscribed, such decisions result in clearly identified "winners" and "losers". The above guidelines for "institution making" need to be given serious consideration, however, if "co-management" is not to result in regimes that are even less accountable and responsible than current arrangements.

### V.E. Commandments I - An Instrumental Hat for the Policy Analyst

The literature briefly reviewed above suggests that, while the

policy analyst may no longer be bound by (nor rely upon) conventional criteria for policy decisions, he or she must be concerned with outcomes, results, and effective, sustainable use of the scarce resources of the biosphere, in the face of irreducible uncertainty about the functioning of ecological systems. While wearing the instrumental hat, the analyst is searching for policies that are good according to substantive criteria, other than simply their acceptability to stakeholders. In this mode, the analyst looks to analysis of allocation decisions and leans toward the principles--many of them tenets of adaptive management--set out in Commandments I.

**Commandments I: Responsible Policy Formulation**

1. **Know the real problem(s):** How the question is framed substantially determines how it is answered. The way a problem initially presents itself may not reflect its more fundamental nature. It may need particularly to be reformulated in light of growing understanding of ecological systems and human interactions with them.
2. **Don't fixate on the differences between means and ends:** Goals become meaningful only when concrete paths to achieve them are examined. Don't propose waiting for consensus on long term goals before seeking agreement on interim action.
3. **Seek resilience, rather than stability and equilibrium.** Resilient systems can withstand shocks and errors. In an uncertain world with faulty human institutions, we cannot eliminate error, so we must ensure that systems (both natural and human) can withstand inevitable surprises and mistakes.
4. **Concentrate on options for changing human behaviour, not on reducing environmental variability and risk.** For example, don't build on flood plains and do maintain genetic diversity. Controlling natural variability reduces minor fluctuations at the expense of major disasters. Redundancy, slack, and precautionary attitudes to intervention are important attributes of long-run performance.
5. **Broaden the set of feasible options considered.** Do not prejudge or limit governments by filtering or censoring options on the basis of your preconceptions of their reactions. Know your audience, but don't "play to your audience". Remember that "The

Truth" can change quickly.

6. **Recognize that the status quo is not an option.** When people talk about the option of the status quo, they usually mean "do nothing" or "no policy change". In a moving environment, the "no policy change" option does not deliver the status quo; the status quo cannot be used as a benchmark. Take all costs into account, including costs of " no policy change".

7. **Focus on options which keep action small, reversible.** Recognize that "no decision" may often be worse than a reversible start. Treat all policies as experiments to be evaluated, not ideological positions to be defended. Experiments are for learning, not for finger-pointing.

8. **Concentrate on the evidence that will make a difference to the decision.** Avoid drowning in data; seek information from data, respect knowledge over information, wisdom over knowledge. Don't expect "right" answers - look for "good" answers based on reasonable assumptions and consistent arguments. Look to distribution and equity, as well as efficiency.

9. **Consider the whole range of potential instruments:** Develop criteria for choice, and examine the spectrum of possible instruments. Do not get stuck on conventional regulatory approaches when economic instruments or performance-oriented agreements might work better. But note that there will still be need for a social framework around market mechanisms.

10. **Remember the benefits of competition:** Encourage diverse and competing ideas and initiatives. Too much emphasis on cooperation and consensus may disguise fundamental disagreements and discourage innovation and efficiency. Excessive cooperation can drift into exploitative collusion.

## VI. Participatory policy making

### VI.A. Multi-stakeholder processes

Participatory policy making - "shared decision-making" or multpartite bargaining" - has emerged in response to what Hoberg (1993) describes as the "second wave" of environmentalism in North America and on a global scale. While the "first wave" (in the late 1960s and early 1970s) produced a

brief flirtation with more direct citizen participation in public decisions, many of these early processes were consultative at best, and tokenistic at worst. In general, they had little influence on established patterns of government/industry bipartite decision-making about resource and environmental policy.

Since the early 1990s, however, multi-partite bargaining with a stated goal of "sustainable development" has become the dominant Canadian policy response to demands for greater involvement of a broader constituency of interests and greater consideration of a broader range of environmental values. While the goal and the process are not necessarily related, Hoberg (1993:314) notes that "... both are based on the idea that corporate interests in development can somehow be reconciled with interests in environmental protection." In its 1995 Report to the Legislative Assembly (50), the Commission on Resources and Environment confirms this view in its definition of "shared decision-making":

> Shared decision-making is a consensus-based approach to decision-making in which those with authority to make a public decision and those who will be affected by that decision are empowered jointly to seek an outcome *that accommodates rather than compromises the interests of all concerned* (emphasis added).

The statement that shared decision-making "accommodates ... the interests of all concerned" represents a laudable objective while simultaneously begging a rather large question. Can the "interests of all concerned" be achieved without substantial compromise in a world of scarcity, uncertainty and conflict? If the current problem

is: a) there is not enough to go around; and b) we have been unable, so far, to produce a generally acceptable criterion for distribution of scarce resources, can assuming that there **is** enough to go around lead to any real solutions? The response to this apparent conundrum lies, of course, in the definition of "interests". In much of the discussion around participatory decision-making, "interests" are contrasted with "positions". Interests are defined, for example, as "fundamental goals (i.e. the needs, desires, concerns and fears) that motivate the positions negotiators take", while "positions" are considered to be those "ideal outcomes" that negotiators seek at the outset of negotiations (CORE, 1995:51). The difference between interests and positions is, however, clearly one of degree. At some sufficiently "fundamental" (and abstract) level, most or all parties to a negotiation would be able to agree on such "interests" as freedom and justice - and community stability, economic prosperity, and sustainable development. The goal statements of many "participatory processes" reflect, in fact, just such a level of abstraction. The Kamloops Land and Resource Management Plan goals included, for example,

- a balanced use of the land and resources which respects and accommodates all interests;
- protection and security of the land and resources for future generation;
- social and economic stability and vitality of local communities (Kamloops LRMP, September 1994:1).

Such "goals" are presumably intended to provide guidance to the process of selecting among competing land and resource scenarios. As Braybrooke and Lindblom (1963) observed more than three decades ago, however, such *naive priorities* "...provid(e) insufficient detail to tell just when to turn from one value to the next" (MacRae and Wilde, 1979:47).

In other words, it must be assumed that we cannot achieve all of the social and economic stability that we would like to have, nor all of the protection and security of land and resources for future generations that we would like to have. This being so, how much of each "interest" is enough? How are the tradeoffs made? To be useful in setting specific policy issues, consensus decision-making must produce more specific criteria for choice.

