Sustainability overview of world fisheries used for reduction purposes

by the

Sustainable Fisheries Partnership

based on information from **FishSource.org**

www.SustainableFish.org

www.FishSource.org

April, 2009

The issue

- Aquaculture uses > 50% of the global production of fish meal and approximately 90% of the global production of fish oil for aquaculture feeds.
- Global aquaculture production is increasing at 5-10% per annum.
- Although the use of alternative non-marine feed sources (e.g. biofeeds) is increasing, demand is likely to hold strong for marine feed sources.
- The sustainability of wild fishery sources of feed is therefore key to sustainable aquaculture.

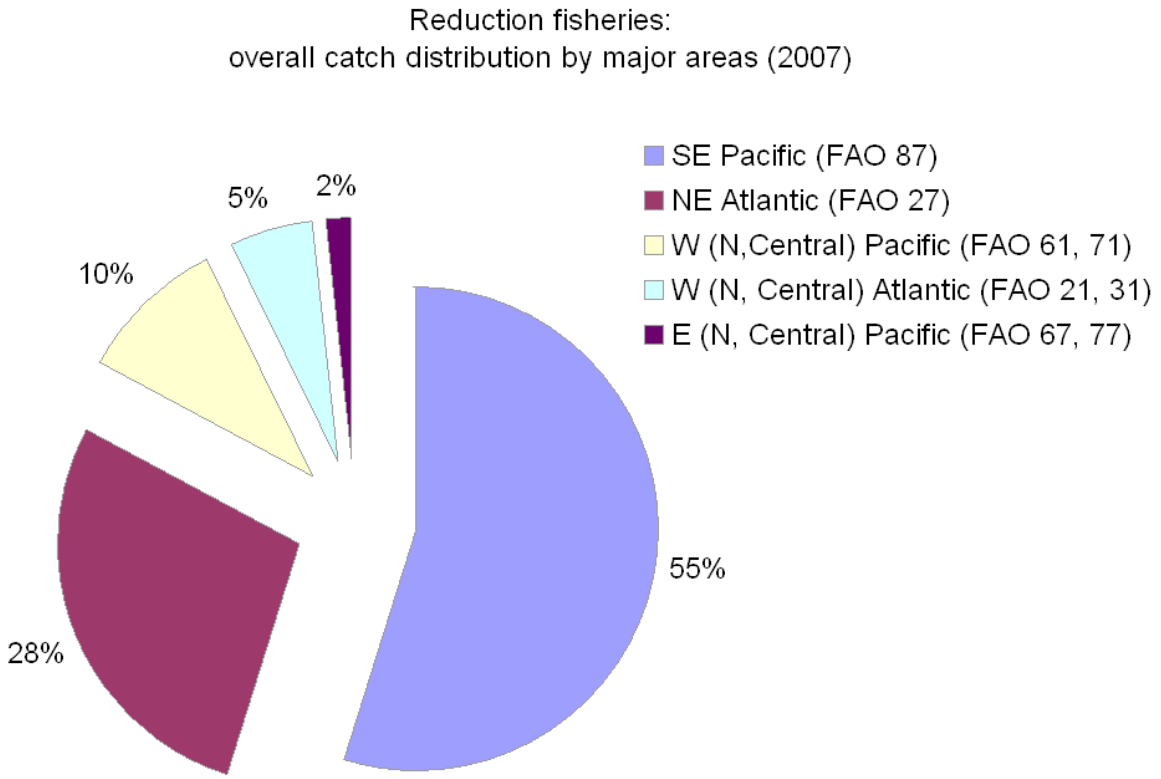
The status – in a nut shell

- Positive:
  - Among the top ten fisheries (in weight of production), only one (Chilean jack mackerel, the fifth on production – 1,292,000 t, 7.9% of total) is currently below the biomass limit reference point.

