Appendix 1
Global Fishery Trends
1. **Global context:** Stable landings mask worrying trends in global fisheries. Catch levels have remained relatively flat since 1990, despite geographic and bathymetric expansion, and exploitation of new species. Bycatch and habitat trends are often ignored but continue to exacerbate biodiversity issues.

2. **Outlook:** Industrialized countries (except Europe), once over exploited, have now moved to a restorative phase; the current epicenter of the fisheries crisis has shifted to Southeast Asia. This expansion will continue into the next frontiers in the Indian Ocean and East Africa.
Global Landings – Falling since 1988 by 0.5MMT/year

Source: FAO Fishstat; SAUP data used to correct China data and to remove Chilean and Peruvian anchovetta
Deteriorating fundamentals: While part of the reduction has been due to rebuilding, overall there has been a 25% increase in fishing effort: resulting in a 25-30% drop in CPUE over the relevant period.

Growth in fisheries landings has been driven by expansion into previously unexploited areas of the ocean...

- Between 1950 and the late 1970s, fisheries expanded at a rate of 1M km² per year. This expansion rate tripled in the 1980s and early 1990s.
- Between 1950 and 2005, fisheries expanded Southward at a rate of almost 1 degree of latitude per year.
- Fisheries expansion helped drive a five-fold increase in catch from 1950 to the late 1980s.
- High PPRs in areas with weak or no fishery management is particularly alarming.

Primary production required (PPR) to sustain global marine fisheries landings expressed as percentage of local primary production (PP)

...expanding southward at a rate between .7 and .9 degrees latitude per year...

Newly exploited area ($10^3 \text{ km}^2$) for each latitude class averaged over each decade

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Charting a Course to Sustainable Fisheries
...and into open waters, as the share of global landings in the high seas increased from 7% in 1970 to 15% in 2006...

Source: FAO FISHSTAT and SOFIA 2008
“Fishing fleets are working deeper and deeper [in the North Atlantic].”

“Bathymetric expansion is happening and EU countries are the biggest deep-sea fishers.”

“You would be surprised by the deepwater fishing happening in Asia.”

...and into new species (though perhaps a function of improved reporting?)

Source: FAO FISHSTAT
Geographic expansion has supported growth in fisheries landings, but we are running out of new areas to exploit.

The area of ocean exploited by fisheries has reached a plateau and the Arctic and Antarctic are the only true frontiers left to exploit.

Some productivity may still be available in the Indian Ocean.


1 PPR estimates for East Africa may be underestimated due to high levels of illegal and unreported fishing.
Newly developed fisheries provide limited volume and revenues

Source: Sethi, Suresh et al., 2010. Global Fishery development Patterns are Driven by Profit but not Trophic Level. PNAS: vol. 107, no. 27, 12163-12167
Non-target-species, including birds, fish, turtles, and cetaceans, have experienced steep population declines\(^1\)

Source: IUCN, 2008 – Jackson, 2008 - Ecological extinction and evolution in the brave new ocean

\(^1\) % Decline measured from pristine conditions before human impact
Bycatch and harvesting are primary threats for most IUCN red listed marine species

Total number of species of cetaceans, sharks, sea turtles, and seabirds in the IUCN red list database (http://www.iucnredlist.org/) affected by threat categories

Global Fishery trends

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2. **Outlook:** Industrialized countries (except Europe), once over exploited, have now moved to a restorative phase; the current epicenter of the fisheries crisis has shifted to Southeast Asia. This expansion will continue into the next frontiers in the Indian Ocean and East Africa.
Overexploitation of fisheries has spread from the North, to the current epicenter of the fisheries crisis in Southeast Asia, and will continue into the West Indian Ocean and Africa.


Primary production required (PPR) to sustain global marine fisheries landings expressed as percentage of local primary production (PP)
A Worm, Hilborn et al. summary of available stock assessments, mostly from high income countries, indicates that 63% of assessed stocks are in need of rebuilding, but most have reduced fishing mortality to below $U_{MSY}$

- 37% of assessed stocks do not need rebuilding. Of those, 77% are in the Pacific.

- Data in the study limited to stocks with assessments: mainly from N. America, Europe, and high seas fisheries.

Strong management exists in the U.S., western Canada, New Zealand, Iceland, parts of Australia; poor management persists in Europe.

EU stocks are more likely to be overfished with overfishing still occurring than stocks in the US and New Zealand.

Source: Costello, C., Gaines, S. 2011, Evaluating Fisheries Sustainability

*Charting a Course to Sustainable Fisheries*
Many fisheries in the North Atlantic continue to be overfished, while management in the North Pacific has reduced fishing pressure below $U_{MSY}$. 

Source: Costello, C., Gaines, S. 2011, Evaluating Fisheries Sustainability

*Charting a Course to Sustainable Fisheries*
Global catch levels have been supported by growth in lower-middle income countries.

Source: FAO FISHSTAT, SAUP, and World Bank

Heading in the direction of upper income countries?
Upper income countries are beginning a recovery from overfishing, the tropics are the current center of the crisis, and East Africa and the Indian Ocean will be the future center of the crisis.
The expansion of fisheries is resulting in collapsed stocks, but wide data variation makes the extent of overexploitation unclear.