Multi-stakeholder processes present other challenges, as well. For example, what is the role of government(s) in such processes? Just another stakeholder? Umpire? Maker of rules? Final arbiter? What are the incentives for such processes to achieve agreement? Are the consequences of no agreement better or worse than the best or worst possible negotiated outcome? Are the incentives for agreement different for different participants? If so, which stakeholders have incentives to obstruct the process? Which have incentives to negotiate? How are the costs and benefits of obstruction or agreement distributed? Do current uses of land and resources continue pending agreement, or are they halted pending agreement? Answers to these questions matter profoundly to the outcomes of participatory processes.

The selection of "stakeholders" in such processes is also of paramount importance. Who should be represented and how should they be accountable to the constituencies they represent? Are the interests to be considered limited to those around the table? Who speaks for those not present - including distant people and future people? Will the consequences of the decision be borne by those who make it, or by others? (Note that it is precisely this role of attempting to find measures to signal the interests of all those affected that was intended to be played by the detached analyst calculating the "public interest".)

Many of the most difficult questions surrounding multi-partite processes revolve around the stage of public decision-making at which they occur, and the degree to which they are intended to "bind" governments to certain decisions. "Participatory policy analysis" (de Leon,1995) in which a variety of interests contribute their knowledge, views and concerns, raises fewer and different considerations than does "shared decision making" in which some degree of authority is devolved from representative elected bodies to less broadly representative groups.

The adaptive management approach may offer alternatives for "participative action" instead of (or in addition to) "participative deliberation". If the object of policy is experimentation and learning, then it is not necessary (or feasible) for a province, region or community to have the "one right answer" before proceeding to address problems through action. The principles of adaptive management - small scale, consciously experimental, inclusive, and cautious - lend themselves very well to community-based initiatives that involve indigenous and "citizen" science, that strive for the development of mutual trust and dependency, and that provide a means of retreat if experiments go wrong. Thus, from an earlier vision of centrally-guided strategic planning, one can move toward much more decentralized and adaptive strategic action.

### VI.B. Commandments II - A Procedural Hat for the Policy Analyst

This discussion suggests that the analyst must also wear a second hat, one that is concerned with process, participation, fair representation of interests, the building of multi-stakeholder consensus, and the "small 'p' political" analysis of distributional outcomes or perceived consequences for winners and losers. While wearing the Procedural Hat, the analyst searches for acceptable

policies and commitments to decisions that can endure in a changing world of shifting interests. In this guise, he or she looks to analysis of negotiating positions, and leans toward the guidelines as set out in Commandments II.

### VI.B. Commandments II: Policy Analysts and Public Participation

1. **Employ Commandments I in serving the participatory process.** Participants in shared decision-making processes need to know:
   - the full set of feasible options
   - that the status quo is not an option, even if "do nothing" is.
   - the evidence that makes a difference to the decision
   - the whole range of potential policy instruments.
2. **Clarify your role.** Why are you there? As a government representative? As a neutral facilitator? To represent particular interests or the public interest? As a resource for information and analysis? To establish the limits within which acceptable options can be developed?
3. **If your role includes negotiation, clarify your mandate and your ability to deliver on commitments you make.** Remember that you must negotiate and deliver at two levels at least: inside and outside the negotiating group. And remember that Parliamentary systems assign ultimate responsibility to Ministers answerable to a legislature.
4. **Respect limits to participants' commitment.** While many of those involved in participatory policy-making are very knowledgeable about and committed to the issues under consideration, relatively few participants are involved as full-time, salaried, professionals. The risk of 'consultation fatigue' and overload is high. By placing unreasonable demands on participants, governments may "weed out" all those except the richest, most extreme or most self-interested voices, thereby jeopardizing the representativeness of the process.
5. **Help participants move from "naive priorities" to "informed choices".** Participatory processes help participants come to grips with extremely complex issues, to identify a broader range of alternative responses to problems, and to appreciate the implications of particular options. A policy analyst can contribute to the process by identifying opportunities and constraints, by assessing the implications of different proposals, and by supplying or finding information that "makes a

difference" to decisions. Except at the broadest and most abstract level, every policy choice involves sacrifices and tradeoffs. Participants who understand these tradeoffs may be less likely to demand the impossible.

6. **Reframe positions as hypotheses:** Encourage participants to develop proposals in an "if/then" format: if we do this, then we expect that - and encourage experimentation to test these hypotheses.

7. **Encourage diversity:** Geographic, cultural and other differences in British Columbia should encourage a range of approaches tailored to regional and local conditions within a broad policy framework that establishes minimum requirements for equity, efficiency and other fundamental aspects of the public interest.

8. **Monitor results and share learning:** Very little systematic assessment has been made of the recent proliferation of participatory, community-based, innovative and/or co-operative management processes and projects. Encourage evaluation of results, preferably in a succinct, easily used format that can be captured in a highly accessible data base. In the meantime, invite participants to share their experiences (positive and negative) with others embarking on similar projects.

9. **Remember participatory processes are only as a good as laws and policies let them be: work toward the right incentives for good decision-making:** Participatory processes are subverted by a policy climate which encourages "end runs", by legislative and regulatory frameworks that allow damaging activities to continue pending "consensus", by the absence of formal definition and recognition of the representativeness, accountability and independence of processes which devolve some policy-making responsibility from government to other arenas. The institutional framework must legitimize the processes which "nest" within them.

10. **Encourage openness and ensure due process:** No participatory process can be fully representative of the "public interest". Openness, transparency, and administrative procedures which guard against consensus at the expense of non-participants are essential if participatory processes are not to be torpedoed by interests who were not involved.

## VII. Implementation and Compliance

### VII.A. Parallel processing and agency politics

Examples of both success stories and problems in formulation, implementation and compliance exist throughout government (Calista, 1994). Like the crumbling wall between "policy" and "administration", the distinctions between policy formulation, and its adoption and implementation are tenuous at best. In the business of public policy, means are rarely separate from ends. The difference between success and failure often depends on the early recognition of the implementation challenge, and the appropriate choice of instruments and implementation processes.

The pronounced, and probably by now irreversible, shift toward participatory decision-making is one attempt to recognize the implementation challenge early in the formulation process. Stakeholder involvement in decision-making is believed to ease implementation by recognizing distributive issues (i.e. who gets what?)at the outset. This recognition may be substantive (participants may shift distribution according to their pre-existing preferences) or symbolic (participants may prefer outcomes which they have helped to determine), or both.

As Weimer and Vining (1992) observe, analysts (and others) need to spend much more time and thought in systematic processes for anticipating and avoiding implementation problems. These authors recommend both *forward mapping* (scenario writing) and *backward mapping* as ways of specifying the links between policy initiatives and their desired outcomes. Backward mapping (moving from desired outcomes to policy decisions) is most useful in generating policy alternatives that have good prospects for successful implementation. Forward mapping requires that analysts consider the full range of individuals and organizations with an interest in the policy in question; attempt to anticipate what could go wrong, and who has an incentive to make it go wrong; and search for implementation

scenarios that will avoid the pitfalls that analysis reveals. The adoption of forward mapping as a standard operating procedure in policy development would probably serve as a useful counterweight to the sometimes unfounded optimism of the champions of new policy ideas!

