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The Ecological Fishprint of Nations

Measuring Humanity's Impact on Marine Ecosystems

REDEFINING progress The Nature of Economics

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In November, 2006, a prominent team of ecologists and economists issued this dire warning: if current fishing patterns continue, all major commercial fish species will suffer population collapses by 2048. In March 2005, the United Nations State of the World Fisheries and Aquaculture report stated that 7 of the top 10 marine fish species, accounting for about 30 percent of all capture fisheries production, are fully exploited or overexploited. Another recent scientific study suggested that nearly 90% of all large predatory fish in the ocean are now gone, forcing nations to increasingly fish down food webs to meet seafood demand. The tragic state of the world's marine fish populations and ecosystems underscores the critical need to better understand the strain humanity is placing on the ocean.

In collaboration with Daniel Pauly and the Sea Around Us Project at the University of British Columbia, The Ocean Project, and Center for Sustainable Economy, Redefining Progress has adapted the popular ecological footprint tool to more accurately quantify the impact of capture fisheries on marine ecosystems. That current global footprint accounts show that our use of fisheries is sustainable is clearly at odds with the reality of widespread overfishing. Our adaptation—the Fishprint—is a research tool for measuring the spatial extent of humanity's appropriation of marine ecosystems that remedies some of the known shortcomings of standard footprint analysis. Our Fishprint tool can be used to assess the ecological impacts and overall sustainability of fisheries production and consumption at the global and national levels. This report provides a brief overview of the Fishprint methodology and findings. For a much more detailed look at the methods, sources of information, and results, please review the technical supplement to this report entitled Recasting Marine Ecological Footprint Accounts, available from the Redefining Progress website (www.rprogress.org).

The Fishprint provides a way to quantify the strain humanity places on our marine ecosystems at the local, national, and global levels; distinguish between sustainable and unsustainable levels of fishing; and model the effects of policy change.

Conceptually, the Fishprint is relatively straightforward. It converts the weight of fish we consume on an annual basis in metric tonnes into an equivalent ocean area expressed in terms of "global hectares," a metric that accounts for ecological productivity. For example in 2003 the global catch was 87 billion metric tonnes which translates into an ocean area of 60.79 billion global hectares (gha). This area can be compared to the area-equivalent of a global sustained yield catch (or biocapacity) to provide an indication of the degree to which our use of fisheries is sustainable. If the Fishprint in any given year exceeds global biocapacity, it is an indication that we are overshooting our ecological limits, depleting global fish stocks, and impairing the next generation's ability to draw sustenance from the seas.

The Fishprint incorporates some unique adaptations to standard ecological footprint analysis. To adapt the footprint methodology to marine fisheries, we made the following changes:

- **Catch data.** Rather than expressing a country's catch in terms of metric tonnes, we assessed extraction rates by calculating the primary productivity required (PPR) for that catch from 1950-2003 based on the trophic level, or position on the food chain, of species. By doing so, the Fishprint captures the effects of fishing down food webs.

- **Sustained yield threshold.** Standard footprint analysis does not distinguish between sustainable and unsustainable use of fisheries. The Fishprint sets a preliminary global ecological sustained yield threshold based on the average catch during the mid 1970s.

- **Marine Protected Areas (MPAs).** Setting aside a proportion of the ocean as "no-take zones" is essential for sustaining the productivity of commercial fisheries and the marine ecosystems on which they depend. The Fishprint assumes that at least 20% of exclusive economic zones need to be set aside as MPAs. In the standard approach, there are no set-asides for other species.

- **Depletion of natural capital.** In years when overfishing occurs, the Fishprint shows declining biological capacity. As such, the Fishprint is consistent with the concept of natural capital depletion. The standard approach assumes marine biocapacity remains constant over time.

We applied the Fishprint methodology to generate a set of global and national Fishprint accounts. The global Fishprint accounts show global catch in PPR, biological capacity, the Fishprint, and ecological overshoot (Fishprint – biological capacity) both total and per capita for each year between 1950 and 2003. The national accounts provide catch in PPR and both total and per capita Fishprint, biological capacity, and overshoot for 2003. Our results provide some quantitative verification of the fact that we are fishing at a very unsustainable rate and probably have been doing so since the mid 1970s. In particular:

- At a global level, the Fishprint associated with marine capture fisheries was 60.95 billion global hectares in 2003 while biological capacity was 23.62 global hectares—an ecological overshoot of roughly 157%.

- On a per capita basis, the Fishprint accounts show ecological overshoot be roughly 6.29 global hectares in 2003.

- Unsustainable use of global fisheries in aggregate most likely began in the mid 1970s. This is when the Fishprint accounts show ecological overshoot first beginning.

- Due to overfishing, marine biocapacity has fallen from 29.21 global hectares in 1950 to 23.62 global hectares in 2003.