- Of concern:
  - None of the world's major source fisheries for fishmeal and fish oil use ecosystem-based methods (EBM) to set biomass reference points.
  - Harvest levels status is less optimistic with some fisheries among the top ten with either harvest levels “above target”, which will affect negatively the future condition of stock biomass, or “unknown” which raises the uncertainty about future stock condition.
  - Production from the 13 most important fisheries within the NE Atlantic area is expected to drop by 725,000 t in 2009 compared to 2007, and by 1,510,500 t compared to 2000-2007 averages.

Global sources

- Over 50% of the total catch of fisheries used for reduction purposes (estimated around 16.3 million t) currently comes from the South American Southeast Pacific.
- The Northeast Atlantic contributes over 25% of the total catch.



Global sources

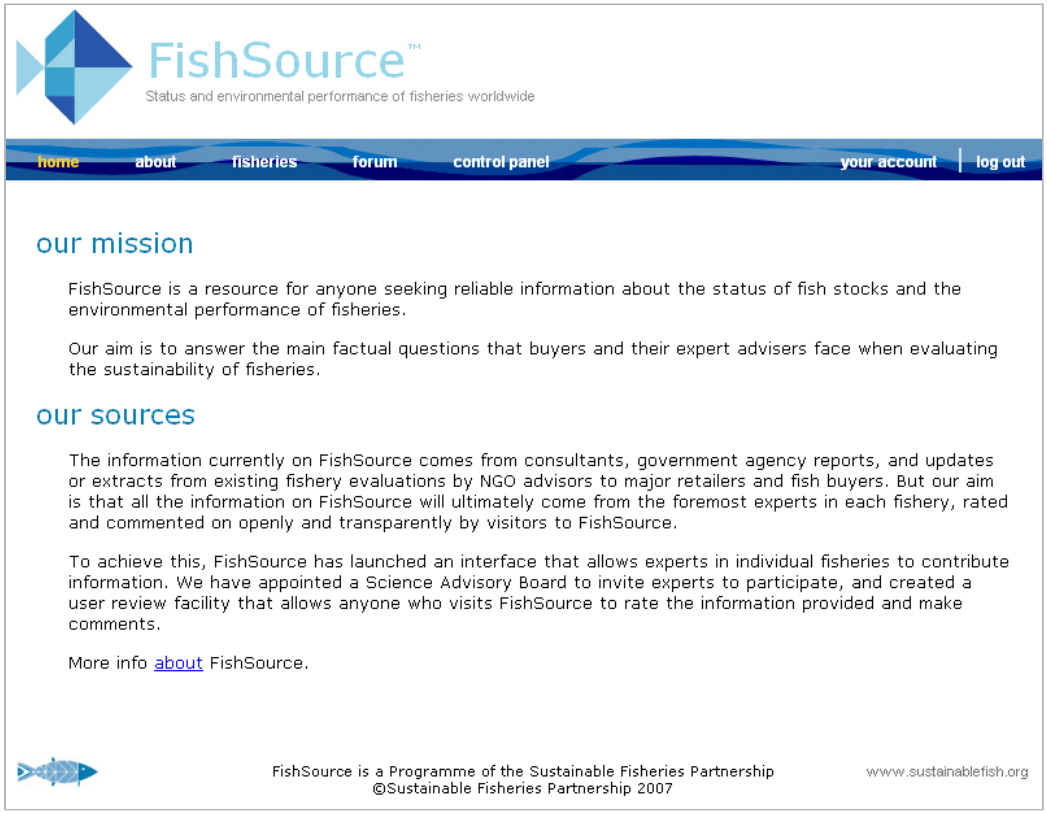
- Small pelagic species comprised the bulk of the total catch in 2007; among the fisheries targeting these species, Peruvian anchovy contributed about 36%, and Japanese anchovy and Blue whiting both 10%.

