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Our File No. 16339-24

Your File No.

January 11, 2011

Cohen Commission
Suite 2800, PO Box 11530
650 West Georgia Street
Vancouver, BC V6B 4N7

Dear Commissioner:

Re: Submission to the Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River

I make this submission in a personal capacity and not on behalf of any client or our law firm.

The submission focuses on the respective roles of values-based and science-based information in the management of a natural resource such as the Fraser River sockeye stocks. It does so by examining the setting of conservation benchmarks under Canada's Wild Salmon Policy. These benchmarks are intended to inform managers when a particular salmon stock is approaching extirpation or when it may be fished at a sustainable level.

As such, the submission contributes to clause a.i.B of your terms of reference and, in particular, offers a principled way of deciding among the government's fisheries policies, its scientific advice and its risk management strategies. It is intended to add to the evidence you have recently heard on the implementation of the Wild Salmon Policy.

Yours truly,
BURI, OVERSTALL

Per: Richard J. Overstall

Richard J. Overstall

enclosure

THE "BALANCING" PROBLEM

Bringing Principle and Transparency to the setting of Wild Salmon Policy Benchmarks

A Submission to the Cohen Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River

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This submission analyses the role of risk tolerance in the setting of benchmarks used to assess salmon stock status under Canada's Wild Salmon Policy. Benchmarks are quantifiable indicators that separate salmon stocks that are healthy from those that are in danger of extirpation. The submission takes as its context a review of the literature on the global decline of marine fish stocks, which concludes that the majority are overexploited because short-term political interests nearly always trump sound scientific advice.

The submission recommends changes to the draft WSP salmon stock status indicator and benchmark setting procedures that allow decisions about levels of risk to be made in as principled way as possible and, in particular, to be insulated from stakeholder power politics.

Two main recommendations emerge:

- "society's chosen level of risk" should be a general principle that is inserted as an agreed formula early in the benchmark-setting process; and

- benchmark criteria for salmon should not be imported from other government processes without a critical assessment of their reliance on others' value judgments.

1. Global Fishery Collapse

Throughout the era of state management, global fish stocks and their ecosystems have been "balanced" to the point of collapse.[1] One group of marine ecologists extrapolated the historical trend to predict that by 2048 no more fish would be caught in the ocean.[2] The balance in question has been between scientists' best assessment of a stock's health and fishery managers' best assessment of the catch level or the ecosystem degradation that the politics will bear:[3]

> In many cases, scientists are warning that populations are being overexploited. But all too often, their advice of setting lower catch quotas, reducing the size of fishing fleets and using less harmful fishing gear is ignored or watered down. When push comes to shove, it seems short-term economic interests steamroller scientific arguments.

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[1] Pauly, D. *et al*, "Fishing Down Marine Food Webs" (1998) 279 Science 860; Pauly, D. *et al*, "Towards sustainability in world fisheries" (2002) 418 Nature 689; Worm, B. *et al*, "Impacts of Biodiversity Loss on Ocean Ecosystem Services" (2006) 314 Science 787; Pitcher, T. *et al* "Not honouring the Code" (2009) 457 Nature 658; Worm, B., Hilborn, R. *et al*, "Rebuilding Global Fisheries" (2009) 325 Science 578.

[2] Worm *et al* (2006) *ibid* at 790.

[3] Schiermeier, Q. "How many more fish in the sea?" (2002) 419 Nature 662; see also Schrope, M. "What's the Catch" (2010) 465 Nature 540.

A more recent paper, which joined the previously diverging perspectives of marine ecologists and fisheries scientists, states:[4]

> Although management authorities have since [the 19th century] set goals for sustainable use, progress toward overfishing has been hindered by an unwillingness or inability to bear the short-term social and economic costs of reducing fishing.

The authors identify the ultimate drivers of rebuilding fish stocks as good local governance, enforcement and compliance,[5] but say it is evident that government subsidies, illegal fishing and fears of job losses, seriously undermine rebuilding efforts.[6]

In Canada, the long-term, perhaps permanent, depression of the east coast cod stocks and change to their ecosystem is the flag-bearer of this phenomenon,[7] while the federal government's 2010 decision not to back an international trade moratorium on the highly-threatened Atlantic bluefin tuna is but one of its more recent examples.[8] It is another instance of what the European Union's commissioner for agriculture and fisheries in 2002 called the "annual political horse-trading" over catch quotas.[9]

The literature is clear that although there may have been errors in the advice given by scientists,[10] the main factor leading to the demise of marine fish stocks worldwide has been the inability of governments to withstand the immediate political pressures from the fishing industry.

