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Introduction to the GPI Fisheries Account (October, 1999)

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Media reports on the "State of Nova Scotia's Fishery" traditionally focus on the annual quantity of fish caught, the income of fishers, the level of fish exports, and the total fishery revenue. All of these factors contribute to the Gross Domestic Product, the conventional measuring stick of our fishery's progress.

These measures, however, do not capture all that we value in a fishery system. The goal of the GPI Fisheries Account is to provide a more comprehensive assessment of the state of the fishery, and measure how well it has progressed towards sustainability. This preliminary report highlights some of the major themes that will be addressed in the full report, focusing particularly on the following:

- Measures of natural capital and natural resource depreciation
- Assessments of sustainable catches and sustainable employment
- Development of a system of sustainability indicators.

Natural Capital and Depreciation.

Traditionally, we have assessed the economic performance of Nova Scotia's fishery by adding up all the revenue obtained from catching and selling fish. This practice misses a critical point, in that it does not account for the value of fish remaining in the ocean after the fishery has taken place, or any damage to the natural system which maintains the fishery. The fish in the sea, the quality of the water, the ocean bottom habitat, and all the other elements of the marine environment constitute 'natural capital' – this is what keeps the fishery functioning and as such needs to be recognized as having real value.

We have traditionally placed a value on human-made capital, such as pieces of machinery, by measuring investment costs. What about natural capital? What is its value? Certainly, there are many roles played by elements of the ecosystem that are truly invaluable and which we cannot directly translate into monetary terms. It has proven useful, nonetheless, to look at natural capital partly in monetary terms. When this is done carefully it can help us to recognize:

(1) the intrinsic value of fish stocks in the ocean, analogous to a savings account from which interest may be harvested year after year, and
(2) the folly of large harvests that seem profitable but actually lead to fishery collapse.

Consider a particular fish species such as haddock. Considerable effort is expended each year by government scientists to estimate the total amount (weight) of haddock within a certain region of the ocean – this is called the 'biomass'. If we multiply this estimate of biomass by the price of haddock, we can calculate a monetary value for all the haddock that live in Nova Scotia's waters. The value of haddock stocks, for example, in Nova Scotia's waters in 1997 was $128 million. This is the value that could theoretically be obtained if every haddock were caught and sold that year. Of course, this is impractical and undesirable – because we want to maintain the fish stock at a healthy level and live off the annual growth. A sensible resource manager should consider fish in our waters to be like the assets of an investment which will yield profit while maintained, or like funds in a savings account whose earnings and interest can sustain people's livelihoods.

We can reconstruct the value of our fish stocks in the past by adjusting for changes in fish stocks, fluctuating prices and for inflation (see Figure 1). If we compare our current stocks to previous ones we can better understand what 'progress' we have made toward a sustainable and healthy fishery.