Fishery	Species' scientific name	2007 catch ('000 t)
Peruvian anchovy	*Engraulis ringens*	5800
Japanese anchovy	*Engraulis japonicus*	1648
Blue whiting (NE Atlantic)	*Micromesistius poutassou*	1612
Chilean anchovy	*Engraulis ringens*	1350
Chilean jack mackerel	*Trachurus symmetricus*	1292
Herring (Norwegian spring-spawning)	*Clupea harengus*	1267
Menhaden (US, Gulf of Mexico)	*Brevoortia patronus*	457
Sprat (Baltic Sea)	*Sprattus sprattus balticus*	388
Herring (North Sea)	*Clupea harengus*	388
Others (#16 fisheries)		1803

Information availability

- >98% by catch weight of the world's small pelagics fisheries used for reduction purposes are covered on FishSource (does not include so called “trash fish fisheries” in, *e.g.*, SE Asia, and trims or retained bycatch processed for fishmeal and fish oil).

- **FishSource** (**www.fishsource.org**) provides neutral information on the main areas of fisheries sustainability: Management, Stock Status, and Environment and Biodiversity



Certified sources

- The MSC – Marine Stewardship Council (http://www.msc.org) - is the main certification system sought by buyers of fishmeal and fish oil and derived products seeking independently certified sources of fish.
- North Sea herring (2.4% of global supply by weight, and ninth largest overall) is already MSC certified.
- Norwegian spring spawning herring (7.8% of global supply by weight, and sixth largest overall) is currently MSC certified for the Norwegian fishing fleets.
- Proportions of the Pacific sardine and of the Iberian sardine fisheries are currently in MSC full assessment.
- Other eco-label systems (i.e., Friends of the Sea) have certified pelagic fisheries, and sustainability ratings for some may be available from other NGOs and aquariums.

Ecosystem-based fisheries management (EBM) currently recognized as best

- **FAO**: *Management measures should not only ensure the conservation of target species but also of species belonging to the same ecosystem or associated with or dependent upon the target species.*
  [excerpt from section 6.2 of FAO, 1995, Code of Conduct for Responsible Fisheries].
- **The MSC new assessment tree requires:**
  - *To ensure precaution in relation to ecological role, consideration should be given to the trophic position of target species, in particular species low in the food chain*

  and, specific for these species:
  - *To reflect the concern that harvesting a low trophic level species poses a greater inherent risk to ecosystems than harvesting mid and high trophic level species, in the absence of specific consideration, an appropriate default assumption would be that low trophic level species should be maintained at stock levels higher than BMSY. An alternative approach, that of managing to higher levels of probability that the stock is above target and limit reference points, could also be acceptable.*
  - Also, to pass without conditions, the MSC requires that *"Should the consideration of the ecological role of the target species indicate a strong interdependence such that maintaining the stock at levels consistent with BMSY would cause significant changes to the ecosystem.... an expectation... would be that the target reference point should have been appropriately adjusted."*

Examples of management approaches to address ecosystem concerns

- Maintain biomass above levels needed to prevent significant changes to the ecosystem
- Use no take zones to maintain prey abundance in areas of importance to predators (*i.e.*, the Steller Sea Lion Protection Measures in Alaska)
- Adjust the seasonal pattern of fishing to prevent any seasonal depletions of prey abundance
- Protect habitats of importance to fisheries and other marine life
- Define and monitor thresholds and limits for impacts on marine life, and target levels for other marine life

NGO concern also centers on biomass levels and whether they are sufficient

- Greenpeace, WWF, Pew Charitable Trusts, Oceana and many other groups have repeatedly expressed strong concern about the failure of biomass reference points to be set taking into account ecosystem needs.

- In an open letter to NMFS, numerous groups and scientists state “Reducing key forage species to less than half of pre-exploitation stock size [our comment: common target used in single-species models] by design is not an appropriate management target.” Source: http://conservefish.org/site/pdf/foragefish_signonltr.pdf

- Greenpeace notes “Industrial fishing for smaller fish such as sandeels and anchovy for use in fishmeal has caused massive disruption to marine food webs and has almost certainly led to the decline in species such as cod, seals and seabirds in the North Sea. Source: “A Recipe for Disaster: Supermarket's Insatiable Appetite for Seafood”

Biomass reference points (BRPs) used in fisheries management: overview

- Commonly fisheries managers use two thresholds: a lower limit reference point (B_{lrp}) and an upper target reference point (B_{trp}).