- Ninety-one countries engaged in ecological overshoot by overfishing their marine biological capacity in 2003, with Japan, Indonesia and China leading the pack.

- Overshoot countries account for 76 percent of global fisheries catch, yet only 30 percent of the global population.

The Fishprint methodology can be used to better understand how we are using our marine resources from the perspective of ecological sustainability. At a country level, the Fishprint can be used to measure how well individual countries are abiding by the United Nations Convention on the Law of the Seas (UNCLOS) and the effects of domestic policy changes designed to protect marine ecosystems or regulate the intensity of their use. We also hope that researchers in the field, fisheries advocates, and government agencies will utilize the Fishprint as a way to quantify the ecological benefits of adapting beneficial fishery management policies such as the establishment of "no take" Marine Protected Areas, adoption of sustained yield benchmarks that incorporate trophic level effects, or elimination of factory trawling.

Over the next year, Redefining Progress and our partners will be making additional refinements to the Fishprint methodology to enhance its accuracy, make it a real time sustainability measure, and demonstrate its relevance in a variety of policy settings. We are seeking partner organizations to accomplish these goals.

Collapsing Fisheries

The status of the world's fish populations and the health of the ocean is alarming. In November 2006, some of the world's top ecologists and economists issued a study that projects "the global collapse of all taxa currently fished by the mid-21st century" (Worm et al., 2006). It has been said that 90% of all large fish in the ocean are gone (Myers and Worm, 2003). Seven out of ten of the top fisheries are fully or over exploited. Clearly, humanity is doing little to halt the depletion of our marine fisheries. Several successful fishery management tools have been developed, including quotas or seasonal restrictions, yet the standards set are often driven by industry and set up to fail. As seen in major fisheries around the world, including Atlantic salmon, Pacific sardine, Atlantic cod and the Barents Sea capeline, the majority of fisheries are collapsing or becoming severely threatened before anything is done.

At the same time, seafood demand continues to soar. Currently, marine resources provide about 20 percent of the animal protein eaten by humans globally and 5 percent of livestock feed. The developing world in particular consumes 60 percent of all fish harvested, and in Asia, about 1 billion people rely on fish as their primary source of protein. In order to keep up with this demand, fishers have substantially increased their effort to capture fish over the last few decades. It has been reported that Norway's fishing industry is at 60 percent above capacity, while the European Union is 40 percent over capacity. In 2003, Pew Oceans stated that, "[t]his type of fishing fleet overcapacity often goes hand in hand with overfishing." But the situation is not merely one of "too many boats chasing too few fish." Excess fish-catching capacity, or fishing power, is a combined result of the number of boats, their size, and their enhanced technology. So as we reach a point in time where scientists believe that non-anadromous marine fish are candidates for extinction (Pew, 2003), it is more important than ever to understand how much of the world's oceanic resources we consume every year.

Another cause for concern is the phenomenon of "fishing down food webs," first documented by Daniel Pauly and others in the mid 1990s. As top predators are depleted, fishing has become more and more concentrated lower down the food chain, or at lower trophic levels. According to Pauly et al. (1998), "[f]or all marine areas, the trend over the past 45 years has been a decline in the mean trophic level of fishery landings from slightly more than 3.3 in the early 1950s to less than 3.1 in 1994." This means a shift from larger, long lived, slow growing species, to smaller short-lived species. One could state that this is the step in the right direction—by fishing lower trophic level species we are consuming less resources—yet the reality is that this change in fishing patterns is simply a result of depletion of higher trophic level fish.

An unprecedented level of international cooperation will be needed to reverse these alarming trends. One initial step is the development of indicators capable of helping us understand the scope of the problem and what we can do about it. The Fishprint is an indicator that can help fill this role. The Fishprint provides a way to quantify the strain humanity is placing on our marine ecosystems at local, national, and global levels, distinguish between sustainable and unsustainable levels of fishing and model the effects of policy change. In the next section, we discuss the basic approach.

What is the Fishprint?

The Fishprint provides a way to measure humanity's appropriation of fish from the sea in terms of area. The unit of area used in Fishprint analysis is the "global hectare." A global hectare differs from a standard hectare in that it is weighted to reflect the relative ecological productivity of the particular biome of interest. In Fishprint analysis, the oceans are divided into two separate biomes with two different weights. A hectare of ocean above the continental shelf, where the oceans are most productive, is equivalent to 2.68 global hectares while a hectare of the high seas is equivalent to just .48 global hectares.

> As we reach a point where scientists believe that non-anadromous marine fish are candidates for extinction, it is more important than ever to understand how much of the world's oceanic resources we consume every year.