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[4] Worm, Hilborn *et al supra* note 1 at 578.
[5] *Ibid* at 583.
[6] *Ibid* at 584.
[7] Hutchings, J.A. "Spatial and temporal variation in the density of northern cod and a review of hypotheses for the stock's collapse" (1996) 53 Can. J. Fish. Aquat. Sci. 943; Frank, K.T. *et al* "Trophic Cascades in a Formerly Cod-Dominated Ecosystem" (2005) 308 Science 1621.
[8] Although the Atlantic bluefin tuna spawning biomass has declined by 85 percent since the mid-1970s, the UN's Convention on International Trade in Endangered Species (CITES) voted down a March, 2010, proposal to ban its trade. Canada lobbied to defeat the proposal despite advice from several science panels, including CITES's own, that the ban was warranted ("Trade Trumps Science for Marine Species at International Meeting" (2010) 328 Science 26). Federal fisheries minister Gail Shea applauded the ban's defeat, saying that Canada would rely on the International Commission for the Conservation of Atlantic Tunas (ICCAT), a tuna fishery management body that has consistently ignored the advice of its own scientists in setting unsustainable annual fishing quotas that led to the collapse (CBC News, March 19, 2010; Mackenzie, B.R. *et al*, "Impending collapse of bluefin tuna in the northeast Atlantic and Mediterranean" (2009) 2 Conservation Letters 25). Minister Shea is the Member of Parliament for a riding in Prince Edward Island where all of Canada's 300 or so bluefin tuna fishers live.
[9] Schiermeier, *supra* note 3 at 664.
[10] For example, in the east coast cod collapse, scientists were deceived by the relatively large catches from offshore and downplayed the declining stocks on the banks, particularly of breeding adults (Schiermeier, *supra* note 3 at 663).

On the west coast, the Commission's inquiry into the failure of the Fraser sockeye runs and two successive years of low sockeye returns on the Skeena indicate that the trend may continue here. For these and other Canadian Pacific salmon fisheries, the Department of Fisheries and Oceans' Wild Salmon Policy (WSP)[11] has been seen as a signal that a more conservation-targeted, transparent, and science-based management regime may be possible. In this submission, I look at the WSP and the proposed process for setting salmon fishery and conservation benchmarks in the light of the global problem of fishery managers overriding and compromising scientists' best estimates of catch limits required to sustain fisheries and maintain aquatic ecosystems.

2. The Wild Salmon Policy

The WSP cites a large number of reasons for why west coast salmon management has become "progressively more challenging" during the past decade. The stated factors range from court decisions to ocean productivity and from global market shifts to altered public expectations.[12]

The WSP document does not mention as a challenge the vulnerability of management for long-term sustainability being overridden by short-term political pressures. In fact, the policy explicitly allows for such balancing to continue:[13]

> While everyone supports conservation, many people depend on salmon for their social and economic needs and insist on a balanced policy that provides for sustainable use of wild salmon... Since harvest restrictions necessary to conserve the wild salmon resource affect communities and individuals, cultural, social and economic impacts need to be considered.

The policy is also explicit as to where the balancing will take place in the WSP planning process:[14]

> [I]n exceptional circumstances, where recommended management actions are assessed to be ineffective, or the social and economic costs will be extreme, the Minister of Fisheries and Oceans may decide to limit the extent of active measures undertaken.

The policy does not say what criteria the minister will use in such "exceptional circumstances" to decide when recommended actions are

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[11] Fisheries and Oceans Canada, 2005, Canada's Policy for the Conservation of Wild Pacific Salmon.
[12] *Ibid* at 1.
[13] *Ibid* at 14.
[14] *Ibid* at 29. See also *ibid* at 47.

ineffective or when costs are extreme. Nevertheless, the development of strategic plans for WSP conservation units (CUs)[15] is said to follow a formal and open five-step procedure that will result in informed decision-making.[16] The details of deciding on stock status indicators and benchmarks for this procedure are now in draft form (the "CU Benchmark Paper"),[17] which is reviewed in the next section from the perspective of how scientific and political decision-making interact.