- The management of reduction fisheries worldwide differ with regard to both:
  - Whether any / which reference points are used:
    - having both in place is best, yet having only B_{lrp} is better than none.
  - How have they been derived, particularly B_{trp}:
    - Ecosystem Based Management derived B_{trp} is best overall. MSY-based BRPs are current best practices when considering single-species stock assessment. Fecundity-based approaches are more robust than using B_{pa} as B_{trp}. B_{pa}, as used by ICES, is just a precautionary boundary for B_{lim} – a limit reference point). But having B_{pa} is better than no target being set all.

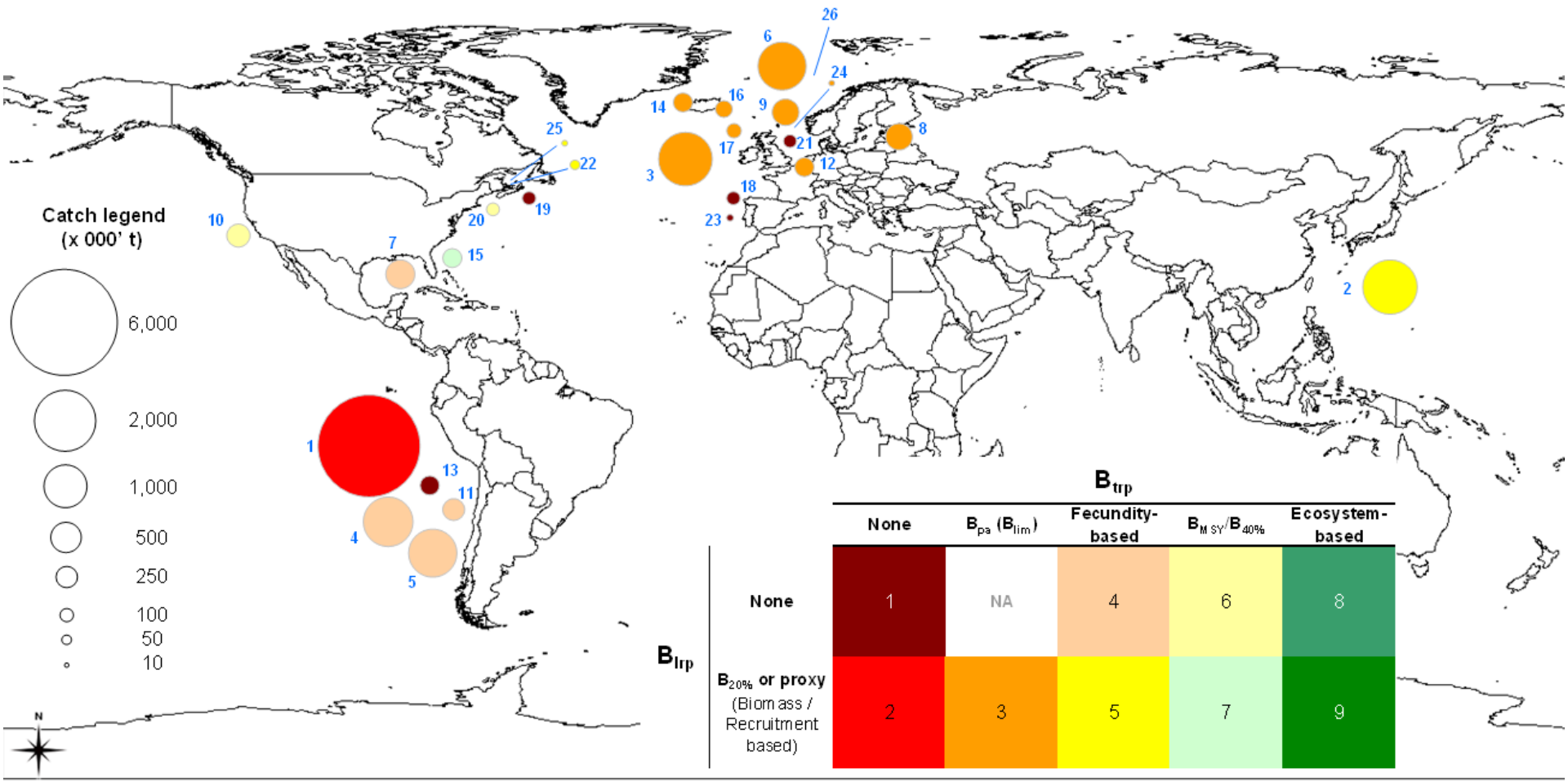
BRPs used in fisheries management: a classification system