One of the major challenges in policy formulation and implementation is the choice of policy instrument (or package of policy instruments) The generally recognized classes of policy instrument are voluntary mechanisms (perhaps coupled with education and persuasion), regulation, direct government action, and financial incentives. The latter class includes both "negative" incentives (e.g. taxes and charges) and "positive incentives" (e.g. subsidies, tax relief, and so on). (Institutional reform--which might involve changing jurisdictional arrangements, devolution of responsibility from government to non-government organizations, definition or re-definition of property rights--might be considered a fifth instrument, but is perhaps better thought of as the construction of the framework within which other instruments are used.)

Regulatory instruments remain the most familiar and widely used means of implementing resource and environmental policy, although they are frequently combined with various types of financial incentives (taxes or subsidies or both) and efforts to encourage voluntary compliance, such as public education and moral suasion. As Jacobs (1993) notes, regulatory approaches are often preferred because they provide for specific targets and standards (they are predictable), appear to apply equally to everyone (they appear to be equitable), have few or no direct costs for initial introduction (unlike grants or subsidies), and do not rely on the workings of an efficient market. Further, new approaches to regulatory measures, such as performance oriented

regulatory programs (PORPS), are emerging in response to concerns about the cost and other drawbacks of conventional prescriptive regulation (Martin, 1995).

In many cases, however, financial and fiscal instruments are intrinsically more efficient than regulation, interfere less with decisions of individual producers and consumers, and encourage more innovation.

Financial instruments, such as ecological tax reform, are likely to be more favourably considered in future for other reasons, as well. Indeed, they are likely to be key and controversial agenda items both within governments and in intergovernmental negotiations. As has been noted earlier in this paper, environmental resources are often overused and misallocated because they are unpriced or under-priced. As the owner of such resources, the public (through its governments) has the right - and indeed the obligation - to set prices or price-like signals to control the level of their consumption. Questions of regional and international competitiveness are, of course, major concerns, as are the distributional effects of raising prices on commodities such as fuel oil, gasoline and available space in landfills. Proponents of ecological tax reform point out, however, that even revenue neutral reforms (shifting the burden of taxation to natural resources and environmental services and away from labour and capital) would substantially improve markets and redress resource mis-allocation, and have no significant effect on the overall competitive position of the domestic economy.

A policy initiative is not complete until it has been translated from authoritative declaration into a continuing commitment to put its intent into effect 'on the ground'.

Analysts must therefore recognize that implementation entails assembling a vast number of autonomous individuals and agencies into a cooperative venture (Bardach, 1979). Within the government, a variety of agents and agencies must be persuaded to adjust procedures and commit resources, with possible impact on their own mandates and jurisdictions as they see them. At some stage, responsibility for action passes to external institutions, again raising many questions of territory, capacity and organizational innovation.

In the exploration of policy options, the analyst must anticipate and explore the roadblocks and 'turf wars' which might become crucial throughout this process of implementation, and indeed the prior process of bargaining and negotiation leading up to policy adoption and articulation of a mandate. This is part of an analytical role in an advisory process.

But in addition, given the need to mobilize the commitment of many independent agents within the bureaucracy, and many intermediary institutions and individuals outside, the analyst inevitably will be facede with need to assume a more active role in advocacy on behalf of policy ideas and initiatives. This task goes beyond advice, into a persuasive role as an actor in processes of 'partisan mutual adjustment' (Lindblom, 1960, Meltsner, 1976.) Efforts to ensure that good policy ideas are successfully carried into action may be guided by Commandments III.

### VII.B. An Entrepreneurial Hat for the Policy Analyst

While wearing the Entrepreneurial Hat, the analyst is concerned with adoption and implementation of policy within the dynamics of an untidy process. In this mode, he or she searches for a phrasing and timing of action that can exploit the windows

of opportunity within which problems, solutions and decision-makers can be effectively linked. The analyst also looks to distributional questions, including and especially the distribution of incentives among those agencies and individuals whose commitment is necessary to successful policy implementation, and is concerned with the strictures of Commandments III.

### VII.B. Commandments III: Effective Policy Advocacy

1. **Understand the objectives and criteria of the decision makers, and frame policy to reflect these.**
2. **Establish and attack only a limited number of priorities, consistent with the strategic agenda of the relevant decision-makers.**
3. **In particular, recognize that a policy initiative is complete only when commitment and compliance have been achieved on the part of all actors and agencies in the chain leading to action and behavioural change 'on the ground'.** Therefore consider ahead of time all the ways in which vetos and diversions may be mobilized not only in the bargaining up to adoption of policy, but in the assembly of all the components essential to implementation.
4. **Recognize the importance of stakeholder groups and interest groups.** Carry out the analytical work on distributional issues, and examine the consequences for "winners" and "losers". Look for ways in which winners might compensate losers.
5. **Recognize that windows of opportunity for policy initiatives are very short--and the window can bang closed abruptly. Therefore recognize the need to be action-oriented rather than analysis-oriented.** If a choice clearly understood appears too subtle or too close to be decided on current information, consider recommending a toss of a coin to enable action to be taken.
6. **Take a strategic approach focused initially on the central issues; return to pick up supporting pieces.**
7. **Remember that opportunistic planning and contingency planning are both essential.**
8. **Recognize that one exceptional consequence can discredit a good policy--plan for it.** Horizontal equity--interpersonal comparisons--and anecdotal evidence are the issues politicians will confront on the street, in accountability moments with

constitutents. Anonymous, statistical, aggregate arguments need to be supplemented with persuasive individual comparisons.

9. **Stress entrepreneurship.** An active and sustained personal agenda (within top-down instructions) may be essential if good ideas are to be fed back up through the policy process and "sold" well enough to mobilize the necessary commitment through the implementation process.
10. **Remember that communication is crucial - first, last and always.**

## VIII. Conclusions

In this report, we have suggested that the conventional idea of strategic plans, based on long-term outlooks and base cases against which long term commitments are made, is, paradoxically, limited in its application to *strategic* policy decisions, although a strategic planning process remains both relevant and useful for *tactical* decision-making and for the selection of least cost alternatives for achieving defined ends. Aspirations to strategic management are similarly limited, founded as they are on the notion that events and environments can be managed by people. What is advocated here is not strategic planning, nor strategic management, but strategic action and adapative management, that is to say, guided or purposive incremental action within a learning system.