3. WSP Sustainability Indicators

The WSP requires that the biological health be assessed for each geographically, ecologically and genetically distinct wild salmon population or CU. A large part of this assessment is to identify biological status indicators, such as spawning abundance and distribution, that can be quantifiably measured. Then, two critical benchmarks are set along each indicator's range. The higher benchmark will indicate a level above which is the desirable state for a population, such as its maximum sustained yield. The lower benchmark will indicate a level below which is an undesirable state, such as approaching extirpation. Populations above the higher benchmark are said to be in the Green Zone, those between the benchmarks in the Amber Zone, and those below the lower benchmark in the Red Zone.[18]

As DFO's decision-making framework paper puts it, reference points and stock status should be determined by science, while fisheries management "in collaboration with fisheries interests" should develop the harvest rate strategy.[19] This will presumably be the balancing process mentioned in the WSP. In practice, however, values and science are intertwined in all steps of the process. The current version of DFO's CU Benchmark Paper makes a good start in separating value judgments from science determinations, but is deficient in two main areas:

- the appropriate type of value judgment at each step and who should make them;
- the incomplete teasing apart of value judgments from science determinations.

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[15] The WSP defines a Conservation Unit (CU) as: A group of wild salmon sufficiently isolated from other groups that, if extirpated, is very unlikely to recolonize naturally within acceptable timeframes (*Ibid* at 38).

[16] *Ibid* at 29 and Appendix 2.

[17] Holt, C.A. *et al, Indicators of Status and Benchmarks for Conservation Units in Canada's Wild Salmon Policy* (2009) Canadian Science Advisory Secretariat Research Document 2009/058.

[18] *Supra* note 11 at 16 to 17.

[19] Fisheries and Oceans Canada, *A fishery decision-making framework incorporating the Precautionary Approach* (March, 2009) at page 4.

3.1 Appropriate Types of Value Judgments

The scheme of determining salmon CU indicators and benchmarks is shown in Table 1 of the CU Benchmark Paper.[20] The table summarises nine steps for determining what is called the 'precautionary lower benchmark" in the state of a fishery, for example, low numbers of spawning adults, that ideally should trigger a management response to recover the stock to healthy levels. This lower benchmark is defined as the level high enough to ensure there is a substantial buffer between it and any level that could lead to a CU being considered at risk of extinction.[21] Table 1 is reproduced below.

Table 1. The steps for determining a precautionary lower benchmark in an idealized assessment framework for an example reference frame (biological yield) and goal (maintenance of maximum yield). Other reference frames and goals are also possible. The providers are either Fisheries Management, FM, or Science.

Step	Provider	Input	Example output
1. reference frame	FM (WSP)	Policy specification	Specified as biological production (i.e., yield)
2. goal	FM (WSP)	Policy specification	Maintenance of maximum yield adjusted for current environmental conditions
3. time frame to achieve goal	FM	Unspecified	Number of years
4. fishery management actions	FM	Unspecified	Actions such as 10% total exploitation rate
5. model relating current state to a future state	Science	Production model	Ricker stock-recruitment model
6. deterministic upper benchmark	Science	WSP specification	Example, *MSY*
7. deterministic lower benchmark	Science	Outputs of steps 2, 3, 4, & 6	Lower benchmark
8. incorporate uncertainty into lower benchmark	Science	Quantification of known uncertainties including model choice, parameter estimation, current state, future state of modifiers (environment), and outcome/implementation uncertainty	Function relating possible values of the lower benchmark to the probability of achieving the goal within the time allowed
9. choice of risk tolerance	FM	Output of step 8	Selected lower benchmark

Note that for each of the nine steps, the second column of the table indicates which of two entities, "Science" or "Fisheries Management," will provide the decision for that step. It would appear that the science determinations are sandwiched between two slices of value judgements. The first slice is incompletely described in the document. While the

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[20] *Supra* note 17 at 5.
[21] *Ibid* at 7.

concept of a reference frame is explained,[22] and the concept of a time frame to achieve a goal is obvious, if unexplained, the kind of value judgments incorporated into "fishery management actions" is neither explained nor readily apparent.