To convert a country's catch into global hectares, we simply divide the weight of fish caught each year in metric tonnes by the productivity of a particular ocean area in tonnes of fish per hectare and then multiply that figure by the appropriate weighting factor. So if a country catches 22 million tonnes of fish from an ocean area with an average productivity of 1 tonne per hectare, its unadjusted Fishprint is 22 million hectares. If all the fish were caught in the continental shelf area, we then multiply this figure by 2.68 (the appropriate weighting factor) to get the final Fishprint figure: 58.74 million global hectares (gha).

We can also express a particular ocean area's sustainable biological capacity—its ability to supply a stable supply of fish year after year—in terms of area. So, for example, if biologists determine that a sustained yield of fish from a country's exclusive economic zone (EEZ) is 6 million tonnes per year we can divide this amount, as before, by the average productivity of 1 tonne per hectare, then multiply by 2.68 to arrive at an estimate of the country's sustainable biological capacity in its EEZ: 16.02 million gha.

How Can the Fishprint Assess Sustainability?

By comparing the Fishprint with biological capacity, we can get a sense of whether or not a country's fishing intensity is sustainable. So in our example, the country's Fishprint is 58.74 million gha while its biological capacity is just 16.08 million gha—implying that the country is overshooting its biological capacity by 265%. Ecological overshoot is equivalent to living off principal, instead of interest. In the case of marine fisheries, the principal is the underlying ecological productivity of the ocean, which, on an annual basis, yields "interest" in the form of renewable fish stocks. The more we degrade underlying ecological productivity, the fewer fish we can sustainably catch and the lower biocapacity will be. The Fishprint incorporates this concept by reducing biological capacity in years when ecological overshoot is occurring so that if overshoot occurs in one year, in the next, biocapacity is reduced. Conversely, if the catch is sustainable—if the Fishprint is less than biocapacity—Fishprint accounts show that biocapacity renews itself back to natural levels.