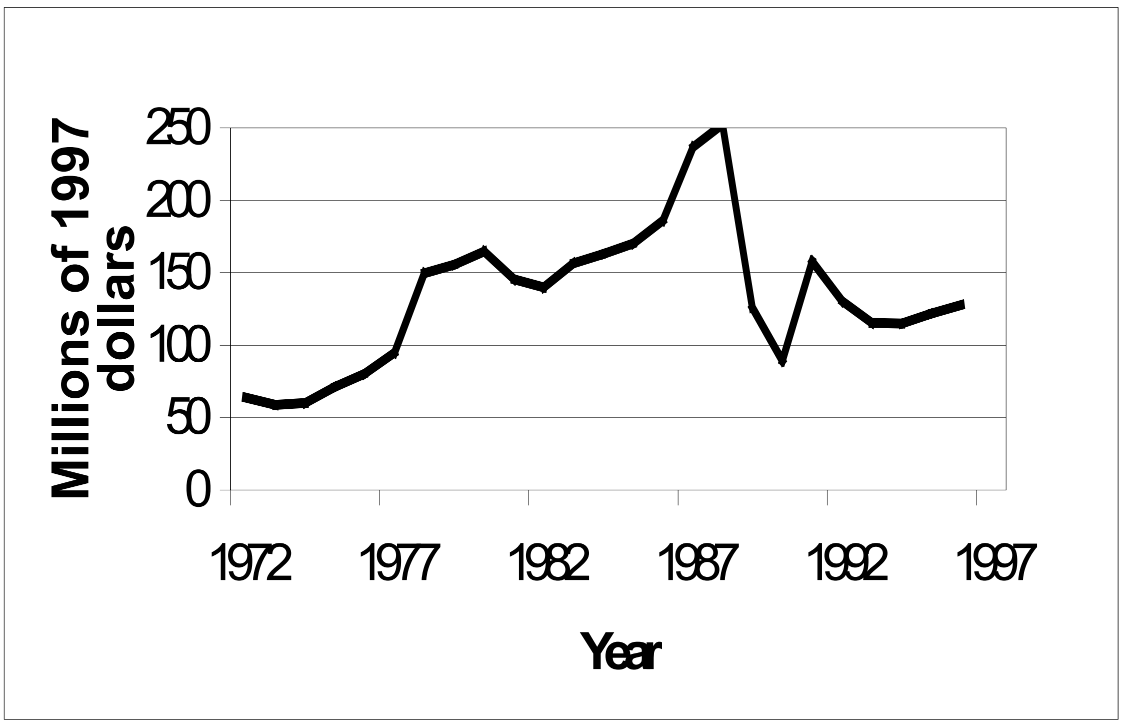

***Figure 1**. The value of Nova Scotia's haddock stocks generally rose between 1972 and 1988 but fell in 1989 and has not yet reached levels as high as those in the 1980's. Unfortunately, data are not available prior to 1972.*

In the late 1980's we had an increasing fisheries GDP, while we were catching, selling and exporting more fish. However, we were simultaneously depleting our natural capital. This is called resource depreciation and is analogous to what happens as a business capital stock (factories, pieces of equipment, etc.) wears out over time. In contrast to a piece of machinery, fish stocks can be self-sustaining and actually appreciate; that is, their economic value as a stock can actually grow naturally. If fish stocks are subjected to over-exploitation or other pressures, however, they will lose economic value.

A clear example of resource depreciation is provided by Nova Scotia's cod stocks. Figure 2 shows the dramatic increase in the gap between the potential value of Nova Scotian cod stocks and the value they actually had. This gap represents the depreciation of our natural assets. We calculated potential value simply in reference to biomass levels in 1982 (the year for which the earliest reliable biomass data are available – earlier data do exist but their consistency and reliability are unclear). Had we been able to estimate biomass of Nova Scotian cod 25, 50, or 100 years ago the resulting graph of depreciation would likely be even more dramatic.