But it is the second slice, the "choice of risk tolerance" that is the most problematic. The document states that "decisions about risk tolerance are largely political"[23] and will be made by stakeholders.[24] An earlier version of the document went on to state, "We assume that such considerations would take place during planning and fishery operations, although, curiously, risk tolerance and its consideration are not explicitly mentioned in the [WSP] section on Integrated Planning."[25] That and the timing of those decisions at the end of the benchmark-setting process would seem to indicate that the decisions will be part of the WSP act of "balancing" conservation with "social and economic needs." As we have seen, such balancing has led, or is leading, to the collapse of many major global marine fisheries.

Here, an alternative assessment process is proposed. It still allows goals, timeframes and risk tolerance to appropriately be chosen as value judgements but attempts to insulate them from short-term power politics. This alternative distinguishes between two types of values, those of fundamental principles (the Charter of Rights and Freedoms for example) and those of an adjudicative or political nature, such as deciding between those rights when the exercise of one conflicts with the exercise of another. The WSP is clear that the highest priority is the conservation of wild Pacific salmon and their habitats.[26] In respect of risk tolerance, both the WSP and the CU Benchmark Paper state that they will apply the precautionary approach, which the federal government has said is synonymous with the precautionary principle,[27] and under which decisions "should be guided by society's chosen level of risk."[28] Further, the government has said that the level of risk protection "should be established in advance through domestic policy instruments"

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[22] *Ibid* at 1.
[23] *Ibid* at 4.
[24] *Ibid* at 33.
[25] Holt, C.A. *et al, Indicators of Status and Benchmarks for Conservation Units in Canada's Wild Salmon Policy* (2008) PSARC Working Paper S2009-1. The "planning and fishery operations" referred to are presumably the Integrated Fisheries Management Plans and the variation orders for fishery openings where the power politics presently occurs. For an example of such politics from the west coast salmon fishery, see North Coast Steelhead Alliance, *Submission to the Commission for Environmental Cooperation* (2009) at 4, accessible at www.cec.org/Storage/29/7744_09-5-SUB_en.pdf.
[26] *Supra* note 11 at 8.
[27] Canada Privy Council Office (2003), *A Framework for the Application of Precaution in Science-based Decision Making About Risk* at 2.
[28] *Ibid* at 7 and *supra* note 11 at 15.

(emphasis added).[29] All of which strongly suggests as a matter of existing policy that precaution and the level of risk tolerance are not ad hoc political decisions but are principles that should be decided at the start of decision-making processes.[30]

In the setting of WSP benchmarks, the decision about the *a priori* level of risk tolerance should be framed as a simple formula; for example, as a defined percentage along the range from the most likely probability that a management strategy will achieve its target (the median value of a CU indicator metric) to the lowest scientifically-determined probability it will achieve its target. As such, society's level of risk tolerance, along with the time-frame to achieve the target or goal, can be debated and decided before their effect on specific salmon stocks or CUs is known. It is thus properly a principle and not an expedient political decision dressed up as a principle.

After conservation and sustainability benchmarks are set, decisions about which zone of biological status (green, amber or red) to assign each CU and the resolution of any conflicts between the conservation goals of specific CUs can be made based on current legal requirements[31] and political value judgments. In this way the effects of the political decisions clearly can be seen in the light of:

- the scientific model-making and data collection;
- the range of uncertainty around those science determinations; and
- the timeframe and risk tolerance principles.

3.2 Separating Science from Values

The CU Benchmark Paper states that: "The proper role of Science is to determine the safe biological limit of the resource... and should, as far as is possible, be free of any implicit assumptions of acceptable or unacceptable risk."[32] This statement, in itself, has already inserted two value caveats into the scientific process – judgments of what constitutes "safe" and what is or is not "possible." In this section of the submission, a number of other instances are identified where values appear to have been inserted into the scientific part of the process.

Lower Benchmarks: The process for determining the lower benchmark for each CU has two stages. The first stage is a determination of the level

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[29] *Ibid* at 7.