In the particular context of environmental policy and resource use concerns, and in the still more particular setting of a Ministry of Environment, Lands and Parks in the Government of British Columbia, these general ideas suggest some particular consequences. In short, policy has to be directed toward maintaining momentum in a setting where the political agenda has attention focused on other priorities. To do so, on-going processes and operational decisions have to be consistently directed toward the agreed overarching purpose of a strategy of sustainability. This overall strategy has been embraced socially and politically in British Columbia; now the machinery has to deliver on that strategy

while the spotlight shifts elsewhere.

To do this requires specifically that the Ministry continue to play its role as the voice for long-term interests, the voice for the public as the owner of the resources of the global commons, and the voice for the health and integrity of eco-systems.

But in addition, the ongoing flow of decisions to be taken in maintaining momentum must be systematically linked to the overall sustainability agenda, and designed to move it forward while learning from the lessons experience generates. With fiscal and resource constraints paramount in the current setting, project and program decisions must demonstrably be taken with a keen eye to efficiency criteria and effective resource allocation. They must respect the dictates of due process, participatory involvement, and consultative process (including the commitments to consultation arising out of the fiduciary obligations of the Queen in right of B.C. as well as Canada). And, more than ever, that flow of decisions must be constructed with an eye to how each can be linked effectively to specific initiatives for which windows of opportunity will open from time to time. There is no question that prospects for dealing successfully with current priorities rest crucially on effective pursuit of the sustainability agenda. The task is to make that link persuasively, concretely and often.

In all this, no one recipe contains infallible instructions. What is called for is watchful, purposive, ethical opportunism: responsible entrepreneurship. It is entrepreneurial because commitment and action will come only when ideas are effectively sold. It must be responsible, because in the end, the policy analyst in the Ministry is the agent of voiceless interests - different, distant, or not yet born. And the ideas to be sold must be good ideas--just, fair and in the public interest.

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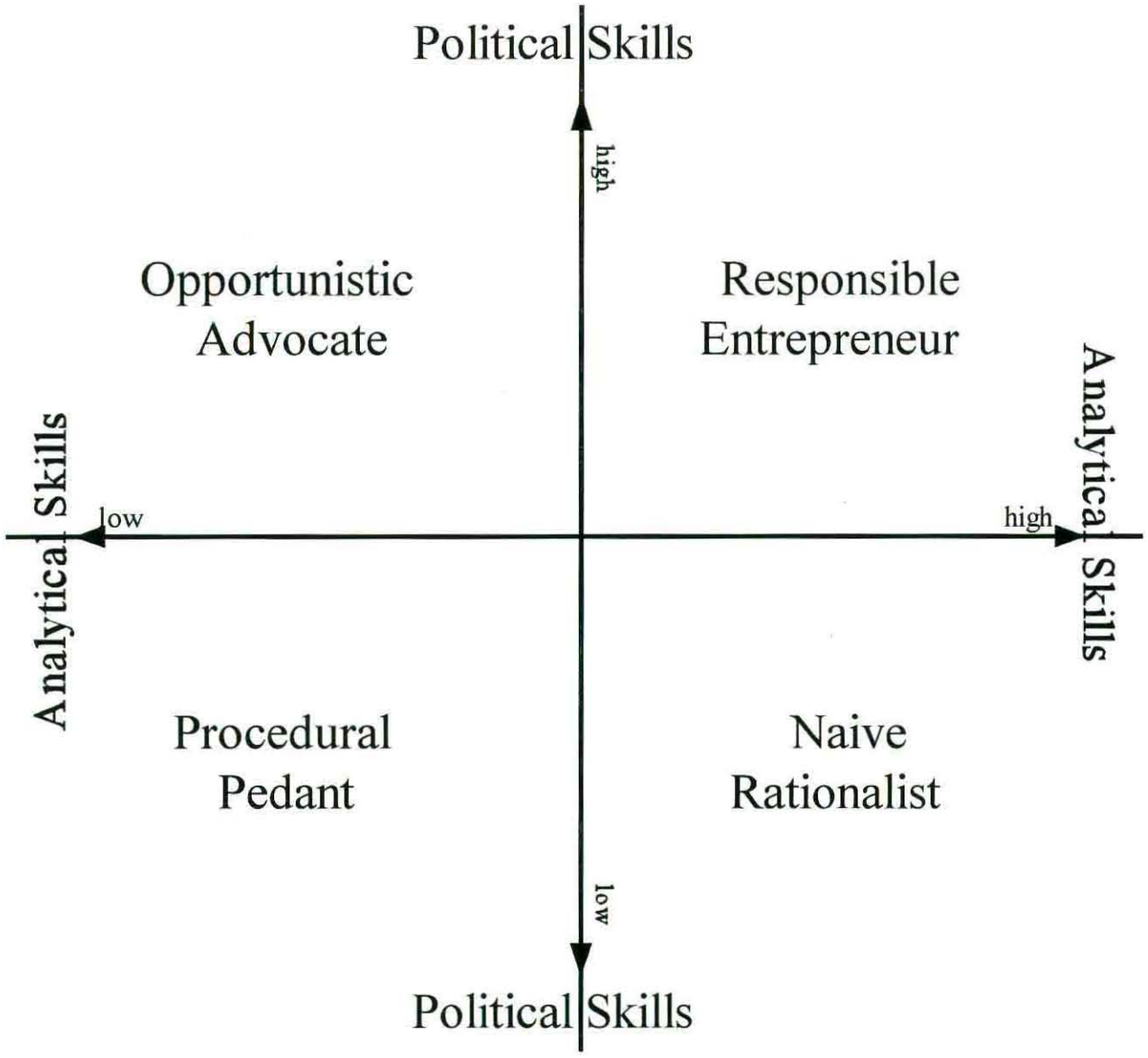
Appendix A

The Balancing Act:

Skill Sets and Organizational Roles

(adapted from Meltsner, 1976)