- From the combination of B_{lrp} and B_{trp}, SFP identifies nine classes of management regimes* applied to fisheries used for reduction purposes. These systems range from a minimum of no management limits and targets at all (1), up to full-blown ecosystem-based reference points (9):

B_{lrp} \ B_{trp}	None	B_{pa} (B_{lim})	Fecundity-based	$B_{MSY}/B_{40\%}$	Ecosystem-based
None	1	NA	4	6	8
$B_{20\%}$ or proxy (Biomass / Recruitment based)	2	3	5	7	9

* Bpa can only be set when Blim, a Blrp, is in place (i.e. previous slide) rendering the "NA" on the classification system; "Fecundity-based" covers Spawning Potential Ratio /Spawning Per Recruit (SPR) methods, egg production, and biomass measures derived from the Stock-Recruitment relationship, such as USR (*Upper Stock Reference* point).

The use of BRPs in reduction fisheries management



Legend of fisheries

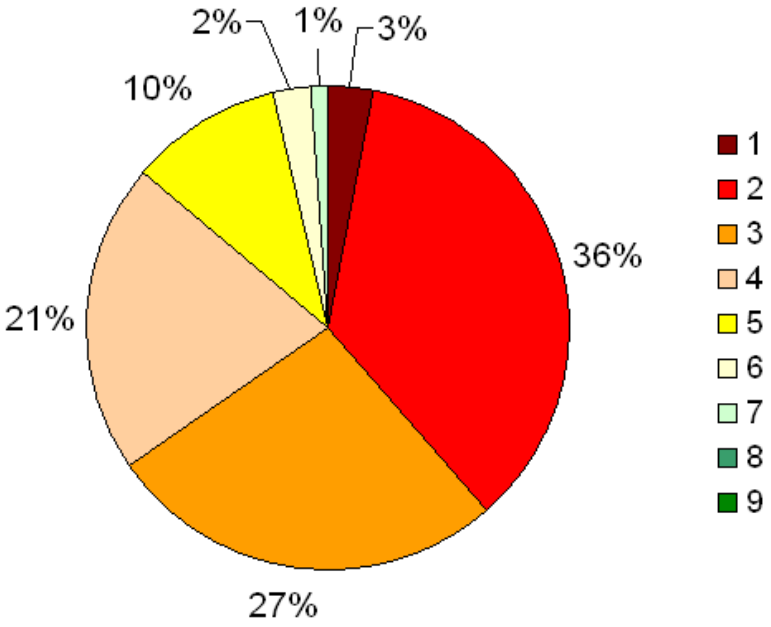
1 Peruvian anchovy
2 Japanese anchovy
3 Blue whiting (NE Atlantic)
4 Chilean anchovy
5 Chilean jack mackerel
6 Herring (Norwegian Spring-spawning)
7 Menhaden (US, Gulf of Mexico)
8 Sprat (Baltic Sea)
9 Herring (North Sea)
10 Pacific sardine (US, Mexico, Canada)
11 Chilean sardine
12 Sandeels (North Sea)
13 Chilean chub mackerel
14 Capelin (Icelandic)
15 Menhaden (US, Atlantic)
16 Herring (Icelandic Summer-spawning)
17 Horse mackerel (W stock, NE Atlantic)
18 Iberian sardine
19 Herring (Canada, NAFO 4VWX)
20 Herring (US, Atlantic)
21 Sprat (North Sea)
22 Herring (Canada, NAFO 4TVn - Autumn spawner)
23 Horse mackerel (S stock, NE Atlantic)
24 Norway pout
25 Herring (Canada, NAFO 4TVn - Spring spawner)
26 Capelin (Barents Sea)