[30] The CU Benchmark Paper allows that the level of risk tolerance could be predetermined (*supra* note 17 at 4), but does not pursue this alternative in the remainder of the paper.

[31] For example: not to unjustifiably infringe on aboriginal fishing rights.

[32] *Supra* note 17 at 3.

of abundance that could lead to a CU being considered at risk of extinction [meaning extirpation] by the Committee on the Status of Endangered Wildlife in Canada ("COSEWIC").[33] Then, the benchmark itself is set at a level high enough to ensure there is a "substantial buffer" between it and the extirpation level.

The CU Benchmark Paper identifies two of five COSEWIC criteria – rates of population decline and absolute abundance – as applicable to Pacific salmon. Both of these criteria, however, contain their own value judgments; for example, under COSEWIC, a 70 percent reduction of mature individuals over the greater of 10 years or three generations will result in an "endangered" status.[34] In this example, both the amount of the population reduction and the timeframe appear to incorporate value judgments. Moreover, they appear to be generalised judgments COSEWIC uses for all Canadian wildlife, both aquatic and terrestrial. In addition, neither the WSP document nor the CU Benchmark Paper indicate which of the three COSEWIC risk status levels (endangered, threatened or special concern) apply to the WSP.

Despite the WSP statement that the lower benchmark be tied to COSEWIC extinction risk levels, the CU Benchmark Paper goes on to consider other criteria such as those in the DFO Decision-making Framework. But these criteria also include value judgments; for example, the choice of a specific proportion of maximum sustained yield ("MSY") as the lower benchmark.[35]

Finally, there is the question of the "substantial buffer" that the WSP says will be placed between the COSEWIC risk-of-extinction levels and lower benchmarks. This, the WSP says, will "depend on available information and the risk tolerance applied," noting that the determination of risk tolerance is a value judgment.[36] The CU Benchmark Paper, however, appears to accept only the data uncertainty and not risk tolerance into its accounting.[37] This may be the result of conflating risk and probability in the y axes of the graphs shown in Figures 1 and 2, as well as the seemingly incorrect positioning of the hypothetical lower benchmarks.[38]

A different version of Figure 1 is appended to this submission. It attempts to show where the "deterministic" lower benchmark for salmon

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[33] *Ibid* at 7.
[34] Committee on the Status of Endangered Wildlife in Canada, *COSEWIC's Assessment Process and Criteria* (April, 2009) at 8.
[35] *Supra* note 17 at 15.
[36] *Supra* note 11 at 17.
[37] *Supra* note 17 at 8.
[38] *Ibid* at 3 and 6.

population would be shown if, as the original figure caption says, it is the level of spawner abundance such that the target [goal] would be attained with certainty; that is, a probability of 1. The appended figure also shows a reasonable range of choice for a precautionary level of risk tolerance between the median (deterministic) level of spawner abundance and the most pessimistic level according to a scientifically-derived range of uncertainty.

Upper Benchmarks: The CU Benchmark Paper endorses the recommendation of the DFO Decision-making Framework that upper benchmarks be equal to or greater than 80 percent of spawner abundance at MSY.[39] The source of the 80 percent figure is not given in the Decision-making Framework but only described as "the best available guidance."[40] Thus, it too appears to be, in part, a value judgment.

There are good reasons for fishing below MSY. First, there is a growing consensus in fisheries science that MSY should be an upper limit for fishery exploitation rates rather than a management target.[41] Second, a discounting of MSY by between 5 and 25 percent has been shown to maximise profits for fishers for some stocks, whereas fishing to MSY maximises revenue but not profits.[42] If these or other reasons are the reason for the proposed discounting of MSY under the WSP, they should be made explicit.

It appears that any transparently-decided risk tolerance under the WSP is to be applied only to the determination of lower benchmarks and not to the determination of upper benchmarks.[43] The reasons for this omission should be explained, as the precautionary principle applies as much to keeping a stock within a healthy, and thus efficiently fished, status as it does to one threatened by extirpation.