Appendix B

## APPROACHES IN APPLICATION

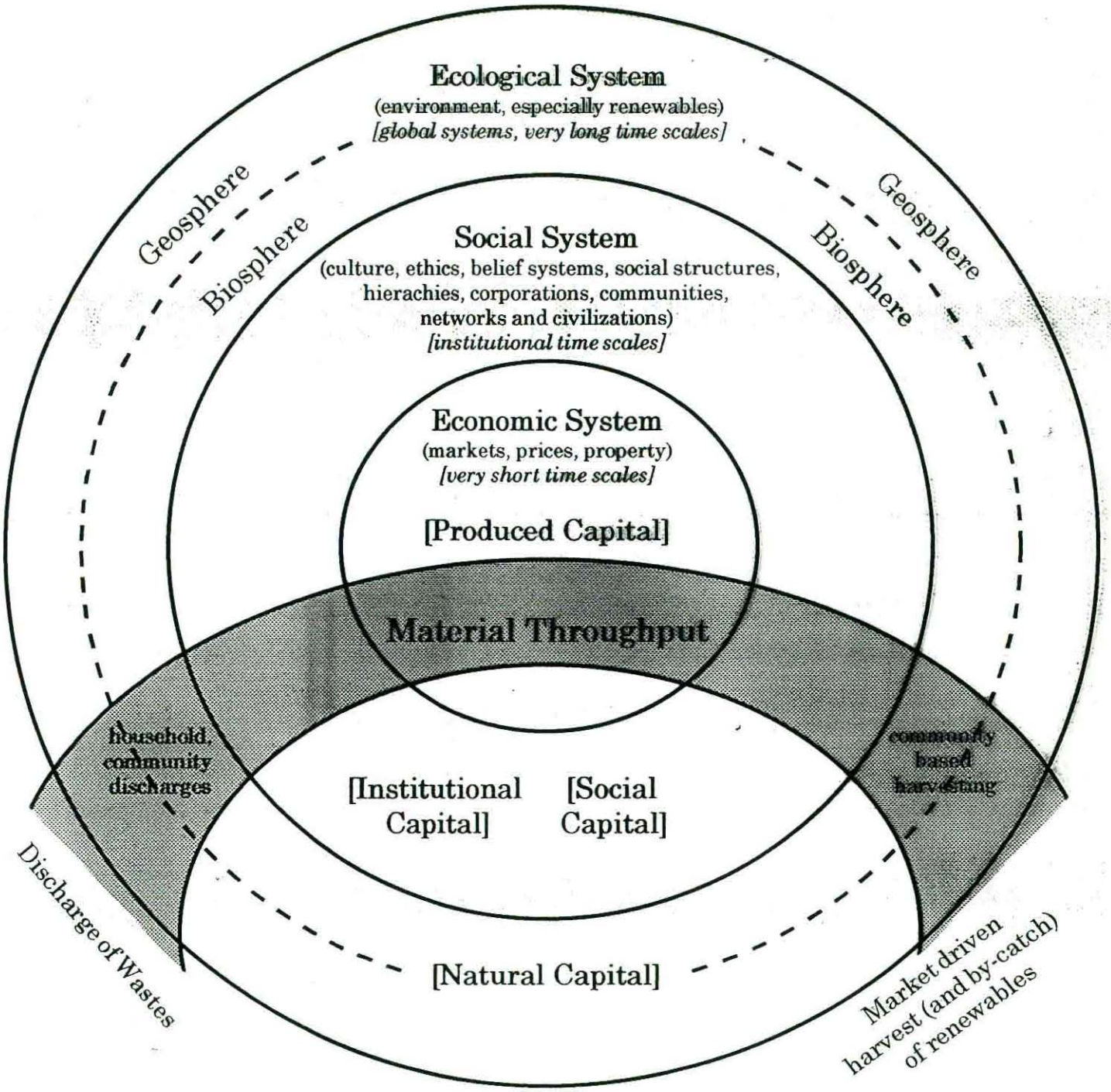
### INTRODUCTION

The first illustrative example given here is broadly concerned with ecosystem health, the integrity of ecological systems and the overall impact of a whole range of human activities on the functioning of ecosystem. The second is somewhat more narrowly concerned with concerns about extractive resource use (harvesting) as one aspect of concerns with "material throughput" (the other major aspect being discharge of wastes).

Both examples represent the application of broad principles of adaptive management, the "precautionary principle" and ecological economics, as well the literature on property rights/institutional analysis and resource economics (pricing and valuation)

The following diagram displays a general ecological frame for policy analysis and a schematic of material throughput issues as part of this overall frame.

# Policy Analysis - An Ecological Frame




Dobell/Longo - Revised June, 1996
(based on Dobell/Foucher - October, 1993)

## APPROACHES IN APPLICATION

### EXAMPLE ONE:

### SUSTAINABILITY AND THE MAINTENANCE OF NATURAL CAPITAL

**Problems**

The global scale of population and industrial activity has become such that the functioning of ecological systems now threatens to place critical constraints on the nature and extent of human activity. In these circumstances, continuing losses of unpriced "natural capital" and continuing damage to the integrity of ecosystem function have become of central concern in public decision-making. It is now widely accepted that there are ecological limits to industrial and household production and consumption. We appear to be in the process of exhausting stocks of "surplus" accumulated natural capital, including the capacity of the environment to assimilate wastes. It has been said that we must now begin living off only the "interest" from this endowment of natural capital and cease drawing down the stock itself. This is, in effect, the meaning of "sustainability".

The critical policy question is not therefore, "are there limits?", but rather "where are the limits" (i.e. what is the permissible overall scale of human activity?") and within this overall scale, "who should bear the costs of controlling human activity to remain within ecological limits?". Until recently, the rich natural endowments and small population of British Columbia, together with our ability to "import" (through trade) productive capacity from developing countries, have enabled decision-makers and their constituents to avoid direct confrontation with these issues. These questions have become more pressing, however, in the context of urban congestion, unacceptable levels of air and water pollution, the imminent "fall down" of timber harvest levels, and dramatic declines in fisheries resulting from over-harvesting, habitat loss and baffling changes in the oceans and the atmosphere, and the consequent losses of jobs and investment. Many of these problems cannot be addressed through economic analysis or interest-group bargaining only, but also require ethical judgments and political fortitude to confront problems fraught with uncertainty and conflict.

(Although this paper does not deal specifically with circumstances in developing countries, it is clear that growth strategies and other efforts to manage growth, including limiting migration from developing nations, pose profound questions about the ethical

claims of humans everywhere to "equal ecological space" and an appropriate share of the benefits of harvesting in the global commons. As favoured members of humanity, are we responsible only for sustainability of, and equitable access by, "us" to "our" resources?

## Approaches

Problems of sustainability include issues of scale, efficiency, and distributional equity. No single policy instrument can simultaneously achieve appropriate scale, increased efficiency and greater fairness. Nor is there a common metric for calculating trade-offs among these three objectives, despite much work on contingent valuation, multiple accounts and analysis and related descriptive displays. It may be more helpful, rather, to view ecological limits and social objectives (including equity) as constraints on the achievement of efficiency objectives, as is suggested by the diagram displayed in the introduction to these policy examples.

In practice, improved efficiency (especially in the long term) and reductions in material throughput ("dematerialization") are often promoted by the same instrument. On their own, however, these same instruments rarely achieve socially desirable distributions of costs and benefits. Participatory decision-making, programs of mitigation and compensation, and initiatives such as revenue "earmarking" will almost certainly be required to gain public support for the often unwelcome consequences of changing our ways to live within our means.

Four sets of policy initiatives are suggested by these considerations.