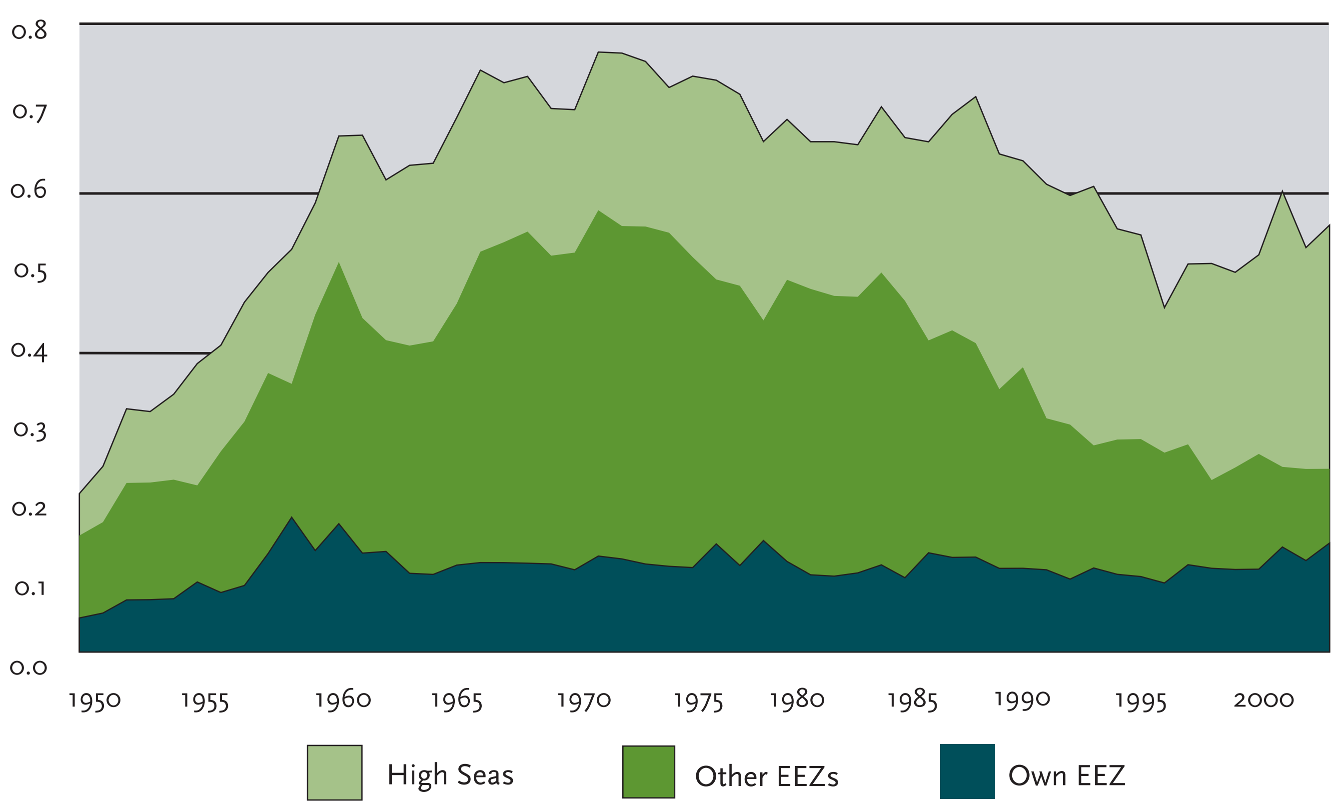
Methodological Refinements

To this basic approach, we make three important refinements to make global fishprint accounts more accurate and more consistent with the ecological realities of overfishing. Our first such refinement incorporates data generated by the Sea Around Us project at the University of British Columbia (UBC). At UBC, Dr. Daniel Pauly and others have developed a unique way to express a country's catch in terms of the primary productivity required by that catch (PPR), which is dependent upon the trophic level of the species caught. The Sea Around Us provides time series data showing PPR by a particular country's fishing fleet in three separate geographic zones:the country's own exclusive economic zone (EEZ); the high seas, and other countries' EEZs. Figure 1 illustrates the data for Japan.

Expressing catch in terms of primary productivity gives a better sense of the ecological strain our fishing fleets place on marine ecosystems because primary productivity measures how much of the total food source available to all organisms in the food chain is appropriated for a particular weight of catch. UBC's research has found that the PPR for a tonne of a particular species caught is related to its trophic level by the formula: PPR = catch*10^TL-1, where TL is the trophic level of the species caught.

This means that the PPR needed to produce one metric tonne of tuna is significantly greater than that of a tonne of

FIGURE 1: Primary Production Required by Japan's Catch from 1950-2003
Provided by The Sea Sround Us Project

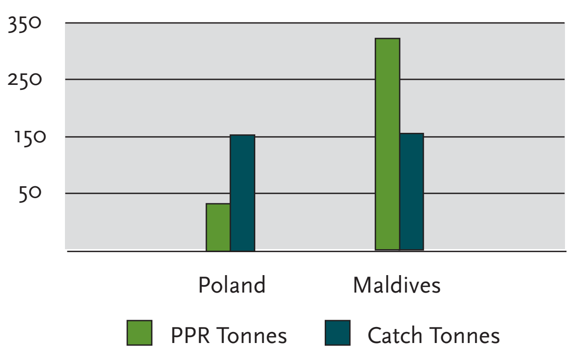


sardines, since tuna are much higher up on the food chain. For a better understanding of this concept, Figure 2 shows two countries, Poland and the Maldives, that have the same catch levels at roughly 150 thousand metric tonnes in 2003, but very different levels of primary productivity required to support this catch. For the Maldives, it took over 320 million tonnes of primary productivity to support its catch while it took only 40 million tonnes of PPR to support Poland's. This is because the Maldives' catch was more concentrated in higher trophic level species such as Dogtooth tuna (trophic level 4.50) and Skipjack tuna (trophic level 4.35) while Poland's catch was more concentrated in lower trophic level species such as Atlantic herring (trophic level 3.46) and European sprat (trophic level 3.00).

Basing the catch on PPR rather than raw tonnes provides a way to measure the "fishing down food webs" phenomenon first noted by Daniel Pauly and others (1998). Recently, Pauly and Palomares (2005) stated that fishing down is "ubiquitous and much stronger than previously believed." As demonstrated by our example from the Maldives and Poland, the Fishprint provides a way to compare equal catches in tonnes to determine what position on the food chain those catches emphasize, thereby providing an early warning of the fishing down phenomenon.

Our second key refinement was to set a preliminary global ecological sustained yield threshold (ESYT) based on the average catch during the mid 1970s. The Fishprint counts the area needed to support global catches above and beyond this level as unsustainable ecological overshoot. In addition, in years when overshoot is occurring, the Fishprint reduces biological capacity in recognition of the fact that overshoot, by definition, depletes the ocean's underlying ecological productivity. While scientific consensus on a global ESYT has yet to emerge, we chose the average catch in the mid 1970s as a way to illustrate how an ESYT can be useful in the Fishprint framework and because after that time,

FIGURE 2: Catch in Tonnes Versus Primary Productivity Required



a number of ominous trends began to manifest in global fisheries including a steep drop in the mean trophic level of the catch, a significant drop in the mean depth of catch, and a rapid increase in the number of fish stocks listed as fully exploited or overexploited by the United Nations Food and Agriculture Organization. A more complete explanation of why the mid 1970s was chosen can be found in Recasting Marine Ecological Fishprint Accounts, the technical supplement to this report that can be accessed on the Redefining Progress website at www.rprogress.org.