The use of BRPs in management: results

- None of the world's major source fisheries for fishmeal and fish oil use ecosystem-based methods (EBM) to set biomass reference points.
- The management system used by the most productive fishery in the world – Peruvian anchovy – is rated at the second lower grade when *only* considering the use of BRPs in management.
- The Japanese anchovy fishery has target and limit reference points, and so appears as level 5 in this categorization. However, the management systems in place for other jurisdictions (*i.e.*, China) are unknown. The majority of the catch is taken by non-Japanese vessels.
- The management for the third to sixth most important fisheries rely on the lower half of SFP's 9-point scale devised to accommodate the management regimes.

The use of BRPs in management:

world catch split by management systems in place



Management system	Fishery	2007 Catch (t)
1	Chilean chub mackerel	203216
	Iberian sardine	96000
	Atlantic herring (Canada - 4VWX)	92000
	Sprat (North Sea)	84000
	Atlantic horse mackerel (Southern)	23400
	Total	**498616**
2	Peruvian anchovy	5800000
	Capelin (Barents Sea)	0
	Total	**5800000**
3	NE Atlantic blue whiting	1612000
	Atlantic herring (Norwegian spring-spawning)	1267000
	North Sea herring	388000
	Sprat (E Baltic Sea)	388000
	North Sea sandeels	206000
	Capelin (Icelandic)	202000
	Atlantic herring (Icelandic summer-spawning)	159000
	Atlantic horse mackerel (Western)	123400
	Norway pout	6000
	Total	**4351400**
4	Chilean anchovy	1350246
	Chilean jack mackerel	1292391
	Gulf menhaden	456576
	Chilean pilchard	269816
	Total	**3369029**
5	Japanese anchovy	1648000
	Atlantic herring (Canada - 4TVn - autumn spawner)	47600
	Atlantic herring (Canada - 4TVn - spring spawner)	3789
	Total	**1699389**
6	NE Pacific sardine (US, Mexico, Canada)	283000
	Atlantic herring (US)	85819
	Total	**368819**
7	Atlantic menhaden	201200
	Total	**201200**
8	NA	**0**
9	NA	**0**