4. Summary of Recommendations

The changes recommended in this submission for determining precautionary upper and lower benchmarks under the WSP can be summarised by amending Table 1 of the CU Benchmark Paper as follows:

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[39] *Ibid* at 15.
[40] *Supra* note 19 at 5.
[41] *Supra* note 4 at 584.
[42] Grafton, R.Q. *et al*, "Economics of Overexploitation Revisited" (2007) 318 Science 1601.
[43] *Supra* note 17 at 11.

STEP	PROVIDER	INPUT
1. Reference Frame	WSP	Policy
2. Goal	WSP	Policy
3. Timeframe to Achieve Goal	Small-p political process	Best expressed in salmon generations
4. Risk Tolerance	Small-p political process	Expressed as a formula related to a scientifically-determined range of uncertainty
5. Develop a model that relates current states to future states	Science	Production model
6. Determine median (deterministic) upper and lower benchmarks for each CU from model	Science	Output of steps 1, 2, and 3 using 5
7. Determine ranges of uncertainty around each upper and lower benchmark	Science	Output of steps 1, 2, 3, 5 & 6
8. Apply Risk Tolerance formula	Science	Output of step 4 applied to output of step 7

It is recognised that some may find it difficult to decide on a level of risk tolerance as a principle in advance of its impact on specific stocks. As a general expression of society's chosen level of precaution, it is somewhat abstract and its relationship to a particular stakeholder's interest will be obscure – as is intended. This abstraction can be mitigated by incorporating the benchmark-setting process into an adaptive management cycle that allows the chosen level of risk to be reconsidered periodically in the light of monitoring information. Discussion of potential monitoring and adaptive management processes in implementing the WSP is beyond the scope of the CU Benchmark Paper and this submission.

APPENDIX A

Holt, et al (2009) Suggested version of Figure 1. so graph conforms to caption specifics.

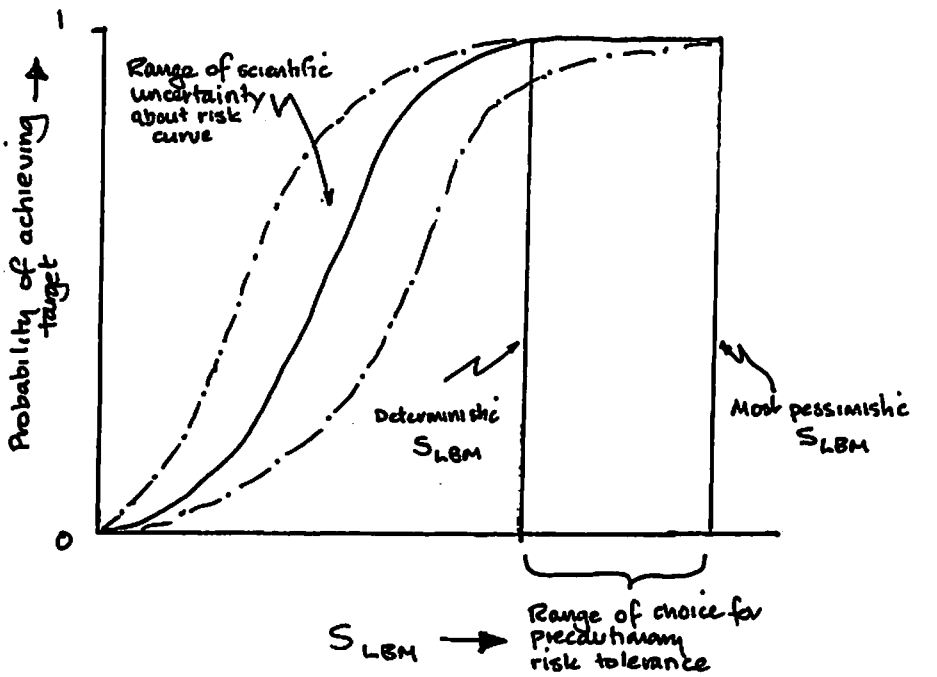

Figure 1. A hypothetical relationship between a lower benchmark (S_{LBM}) and the probability of achieving a target within a specified time (The deterministic S_{LBM} is the level of spawner abundance such that the target would be attained with certainty [Probability = 1] within a specified time if there was no uncertainty. The "most pessimistic" S_{LBM} accounts for the lower limit of the range of uncertainty.)