**Global trends in fishery exploitation**

**FAO ASSESSMENT**

- **1974**: 90% under-exploited, 10% crashed and overexploited
- **1985**: 82% under-exploited, 18% crashed and overexploited
- **1995**: 73% under-exploited, 27% crashed and overexploited
- **2004**: 75% under-exploited, 25% crashed and overexploited

**UBC ASSESSMENT**

- **1974**: 81% under-exploited, 19% crashed and overexploited
- **1985**: 65% under-exploited, 35% crashed and overexploited
- **1995**: 50% under-exploited, 50% crashed and overexploited
- **2004**: 28% under-exploited, 72% crashed and overexploited

The number of commercial fisheries that are overfished is steadily increasing and the number of underexploited fisheries is decreasing. While the FAO (top) and scientists at the University of British Columbia (bottom) provide different interpretations of the same data, the overall trends are the same (FAO, 2008; Pauly et al., 2008; www.seaaroundus.org).

**Source:** FAO SOFIA 2008
Landings in lower-middle income countries, especially in Asia, have dramatically risen even when most other regions have been flat/declining.

Marine fisheries landings of the top 8 lower-middle income countries

Source: FAO, Sea Around Us Project, and World Bank country classifications
Effort is increasing in Asia at a faster rate than in any other continent and as a result Asian fisheries are operating below optimum productivity

- Effort in Asia has increased faster than in any other continent and will soon surpass that of Europe
- 8 million of the 9 million fishermen added to the industry between 1990 and 2002 were located in Asia
- The potential catch loss due to overfishing has grown faster in Asia than in any other continent since 1980
- Fisheries in Asia will soon surpass those in Europe as the most underperforming fisheries assets from a catch weight perspective
- “If you want to talk about what’s the state of fisheries, [Asia] is where the action is.” - Expert Interview

Asian countries also spend the most on capacity-enhancing and ambiguous subsidies which increases the severity of overfishing.

**2003 Subsidy Estimates by Major Geographic Region**

<table>
<thead>
<tr>
<th>Region</th>
<th>Subsidies</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>Beneficial</td>
<td>$2.9 billion</td>
</tr>
<tr>
<td></td>
<td>Capacity-enhancing</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Ambiguous</td>
<td>15%</td>
</tr>
<tr>
<td>Europe</td>
<td>Beneficial</td>
<td>$4.6 billion</td>
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<tr>
<td></td>
<td>Capacity-enhancing</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td>Ambiguous</td>
<td>28%</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>Beneficial</td>
<td>$1.5 billion</td>
</tr>
<tr>
<td></td>
<td>Capacity-enhancing</td>
<td>49%</td>
</tr>
<tr>
<td></td>
<td>Ambiguous</td>
<td>7%</td>
</tr>
<tr>
<td>Africa</td>
<td>Beneficial</td>
<td>$778 million</td>
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<tr>
<td></td>
<td>Capacity-enhancing</td>
<td>60%</td>
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<tr>
<td></td>
<td>Ambiguous</td>
<td>1%</td>
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<tr>
<td>Asia</td>
<td>Beneficial</td>
<td>$15.7 billion</td>
</tr>
<tr>
<td></td>
<td>Capacity-enhancing</td>
<td>68%</td>
</tr>
<tr>
<td></td>
<td>Ambiguous</td>
<td>22%</td>
</tr>
<tr>
<td>Oceania</td>
<td>Beneficial</td>
<td>$1.7 billion</td>
</tr>
<tr>
<td></td>
<td>Capacity-enhancing</td>
<td>52%</td>
</tr>
<tr>
<td></td>
<td>Ambiguous</td>
<td>37%</td>
</tr>
</tbody>
</table>

**Beneficial** – Subsidies that support healthy fish populations
- Fisheries management
- R&D
- MPAs

**Capacity Enhancing** – Subsidies that enhance fishing capacity and contribute to overfishing
- Boat construction, renovation
- Fisheries development project
- Fishing access
- Fishing port development
- Fuel subsidies
- Marketing and storage infrastructure
- Tax exemption

**Ambiguous** – Unclear what effect the subsidies have
- Fisherman assistance
- Rural fishing community development
- Vessel buyback

Professional opinion is that the absence of management and pressure of Malthusian overfishing will result in worse outcomes in SE Asia than previously experienced in the developed world

**Absence of Management**

- “Small scale inshore fisheries are of major importance [...] Ironically hardly any fisheries management frameworks in the world are applicable to small scale coastal fisheries.” Expert interview

- “The Philippines and Indonesia, to be honest, are very difficult. The countries are so big, people so poor, fishery status so bad, governments so backwards. The Minister of Fisheries has a target to massively increase production of the sea. They make these decisions with absolutely no resource reality. The pressure on resources is so enormous.” Expert interview

- “Manila Bay and the Gulf of Thailand are a case study in ecosystem overfishing. What’s left are the weed species – the ones that can handle relentless fishing pressure, such as short lived anchovies and sardines. The demersals and the formerly common species like groupers are all but gone.” Expert interview
Distant water fishing, and increasing domestic pressure will drive a fishery crisis in Africa in the future

Total fishing years in FAA in the 1990s

- With overcapacity and underperforming stocks in their own fisheries, Europe and Asia will outsource more fishing effort to Africa
- Europe has recently reduced its foreign fishing effort, but vessels from Asia continue to fish in foreign waters