### 2. Changing the Signals

a) One of the reasons why natural resources and environmental capacity are misused and wasted is that they are not "counted" in current systems of national accounts. The GDP, for example, is the single most widely used indicator of changes in economic well-being. Yet it does not account for losses of natural capital, such as trees cut down for timber or fish lost when rivers are dammed for hydroelectricity. Nor do conventional national accounts distinguish between productive and defensive expenditures. As a result, increases in the GDP may disguise losses of natural capital as well as declines in subjective well-being. At the level of the individual firm or corporation "green accounting" provides a counterpart to "Green GDP" and attempts to develop better indicators of social well-being. Key to such better signals at any level of aggregation, however, is the extension and correction of

prices to reflect the value and scarcity of natural capital.

## 3. Changing the Incentives

### i) Fiscal or Market Instruments

a) While it is difficult to calculate the "right" price for, e.g. emission of airborne pollutants, traffic congestion, the loss of agricultural land or forest lands to housing development, any price greater than current prices will tend to reduce the incidence of activities which erode natural capital and reduce sustainability.

b) Many of the better known economic or so-called market-based instruments are concerned with pollution prevention and abatement. There is a large range of potential instruments, however, including increased resource royalties, carbon taxes, and various deposits and user charges.

c) It is probable that the impacts of many taxes and charges will not be known until the price increases are actually put into effect. From the perspective of "adaptive management", the prices of various undesirable activities could be raised on an experimental basis with clear stipulations as to 1) how the revenues will be used; 2) what the implications will be of various responses to the charge and 3) if the costs of the charge are unfairly distributed, how those adversely affected will be treated. Such "policy experiments" need not be large or disruptive, but their intent must be clearly understood and their effects must be clearly evaluated. Given current levels of public resistance to tax increases and expressed political commitments to tax freezes. The involvement of non-governmental organizations in the development and collection of such charges (such as charges to pay for disposal of hazardous wastes) may be important in promoting public acceptance of "green charges". The removal of subsidies and other support for e.g. clearing land or for transportation systems that encourage "urban sprawl" are equally important in correcting the current imbalance of economic incentives.

d) The flip side of increasing the price of "non-sustainability" is, of course, to reduce the price of "sustainability". The use of revenues raised by carbon taxes to subsidize public transit or build bicycle lanes, payments to farmers to protect wildlife habitat on their lands, incentives for development and production of technologies for solar, wind or tidal power generation: all contribute to the use of environmentally friendly alternatives to current production and consumption activities. Sandborn (1996) describes a wide range of legislative, regulatory, policy and expenditure initiatives that would alter

current incentives for the preservation of natural capital and "harness" the interest of individuals and non-governmental organizations in conservation of natural areas, including the development of community land trusts, and tax relief for key conservation lands.

**ii) Rights-based instruments**

**e)** All of the above approaches are in the category of fiscal measures and pricing instruments, which must be applied within a given framework of property rights. Changes in the definition and allocation of property rights are also required to deal with problems of undervaluation of natural capital and waste and misuse which frequently follows from situations characterized by open access or an "unmanaged commons". Definition and allocation of property rights can achieve not only efficiency and sustainability objectives, but also result in more equitable distribution of benefits and costs. If a community has property rights in a tract of ecologically sensitive coastline, for example, it may choose to protect rather than develop such an area because protection better represents community valuation of aesthetics and amenities, but also because the community can realize economic benefits from, e.g. tourism or other low impact activities. In this case, the community realizes benefits from protection (economic and non-economic) rather than just non-economic benefits offset by (possibly substantial) economic costs, such as job loss or foregone investment.

4. **Guarding Against Mistakes**

**a)** While much can be done to change the incentives of individuals, communities and corporation relative to the use of natural capital, system uncertainty and human fallibility require that we guard against exposing all of the "portfolio" of natural capital to possible mistakes in management. In the face of complex uncertain systems, policy makers ought to adopt an overall posture of diversification, with representative natural areas (reserves) playing the role of a basic "risk free" asset. Much progress has been made on the protection of upland areas in British Columbia, but continued effort is needed to embrace integrated coastal management and marine resources.

b) Risk reduction can also be achieved by a focus on protection of physical assets rather than on derived economic values. As we cannot currently "price" many of the values represented by endowments of natural capital, e.g. genetic diversity and aesthetic values, it may be necessary to implement policies requiring "no net loss" of specified ecosystems, through, for example, "shadow projects" that replace areas to be damaged by development or through prohibition of any further development of

certain areas unless it can be demonstrated that no environmental damage will occur.

c) Economic diversification may also serve to protect natural capital, as communities that rely on diverse elements of an ecosystem may prove to be more stable and more sensitive to ecosystem damage than communities that specialize in industrial monocultures that exploit only one element of the ecosystem.

## 5. Making the Transition

To the extent that current levels of investment, employment and prosperity in British Columbia have resulted from drawing down accumulated capital stocks and/or importing productive capacity from other parts of the world, a strategy which relies on "living off interest" rather than capital must, by definition, produce smaller flows of benefits than we have been accustomed to receiving. This does not mean than ***subjective well-being*** must be compromised in the long run. It does mean there will be difficult adjustments to make and that policy makers must ensure that the costs of these adjustments are distributed fairly. Transitional strategies are discussed in greater detail in the "fisheries" example which follows, but will be required in all cases where the transition to sustainability involves higher prices, reduced production or consumption, loss of accustomed convenience or amenities, and, in general, more thoughtful and careful relationships with the non-human world. In short, there will be few cases in which transitional strategies will not be essential to the successful implementation of progress toward sustainability and the protection of natural capital.

## Example 2: Adaptive Management and Sustainable Fisheries

### Introduction

Long-standing problems in British Columbia fisheries have been brought into renewed public prominence in 1996 by the introduction of the so-called "Mifflin Plan" for the reduction of the Pacific salmon fleet. The British Columbia government has played an unprecedented role in the debate about the Mifflin Plan and about fisheries issues more generally. Under the rubric of "Fisheries Renewal B.C.", the provincial government has proposed a greater role for itself in fisheries management, including but not limited to protection of fish habitat and protection of the economic interests of fishery-dependent communities.

The purpose of this brief example is

a) to outline the "fisheries problem" in broad terms

b) to identify underlying forces and conditions that typify policy problems in this and other resource sectors, and

c) to suggest some approaches whereby policy-makers might correct, and prevent the recurrence of, serious difficulties which plague fisheries in British Columbia.

### The Problems

Fisheries typically suffer from three kinds of problems, all of which represent current concerns in British Columbia:

1. **Biological** - resource use is not sustainable.

Sustainability requires both better stewardship (the tendency for resource users to maintain productivity and ecological

characteristics of the resource) and more resilient systems (the ability of the system to absorb and deal with changes and shocks).

The B.C. salmon fishery, for example, is not only over-exploited, but the resource system itself is highly vulnerable to both natural and man-made events, such as increased levels of predation by mackerel or seals, habitat alteration, or "mistakes" in stock assessment, made more damaging precisely because over-exploitation of an uncertain system leads to operating 'too close to the line', with inadequate margins for error.