A third refinement was removing 20% of each country's exclusive economic zone (EEZ) from biological capacity as a proxy for the area needed to be set aside as "no take zones," or Marine Protected Areas (MPAs). Setting aside a proportion of the ocean as MPAs is essential for sustaining the productivity of commercial fisheries and the marine ecosystems on which they depend. Recently, Worm et al. (2006) found that "reserves and fisheries closures showed increased fish species diversity of target and nontarget species, averaging a 23% increase in species richness. These increases in biodiversity were associated with large increases in fisheries productivity, as seen in the fourfold average increase in catch per unit effort in fished areas around the reserves." In the standard footprint approach, there are no set-asides for other species, and the entire ocean is assumed to be available for exploitation by our fishing fleets. Currently, only about one half of one percent of the world's oceans have been set aside as MPAs. Globally, the Fishprint sets aside about 4.62 billion gha. These numbers are based on a scientific literature review on MPAs completed by the National Academies of Science in 2000 (NAS, 2000).

While these refinements are certainly a step in the right direction, there are many other advancements needed to make the Fishprint a more rigorous research tool and guidepost for assessing the sustainability of global fisheries. For example, the Fishprint assumes that the ocean's productivity is evenly distributed, and static. In fact, productivity is highly concentrated, and varies with climatic conditions, and in future iterations of the Fishprint this lack of homogeneity must be addressed. One promising avenue we are researching is to tie Fishprint data to real time satellite measurements of net primary productivity and human appropriation of that productivity. Another limitation is the Fishprint's inability to address qualitative aspects of overfishing—such as fishing practices that disproportionably affect experienced spawners in a given fish stock. The Fishprint is also limited in that it only considers direct effects on fish stocks, and does not address additional impacts such as those related to carbon emissions, fuel spills, flotsam, and land processing and transportation. These are all issues that will be addressed as the Fishprint tool continues to evolve.

Global Fishprint Accounts 1950-2003

We applied the Fishprint methodology to generate a set of global Fishprint accounts that show global catch in PPR, biological capacity, the Fishprint, and ecological overshoot (Fishprint – biological capacity) both total and per capita for each year between 1950 and 2003. Our results provide some quantitative verification of the fact that we are fishing at a very unsustainable rate and probably have been doing so since the mid 1970s. Figure 3 illustrates these global trends.

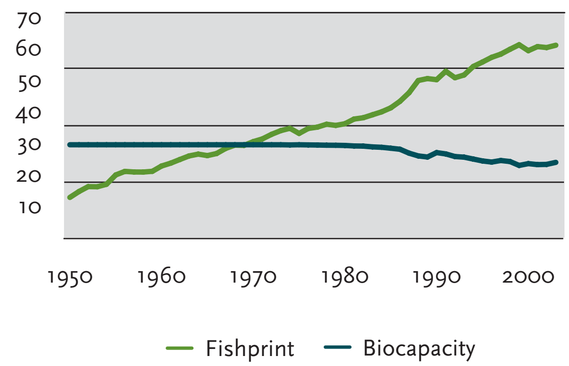
In 1950, we estimate that the Fishprint associated with marine capture fisheries was just 12.50 billion gha while marine biocapacity was 29.21 billion gha, implying that at a global scale, the world's fleets were fishing well within ecological limits despite localized incidences of overfishing. By 2003, however, the Fishprint had risen to 60.79 billion gha, while biocapacity had dropped to just 23.62 billion gha due to years of unsustainable fishing that undermined the ability of the ocean's fish stocks to replenish themselves. Ecological overshoot—or the Fishprint minus biocapacity—in 2003 was 37.12 billion gha, or 157%. As shown in Figure 3, ecological overshoot began somewhere in the late 1970s, topped out at 169% in 1999, and has been dropping slightly since then implying that of late, fishing pressure may be diminishing somewhat or that we are increasingly fishing down food webs to meet our seafood needs. Despite the recent leveling out of the Fishprint, the global accounts indicate that we are still fishing well beyond the ocean's renewable biological capacity.

Country Level Fishprint Accounts 2003

We also produced a set of country level Fishprint accounts showing Fishprint, biological capacity, and ecological balance for 2003. Appendix 1 (see page 9) reports 2003 Fishprint accounts for 149 nations for which Sea Around Us data is presently available. Appendix 1 ranks countries from "worst" to "best" in terms of ecological balances. Ninety-one countries had negative ecological balances, with Japan, Indonesia, China, Norway, the Philippines, Taiwan, Thailand, the United States, Iceland and Russia topping out the list with an average ecological balance of minus 2.1 billion gha. For this group as a whole, overshoot is 188%. In footprint speak, if every other nation on Earth placed similar demands on the world's marine fisheries, we would need 2.88 Earths to sustain this demand in perpetuity.