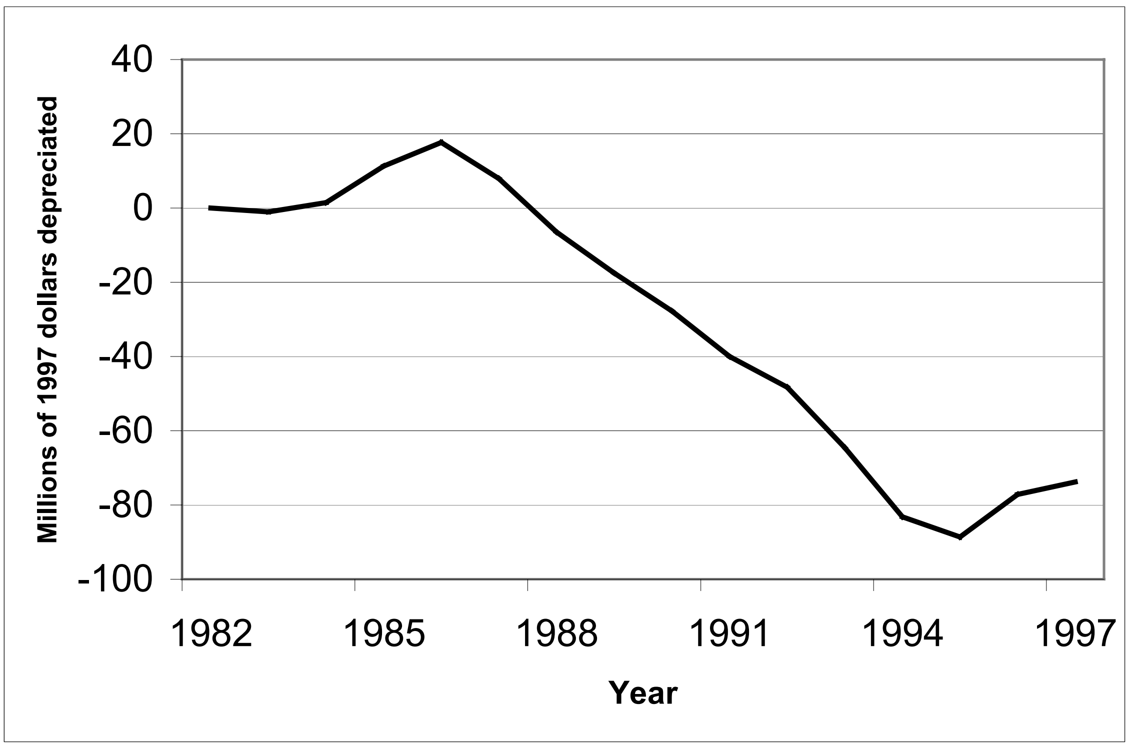

***Figure 2**. The value of cod living in Nova Scotia's waters greatly depreciated between 1986 and 1996. By 1996 the loss of natural assets, compared to the level of cod stocks existing in N.S. waters in 1982, amounted to more than $70 million. Note that since depreciation is measured relative to 1982 stock levels (the first year for which reliable data are available), significant depreciation may already have occurred in prior years relative to potential carrying capacity. Earlier data do exist, but their reliability is unclear.*

If a private company allowed this level of depreciation in its produced capital, its factories would soon be falling apart. Yet in the fishery, this depreciation occurred behind the scenes while annual reports of progress told of high profits and a strong industry. The GPI fisheries accounts begin to remedy this flaw by measuring harvests *in relation to* stock values over time.

Sustainable Catches and Employment.

Historical catch levels in Nova Scotia's fishery are available for some major species back to the turn of the century.[1] These records are useful for roughly estimating a 'safe' amount of fish that the ocean has consistently provided to fishers. The Nova Scotian lobster fishery, for example, consistently landed about 10,000 metric tonnes per year for the 50 years between 1920 and 1970. That level may not compare well with recent much higher landings, but that level endured for so long as to reflect what has historically proved to be a truly sustainable level. The GPI fisheries study reviews historical catches for several species, not to illustrate a *maximum* yield that could be taken from the resource, but rather to indicate levels of fishing that have worked and been sustainable in the past. The strong advantage of such a conservative valuation is that, unlike maximum yield estimates, it allows for natural fish stock changes due to environmental fluctuations.

These sustainable catch estimates directly affect employment and pose a key question for policy makers: How many jobs could there be in a sustainable fishery? The answer depends both on the sustainable catch levels discussed above and on what is considered a reasonable average income for a fisher. In fact, the number of sustainable jobs can be calculated as follows, for any particular mix of gear and fleet types:

1. Determine a 'sustainable gross revenue' (or landed value) for each species by multiplying its sustainable catch level by the unit price;
2. Determine a species-specific 'sustainable net revenue' as a fraction of the above, to deduct costs of harvesting (allowing for the mix of fleets involved);
3. Calculate the total net revenue from the fishery by summing the net revenues across all species involved;
4. Obtain the sustainable employment by dividing this total net revenue by an appropriate annual fishing income, based on the average industrial wage in the province.

Note that this calculation does not imply that everyone in the fishery receives the average annual income, but rather that an average fisher receives this income. Matters of income distribution and fairness will be considered elsewhere in the GPI accounts. Note also that here we are calculating 'full-time equivalent' jobs. Many more people can be involved in

[1] The historical data actually vary according to species. Data for all major species are available from 1972, and for some species from 1960. For the inshore fishery, records were published from 1920 to 1950. Some of the most consistent records dating to the early part of the century are for the lobster fishery.

the fishery if they also work and obtain income in other economic activities, along with their fishing. Finally, note that the calculated level of sustainable employment will vary with the mix of fleets; not surprisingly, using a more capital-intensive fleet results in a lower level of employment.