2. **Economic** - resource use is inefficient; harvest costs or management costs or both are excessive. Many fisheries represent a net loss to harvester nations and are maintained only through continuing subsidies, explicit and hidden.

Most, if not all, B.C. fisheries are over-capitalized. Costs, including management costs and Unemployment Insurance transfers, likely equal or substantially exceed the economic returns from many fisheries,particularly the salmon fishery (Walters, 1995).

3. **Social** - distribution of benefits and costs associated with the resource is inequitable. Fishery dependent communities are deprived of basic resources by industrial interception fisheries; government subsidies and management costs result in taxpayers, rather than fishers, paying the costs of mis-use of resources.

Technological developments, industrial concentration, urbanization and other global changes have eliminated many of the "natural" incentives for fisheries to be conducted by small, fishery dependent communities.

Political and social considerations, rather than economic factors, are mainly responsible for the survival of "small boat"fisheries in British Columbia. One of the major objections to the "Mifflin Plan" is that economic rationalization will tip the scales yet more heavily against small boat owner-operators in coastal communities by facilitating the concentration of licenses in corporate hands.

These problems are, of course, heavily interwined. Over-

capitalization, for example, provides strong incentives for biological overfishing and such practices as dumping and mis-reporting of bycatch, highgrading and other profit maximizing strategies. Efforts to maintain equity, e.g. to ensure that groups that have historically been active in fishing are able to continue to participate, may maintain overcapacity and a fishery which is both inefficient and costly to manage. The decline of small fishery-dependent communities may reduce incentives for long-term stewardship of the fishery resource.

Underlying these problems are two sets of conditions which are becoming increasingly apparent in a wide variety of resource and environmental policy settings:

1. **Irreducible uncertainty of the resource to be harvested**

Natural variability and complexity of natural systems are much greater than previously thought. Management systems which rely on the calculation of equilibria such as maximum sustained yield, or that focus on single species rather than complex interrelationships in ecosystems, founder on misapprehension of the nature of the resource itself.

2. **Failures in the institutions that regulate human activities which threaten the resource.**

These failures are pervasive and circular. Markets fail to provide the correct incentives for proper resource use, prices frequently being lacking or inappropriate, and property rights absent or ill-defined; governments fail to provide the institutional framework within which markets could provide better incentives; social, economic and political inequities result in insufficient incentives for governments to change the institutional framework; continuing market failures perpetuate existing econmic, social and political inequities and continuing non-sustainable resource use.

**Approaches**

Resolution of these problems requires recognition of both profound system complexity and extensive institutional failure.

The "problem" is not simply that one level of government or one or more group of resource users is incompetent, insensitive or greedy. The **underlying nature of the resource system and the current institutional framework and incentive systems** are such that **any** regulatory agency and **any** group of users can be expected to behave in ways which have produced the current problems.

Thus, unless these fundamental questions are acknowledged and addressed in policy approaches, the same problems can be expected to persist. Only the names will change.

It must also be recognized that policy responses must deal with all three aspects of fisheries problems - biological, economic and social- and that a package of instruments will likely be necessary to achieve thse multiple goals.

Such a "package" might include the following three groups of policy responses:

1. **Institutional Reform**

Changes in the 'rules' that would remove distortions in the system of incentives that currently result in inefficient, wasteful use of fisheries resources by harvesters and others.

Changes in the decision-making arrangements that govern fisheries management.

2. **Applying the "Precautionary Principle" and practicing adaptive management**

Provision for continued and expected failures in institutional arrangements, i.e. a series of "backstops" that recognize the complexity and variability of resource systems and the limitations of human ability to manage themselves in relationship to such systems.

3. **Transitional Arrangements**

Arrangements that facilitate the continuing readjustment of

economic activity necessary in a changing world, while promoting where possible the cultural survival and continuity of lifestyle sought by many communities.

**Examples**

In the British Columbia context, examples of the above approaches might include the following:

1. **Institutional Reform**

a) **Changing Incentives**

**i) The Importance of Allocation**

Most British Columbia fisheries are characterized by what is often described as the "tragedy of the commons". Because no one "owns" the fishery resource, that is, no one has a guaranteed entitlement to some stream of benefits from harvesting of the fishery resource, no-one has a strong incentive to husband the resource in such a way that long-term benefits are maintained. If a fisher takes fewer fish than he or she is able to - in the interests of conservation and/or or maximizing economic return- there is no guaranteethat the same fisher will be able to harvest those fish tomorrow or next year. If one fisher does not take the fish, another will. The "tragedy of the commons" is exacerbated when there is acute competition for the available resource, especially competition among mutually antagonistic groups which can escalate into extremely destructive "fish wars".

**It is unlikely that any significant progress can be made in resolving fisheries issues in British Columbia untilthe question of allocation is resolved** in such a way that competition for the resource is reduced and property rights are defined which give resource users a secure, long-term interest in maintaining the viability of the fisheries upon which they depend.

These property rights may take various forms depending on the nature of the resource, the community of users, historical patterns

in the fishery, and concerns about social equity and economic efficiency. In some cases, individual quotas will be most appropriate; in others case, communities may acquire territorial use rights of volume quotas. In yet other cases, it may be concluded that some fisheries cannot be adequately managed as capture fisheries, and that the wild fishery should be closed in some areas, or to some types of use. Aquaculture may be a preferred method of producing some species, particularly where allocation of property rights to a particular resource and its habitat encourages owners to defend their interests against other, degradative uses or damage by other activities.

The potential importance of arrangements under which collectivities--cooperatives or communities--exercise use or access rights and carry management responsibilities, and especially their possible advantages in terms of monitoring and accountability should be emphasized. (Pinkerton and Weinstein, 1995)

Where transferable quotas or other rights are allocated, consideration should be given to restricting transferability in order to reduce speculation, investment mobility, and inappropriate concentration of fishing opportunities.

The question of allocation of rights in fisheries other than the salmon fishery should be addressed immediately. If steps are taken now, it may be possible to avoid the extreme conflict which has arisen around the pacific salmon fleet. Lessons from the introduction of transferable quotas in the Pacific halibut fishery may have application more widely.

### ii) Getting the prices--or at least price-like signals--right

It is widely acknowledged that investment and employment decisions in the fisheries are often highly distorted. In theory, such decisions are guided by prices which signal the value of resources consumed and demands satisfied, and in particular provide guidance on the tradeoff between fish harvested now and fish left as a resource to increase and be harvested later. Evidently there are a lot of missing prices in the markets which relate to fisheries, key among them being the asset price of fish as natural capital in an ecological system as contrasted with the market price of fish as a highly perishable consumption good in current transactions.