The 91 nations that had negative ecological balances in 2003 accounted for 76% of the total catch, but include only 30% of the world's population. To be fair, much of this excess production is distributed to nations who do not fish so intensively. As such, the overshoot figures overstate the case against these countries' fisheries practices. Nonetheless, the degree of overshoot for these and other nations near the

FIGURE 3: Global Fishprint and Biocapacity 1950-2003 in Billion Global Hectares



top of the list in Appendix 1 is an ominous signal consistent with what we know about the state of fisheries exploited by these nations.

For example, the fishing fleets of Russia, Norway and the United States have been engaged in well-known episodes of overfishing and stock depletion for Atlantic cod, Atlantic salmon and capelin. Our results suggest that Indonesia has a 301% overshoot, a finding in line with known fisheries concerns such as the collapse of wild-caught grouper populations due in part to destructive blast fishing practices (Pet-Soede and Erdamm, 1998).

Policy Implications

As stated by William Catton in 1980, "[w]hen the oceans seemed vast and fishing stocks seemed unlimited, there were no inhibitions against perpetually increasing annual catch. By the time the danger of destroying the resource became evident, the people who needed the fish were already present, and the nation's dependence on the resource-destroying rates of harvest was already established" (Catton,1980). Today, more people than ever depend on marine fisheries but the ocean's ability to meet their needs is in grave danger, so what can be done to counteract this massive over-exploitation of our oceans?

The most important global initiative regulating use of the ocean is the United Nations Convention on the Law of the Sea (UNCLOS), which was adopted in 1982. It authorizes a country's exclusive use of the undersea resources in its EEZ. Specifically, UNCLOS gives a country authority to, "exploit, develop, manage and conserve all resources—fish or oil, gas or gravel, nodules or sulphur—to be found in the waters, on the ocean floor and in the subsoil of an area extending 200 miles from its shore" (United Nations, 1998).

To encourage sustainable practices, Article 61 of UNCLOS requires countries to maintain and restore fisheries using best management practices by monitoring their catch in relation to both economic and environmental sustained yields. The Fishprint can be used as a tool for evaluating the sustainability of country level catches taking into consideration trophic level effects and EEZ specific biological capacity. Because the Fishprint methodology would be the same country to country, it can help overcome problems with inconsistent sustainability indicators that now vary fishery to fishery and country to country.

Another potential use of the Fishprint is in helping to shape global aquaculture policy. Cultured fish now account for about a third of all fish consumed in the world, and the U.S. and other nations are looking for ways to reduce the amount of fish they import. Yet in the U.S. and elsewhere, proposed aquaculture laws fail to set environmental standards or sustainable management tools for these marine based fish farms. The Fishprint methodology can be applied to evaluate the relative sustainability of various forms of intensive and extensive aquaculture operations to determine the cumulative effects such operations will have on the marine ecosystems in which they are embedded. Such analysis can play a critical part in enforcement of environmental laws, such as the National Environmental Policy Act (NEPA) in the United States, which requires disclosure and mitigation of cumulative effects.

Taking Personal Responsibility

While the Fishprint cannot account for all marine problems—such as pollution levels in fish—it is an educational tool for understanding and communicating the enormous impact of humanity's seafood consumption on the ocean environment.

As discussed earlier, the Fishprint expresses the catch in terms of primary productivity required (PPR), which is largely a function of the trophic level of the species caught. This information allows consumers to better quantify their impact on marine ecosystems if they choose to eat seafood as a regular part of their diet. As noted earlier, the higher up a fish is on the food pyramid, the more of the ocean's resources, or PPR, is needed to sustain that fishery. Figure 4 provides a list of commonly eaten species in the U.S., their trophic level, and the PPR required to produce one metric tonne of that species. For instance, a metric tonne of white scallops requires just 10 tonnes of PPR, while a tonne of Coho salmon requires over 1,778 tonnes. Thus, the Fisprint implies that by eating more white scallops and less Coho salmon, seafood consumers can reduce their impacts on the ocean. In this way, the Fishprint can point the way towards more sustainable seafood choices, provided that they are harvested with ecologically sensitive techniques.

FIGURE 4: Trophic Level Impacts of Commonly Consumed Fish

	Trophic level	Primary productivity required per tonne
Scallops	2	10
Shrimp	2.2	15.85
Menhaden	2.25	17.78
Spiny lobsters	2.6	39.81
Crab	2.6	39.81
Anchovies	2.9	79.43
Herring	3.15	141.25
Mackerels	3.18	151.36
Sole	3.27	186.21
Rainbow trout	3.39	245.47
Alaska pollock	3.45	281.84
Perch	3.5	316.23
Sea catfish	3.6	398.11
Sockeye salmon	3.73	537.03
Octopuses	3.8	630.96
Sablefish	3.86	724.44
Snappers	3.9	794.33
Chum salmon	3.95	891.25
Black seabass	3.98	954.99
Mackerels, tunas, bonitas	4	1,000.00
Red snapper	4.01	1,023.29
Yellow amberjack	4.06	1,148.15
Groupers	4.1	1,258.93
Pacific halibut	4.13	1,348.96
Pink salmon	4.19	1,548.82
Amberjacks	4.2	1,584.89
Bluefin tuna	4.21	1,621.81
Coho salmon	4.24	1,737.80
Blue shark	4.25	1,778.28

Is There a Catch to that Catch?