After adjusting for inflation and changes to the market price of fish products, we have estimated a livelihood carrying capacity for Nova Scotia's fishery, using the above method. Through the 1980s and 1990s, the number of fishers that could be employed full time without over-exploiting Nova Scotia's fish stocks was between 7000 (using an industrial average wage) and 11,000 (using a poverty-line income for a 4-person family). Interestingly, Statistics Canada reported between 6000 and 12 000 Nova Scotians were occupied in the fishing industry during the same time period. These numerical ranges are remarkably close. This does not imply that exploitation was sustainable over this time period – at least in the ground fishery. It clearly was not. However, the similar numbers do suggest that employment in a sustainable fishery need not be much lower than it has been in recent years, provided a reasonably fair distribution of income is maintained.

'Genuine Progress' Sustainability Indicators

Assessments of natural capital, sustainable harvests, and sustainable employment provide some key ingredients to a more comprehensive measurement of 'genuine progress' in Nova Scotia's fishery. A full analysis must also include a range of ecological, economic, social, and institutional factors. Such factors are called 'indicators' because they provide indications of how close to or far away from sustainability the fishery is. The GPI fishery report discusses, using current and historical data where possible, a variety of indicators, such as the following:

Ecological Indicators:

- biomass of targeted species and level of resource depreciation
- average size of fish (affected by over-harvesting and environmental stress)
- extent of protected areas, providing fish with refuges from harvesting
- extent of habitat on the ocean floor unaffected by fishing
- level of marine diversity
- level of toxic contamination
- level of discarded waste

Socioeconomic Indicators:

- level of employment versus sustainable livelihood capacity
- level of fleet catching power versus sustainable capacity
- landed value of fish caught
- level of exports

- depreciation of capital assets
- resilience (age structure of fishers, extent of licensing for multiple species)
- concentration of access and wealth (across fleet groups)
- level of debt and bankruptcies
- safety at sea

Institutional Indicators:

- level of resources allocated for science and conservation
- priority placed on sustainability
- cooperation and sharing of power with fishing communities

Note that the first ecological indicator listed, and the first two socioeconomic indicators, are obtained from the results of the calculations discussed earlier in this article. Others are calculated (or assessed qualitatively) using data and information obtained in the course of the GPI research. Details on defining and measuring the indicators, as well as results for each, are provided in full in the report.

What are the implications of the GPI fisheries results?

What we measure is a sign of what we value. Traditional measures, such as fishery revenues, exports and employment, are clearly relevant, but a preoccupation with these measures has misled us in the past. By failing to include such factors as ecosystem health, fishery resilience, and resource depreciation in past calculations, strict economic accounting has given these vital factors an implicit value of zero.

As noted, direct physical and monetary measurements can assist in assessing stock values, depreciation rates, and sustainable catch and employment levels. While not all variables are measurable in these terms, ecological and social variables that enhance sustainability and promote long-term prosperity at least deserve qualitative valuation if we are to preserve our natural wealth, and to maintain a viable fisheries sector and healthy coastal communities into the future.

By not measuring what we value, we have also neglected what we value in the policy arena, producing policy outcomes that have undermined the sustainability of the fisheries sector and depleted our natural wealth – outcomes clearly at variance with our common goals as a society.

A full GPI analysis can help decision-makers distinguish between the real costs and benefits of different options. One option may generate considerable economic activity and positive GDP growth in the short term, but may have such great social and ecological costs, not counted in a typical GDP calculation, as to produce a net negative impact. This was amply demonstrated in the fishery collapse – the devastation associated with a system of valuation that failed to account for its own future well-being.

As Nova Scotia moves into the future, a key goal will be to ensure that its natural resources are used in a sustainable manner that benefits the people of the province, their communities, and the natural environment both now and in the future. Maintaining a system of GPI fisheries indicators may help guide us in this direction.