Without such asset prices attached to fisheries as stocks of natural capital, both employment decisions currently, and investment decisions intertemporally, are biased toward dramatic overemployment and overcapacity, leading to excessive fishing effort and either outright economic loss (in the case of effective regulation) or overexhaustion of the fishery (in the case of ineffective regulation) or probably both.

While it is unlikely that any institutional change other than the creation of outright ownership provisions (which are unlikely to be feasible) will generate market observations on these missing prices, some relevant information will be obtained from trade in transferable quotas, as discussed below.

Further, particularly with investment decisions related to the choice of technology, or decisions on investments in new or more capital intensive technology, the absence of appropriate prices to signal the costs of by-catch, degradation of spawning grounds or other habitat, or other spillovers and unpriced adverse consequences will lead to distored decisions as to what is economically 'efficient'. Technologies which at first glance, on the basis of observed market prices, appear to be essential to maintaining competitive position in an industrial fishery may turn out, on closer examination and with effective pricing of their adverse consequences, to be thoroughly uneconomic and inefficient on conventional economic terms, without consideration of extraneous social or environmental goals.

Direct regulation to control by-catch and adverse impacts on habitat offers one approach to compensate for missing or distorted prices. In some cases, contingent valuation methods may offer another approach to forcing employment and investment decisions to recognize consequences which are otherwise ignored in transactions involving fisheries resources.

### iii) Increasing Accountability

In order to increase enforceability and compliance, consideration should be given to measures which increase the incentives for harvesters to monitor each other, and to be accountable for their joint responsibility for the fishery resource. Some of these incentives may be "built into" the allocation process through means such as communal or group licensing. License sanctions and other non-judicial penalties

would also facilitate prompt and predictable punishment of fisheries violations. As noted below, part of "self government" by resource users should include the capacity to discipline members of the user group.

### b) Changing Management Arrangements

Most actors in the current debate about fisheries reform British Columbia stress the need for stakeholders - the federal government, the province, fishers, aboriginal communities, environmental groups - to "work together" to solve problems. Presumably this "working together" would constitute or lead to a new set of management arrangements whereby the federal government's traditional pre-eminence would give way to more decision-making authority on the part of other interested groups. In developing effective management arrangements, including co-operative community-government management regimes, careful attention needs to be given to such issues as:

. each party's constituency and the nature of its interests;

. representativeness of the party and its accountability for its actions both to its constituency and to other parties, including the wider public interest;

. management capacity (legal, financial, and otherwise) of each party;

. the degree to which senior levels of government support and legitimize greater autonomy on the part of user groups, local governments or other community decision-making groups;

. the degree to which the new management regime is suited to the nature and extent of the resource and of the ecosystem of which the resource is part.

Given the diversity of British Columbia fisheries, it is unlikely that a single management model will be appropriate in all cases. The provincial government should encourage experimentation with diverse management regime, and ensure that such experiments are explicitly monitored and evaluated on the basis of clearly established criteria, and that the results of such evaluation are widely disseminated.

Management regimes that include a broader range of participants and rely on wider sources of input and knowledge will require changing roles for analysts and field level personnel. There should be an emphasis on training and orientation that integrates "science" and traditional ecological knowledge with an understanding of human institutions and institutional change. Fishers and other community participants will also need orientation and support in exercising new governance responsibilities.

## 2. Applying the Precautionary Principle

Regardless of how successful, institutional reform, including the implementation of better systems of property rights and incentives, cannot foresee nor prevent every instance of natural variability or human frailty. In accordance with the precautionary principle, fisheries policy requires a strong framework of "backstop" provisions that contribute to resilient systems and minimize the risk of serious and possibly irreversible damage to ecosystems and their constituence resources. Currently, fisheries policy in British Columbia (as elsewhere) relies too heavily on the ability of fisheries managers and scientists to predict and control the behaviour of both human and non-human species and provides too few "reserves" to cushion the shock of mistakes and unforeseen events. The need for precautionary backstops requires a strong ongoing role for governments in establishing a regulatory environment that recognizes uncertainty and the likelihood of management failure.

For example,

- harvest levels should be oriented more towards 'worse case' or low cycle levels, than towards maximum or "optimum" yields
- marine reserves and other protected areas should be established to shelter part of the fisheries "portfolio" from management errors and unexpected changes in natural systems
- restrictions should be placed on gear types or other technologies that result in high levels of bycatch or that are so 'efficient' that only very sophisticated and constantly monitored management systems can prevent them from damaging the resource
- the burden of proof in development decisions should be shifted such that potential investors proposing intervention in natural systems must provide persuasive evidence

that economic activity **will not** cause unacceptable harm to fisheries stock and their habitats, rather than requiring opponents to demonstrate that harm **will** occur.

. "shadow project", "no net loss", contributions to "mitigation banks" or similar offset provisions should be required to deter further losses of natural capital.

## 3. Making the Transition

One of the most widely voiced objections to the "Mifflin Plan" is that it has not considered the impact of fleet reduction on coastal communities and so-called "small license holders", primarily owner-operators of smaller (more labour-intensive and selective) gill net and troll vessels. On various occasions, the Premier and the Povincial fisheries minister have advanced some suggestions for dealing with the impact of this transition, including the allocation of new opportunities in commercial sports fishing to local communities, the use of Watershed Restoration funds to train and employ displaced fishers and shoreworkers, and the maintenance and expansion of hatcheries and other enhancement activity. Research is also being carried out on the employment and other impacts of current and proposed salmon fleet reductions.

Given the acknowledged overcapacity in the salmon and other fisheries, any plan to restructure fisheries from both sustainability and efficiency standpoints will cause individual and community hardship to a greater or lesser degree. In such cases, measures will be required to address such hardship in ways that do not themselves result in "unsustainable" local economies, i.e. local communities that continue to rely on short term jobs, based on resource extraction and heavily supplemented by unemployment benefits and other government transfers. To the extent that high income levels in some coastal communities have been made possible only by the systematic depletion of the "natural capital" of forests or fisheries, the continuation of these artificially high income levels will not likely be possible if now only the "interest" on this capital is to be used. Different uses of this capital (e.g. tourism), additional investment in capital formation (e.g. stock enhancement and repair of damaged habitats) and more efficient resource use (e.g. more value added processing) are all possible and should be pursued. At some point it must be acknowledged, however, that fundamental changes in our relationship with fisheries resources must occur. The impacts of these changes

can be mitigated, but, like the "falldown" in the forest industry, they cannot be avoided for long.

In the end, resolution of the policy problems and social problems posed by the 'jobs, fish, financing' nexus will come only when it is widely recognized that for many communities cultural and social survival rests directly on maintenance of vigorous and economically viable fishing activity, and that in turn rests crucially on conservation and sustainability of the complex natural systems which make up the fishery. More modest demands on the resource in the short-run ultimately will prove the only key to maintenance of the base of natural capital essential to a fishing industry viable in the long run.

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