Because of its health benefits and great taste, more and more of us are choosing seafood, but when so many ocean species are overfished, smart choices are important. By opting for ocean-friendly seafood, you can eat well and reduce your impact.

- **Choose sustainably fished or farmed seafood to help conserve ocean species and ecosystems. Farmed catfish, clams, dungeness crab, and spiny lobster top the list of ecologically better choices.**
- **Don't supersize your seafood. Eating large portions leads not only to obesity and a greater stress on our own bodies, but also greater stress on the natural world.**
- **Buy local, environmentally responsible seafood as much as possible. By doing so, you preserve a way of life for progressive-minded farmers and fisherman in your region.**
- **Choose wild salmon over farmed. While much aquaculture is positive and can help feed the world, salmon farming pollutes our oceans and threatens wild salmon.**
- **Skip the shrimp. Five pounds of sea creatures are killed for every one pound of shrimp caught, and shrimp aquaculture damages coastal ecosystems. A very few sustainable shrimp farms exist; support them instead.**
- **Make the land-sea connection. Choosing organic, locally grown, and in-season food reduces the amount of pesticides and fertilizers polluting our oceans.**

This information is adapted from "Is There a Catch to That Catch?," a publication of The Ocean Project/ Seas the Day. Learn more at http://seastheday.

Fishprint accounts also help indicate areas of the ocean that are severely overfished and those that are likely to be fished more sustainably by providing ecological balance information on a country-by-country basis. This does not mean that consumers should avoid all fish caught by nations that show a negative ecological balance. Instead, we should simply pay extra attention to fish caught by the countries at the top of the list in Appendix 1 and more carefully scrutinize their fishery practices.

Finally, Fishprint accounts provide a sense of how our seafood demands relate to the ocean's ability to meet this demand on a renewable basis. As discussed earlier, overfishing may be in the order of 157%. If we all take personal responsibility for this level of overshoot, it means that we must all significantly reduce our consumption. By helping consumers to be aware of where the fish they buy and eat are located on the food chain and where they come from, the state of marine fisheries around the world, and whether or not their seafood originates in geographic regions of concern, the Fishprint can be a tool for promoting sustainable seafood choices.

Over the next year, Redefining Progress, The Ocean Project, and Center for Sustainable Economy will be refining the Fishprint tool and applying it in a variety of research, policy, and educational settings to promote sustainable management of our marine ecosystems. We welcome the involvement of other interested organizations and individuals. Please contact us.

Endnotes:

Catton, William: 1980, "Dependence on phantom carrying capacity." Chapter 3 of Overshoot: The Ecological Basis of Revolutionary Change. Chicago, University of Illinois Press.

Myers, R., and B. Worm: 2003, "Rapid worldwide depletion of predatory fish communities." Nature 423, 280-283.

PEW Ocean's Commission (PEW): 2003, America's Living Oceans: Charting a Course for Sea Change. A Report to the Nation: Recommendations for a New Ocean Policy.

Pauly, Daniel, Villy Christensen, Johanne Dalsgaard, Rainer Froese, and Francisco Torres Jr.: 1998, "Fishing down marine food webs." Science 279, 860-863.

Pauly, D. and M.L. Palomares: 2005, "Fishing down marine food webs: it is far more pervasive than we thought." Bulletin of Marine Science 76(2), 197-211.

National Academy of Sciences: 2000, Sustaining Marine Fisheries. National Academy Press, Washington, DC.

Pet-Soede, Lida and Mark Erdamm: 1998, "An overview and comparison of destructive fishing practices in Indonesia." SPC Live Reef Fish Information Bulletin 4 (April).

United Nations (UN), 1998: The United Nations Convention on the Law of the Sea: A Historical Perspective. New York, United Nations Division of Ocean Affairs and Law of Sea.

Worm, Boris, Edward Barbier, Nicola Beumont, et al. 2006. "Impacts of biodiversity loss on ocean ecosystem services." Science 314 (3 November 2006): 787-790.

Appendix 1: Country Level Fishprint Accounts

Country	Biocapacity	Fishprint	Ecological Balance
Japan	513.5	3,996.1	-3,482.6
Indonesia	866.5	4,298.8	-3,432.3
China	5,212.2	8,512.1	-3,299.9
Philippines	311.1	2,381.0	-2,069.9
Thailand	256.4	2,270.6	-2,014.2
Norway	18.1	2,029.0	-2,010.9
Taiwan	92.3	2,082.6	-1,990.3
United States	1,153.2	3,058.8	-1,905.6
Russia	583.4	2,102.7	-1,519.3
Iceland	1.2	1,394.2	-1,393.1
South Korea	189.8	1,517.7	-1,327.9
Chile	62.1	1,342.7	-1,280.6
New Zealand	15.4	1,148.7	-1,133.3
Spain	161.0	1,273.3	-1,112.3
Malaysia	90.4	1,150.1	-1,059.7
Myanmar	195.1	1,101.0	-906.0
Namibia	7.2	876.7	-869.4
Peru	105.2	840.7	-735.5
Viet Nam	319.3	1,046.0	-726.7
Argentina	151.2	868.7	-717.5
France	239.8	937.8	-698.1
Ecuador	51.9	709.9	-658.0
Mexico	404.8	1,017.2	-612.4
Denmark	21.5	517.3	-495.8
Papua New Guinea	19.8	467.5	-447.6
South Africa	176.6	619.9	-443.3
Venezuela	99.3	522.6	-423.3
Maldives	1.3	417.0	-415.8
Canada	125.1	498.5	-373.4
Sri Lanka	77.0	408.2	-331.2
Iran	287.8	552.6	-264.7
Seychelles	0.3	242.0	-241.6
Ghana	79.6	302.1	-222.5
Morocco	122.7	297.4	-174.7
Panama	11.7	183.2	-171.5
Portugal	40.5	207.5	-167.0
Netherlands	64.2	217.4	-153.1
Senegal	39.0	191.9	-152.9

Country	Biocapacity	Fishprint	Ecological Balance
Lithuania	14.9	165.7	-150.8
Oman	16.4	152.8	-136.3
Sweden	35.6	171.8	-136.1
Australia	78.0	202.7	-124.7
United Kingdom	241.0	363.1	-122.0
United Arab Emirates	10.7	129.5	-118.8
Ireland	15.5	133.2	-117.7
Marshall Islands	0.2	109.7	-109.5
Vanuatu	0.8	94.2	-93.3
Angola	54.6	145.4	-90.8
Solomon Islands	1.9	92.1	-90.2
Micronesia	0.4	89.1	-88.7
Uruguay	13.4	93.7	-80.2
Yemen	77.1	148.4	-71.3
Fiji	3.3	54.4	-51.1
North Korea	90.5	135.8	-45.3
Mauritania	11.1	53.5	-42.4
Madagascar	66.3	105.2	-38.9
Kiribati	0.4	32.5	-32.1
Guyana	3.0	33.6	-30.6
Costa Rica	16.6	46.7	-30.1
Latvia	9.7	30.1	-20.4
Tunisia	38.6	57.6	-19.0
Guinea	33.4	51.3	-17.9
Greece	42.8	60.7	-17.8
Estonia	5.6	22.6	-17.1
El Salvador	25.8	42.7	-16.9
Sierra Leone	18.5	35.3	-16.8
Qatar	2.4	18.1	-15.7
Samoa	0.7	14.7	-14.0
Gabon	5.3	17.2	-11.8
St. Vincent/ Grenadines	0.5	12.2	-11.7
Trinidad and Tobago	5.2	16.4	-11.1
Comoros	3.0	13.8	-10.8
Mauritius	4.7	13.8	-9.1

Appendix 1: Country Level Fishprint Accounts, Cont.

Country	Biocapacity	Fishprint	Ecological Balance
Suriname	1.7	10.8	-9.1
Cape Verde	1.8	9.7	-7.8
Finland	20.9	28.4	-7.5
Tonga	0.4	6.1	-5.6
Gambia	5.7	10.9	-5.2
Grenada	0.4	5.3	-4.9
Colombia	172.6	177.3	-4.6
Tuvalu	0.0	3.0	-3.0
Saint Lucia	0.7	3.1	-2.4
Sao Tome and Principe	0.7	2.9	-2.2
Barbados	1.1	3.0	-1.9
Malta	1.6	3.3	-1.8
Dominica	0.3	2.0	-1.7
Antigua and Barbuda	0.3	1.3	-1.0
Palau	0.1	0.8	-0.8
Saint Kitts and Nevis	0.2	0.5	-0.3
Brunei Darussalam	1.4	1.6	-0.2
Nauru	0.1	0.1	-0.1
Belize	0.9	0.8	0.2
Equatorial Guinea	2.0	0.9	1.1
Djibouti	1.8	0.5	1.3
Cyprus	3.2	1.3	1.9
East Timor	3.1	0.4	2.7
Congo, R. of	14.7	11.5	3.2
Guatemala	47.1	43.7	3.4
Guinea-Bissau	4.9	1.4	3.5
Jamaica	10.5	6.7	3.8
Eritrea	15.4	10.8	4.6
Benin	26.0	20.8	5.2
Liberia	12.5	7.2	5.4

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