Sustainability status: biomass and harvest levels

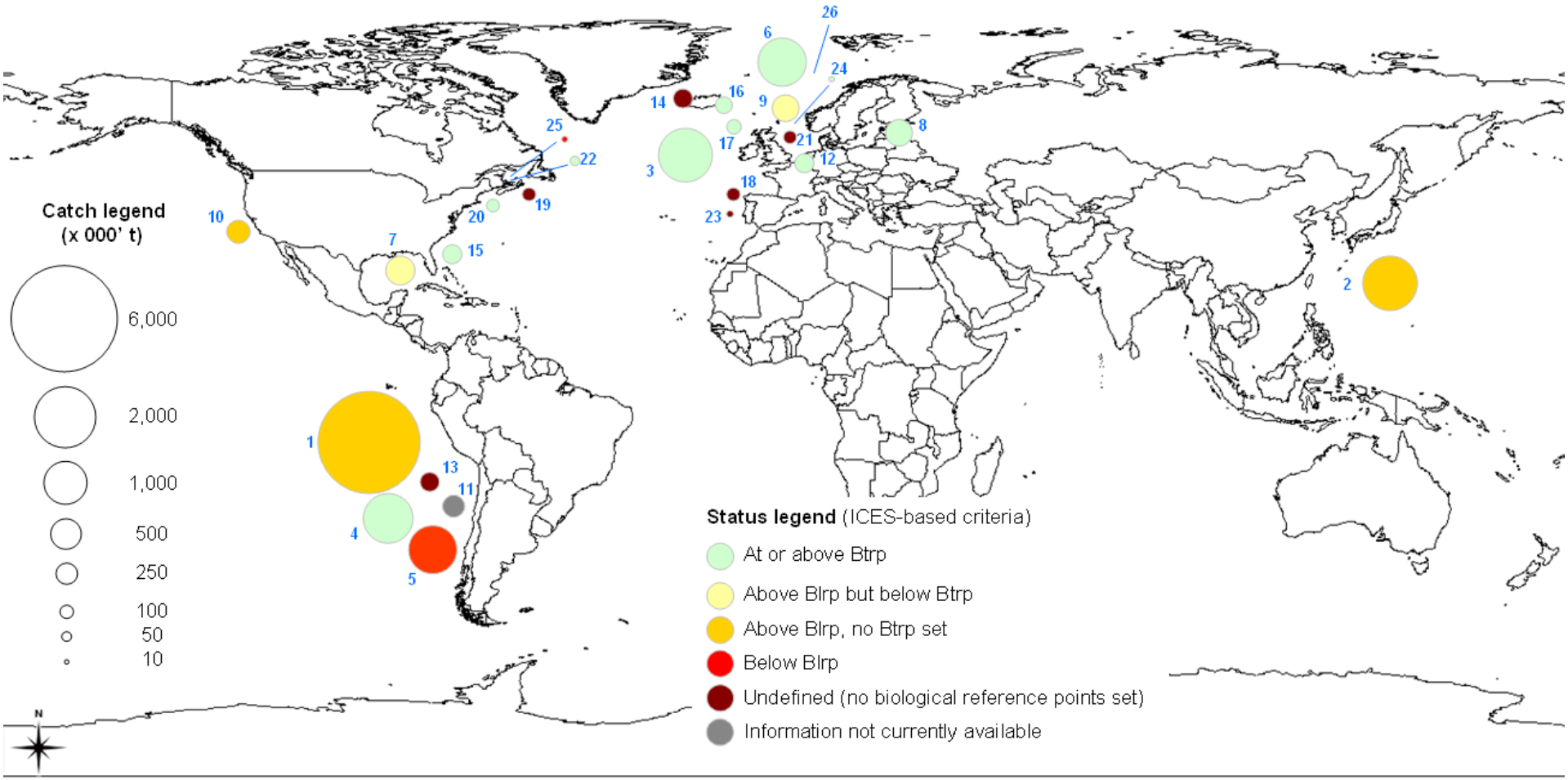
- Analyzing both biomass and harvest levels (e.g., fishing mortality, harvest rate) against reference points is required because while the former provides a current view, the latter helps to anticipate future changes in biomass status.

- The sustainability status of the fisheries provided in the following slides are in light of the latest stock assessment available (e.g., for all fisheries within the ICES area of the NE Atlantic the information is updated to the late fall of 2008).

- The status (biomass and harvest levels) criteria have been standardized to the ICES rough principles, also shared by other organizations such as the NOAA and DFO, and evaluated against the limit and target thresholds (for both biomass and fishing mortality F or proxy).

  - Caveat: sustainability status is judged here against the currently used reference points. As noted previously, where these exist, they are single-species, not ecosystem-based reference points.

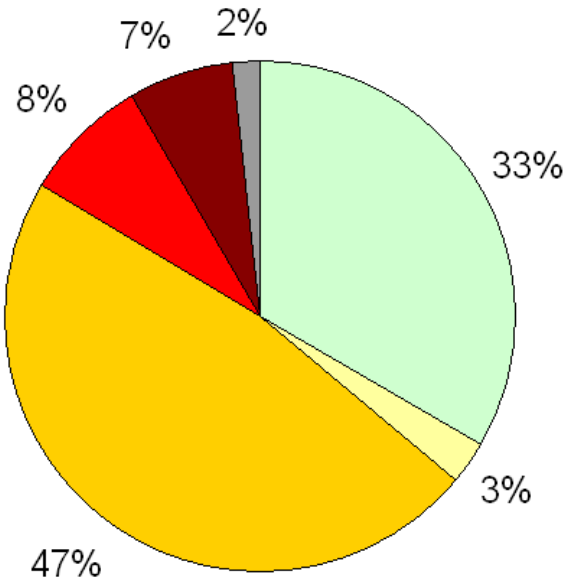
The status of fisheries – biomass levels



Legend of fisheries

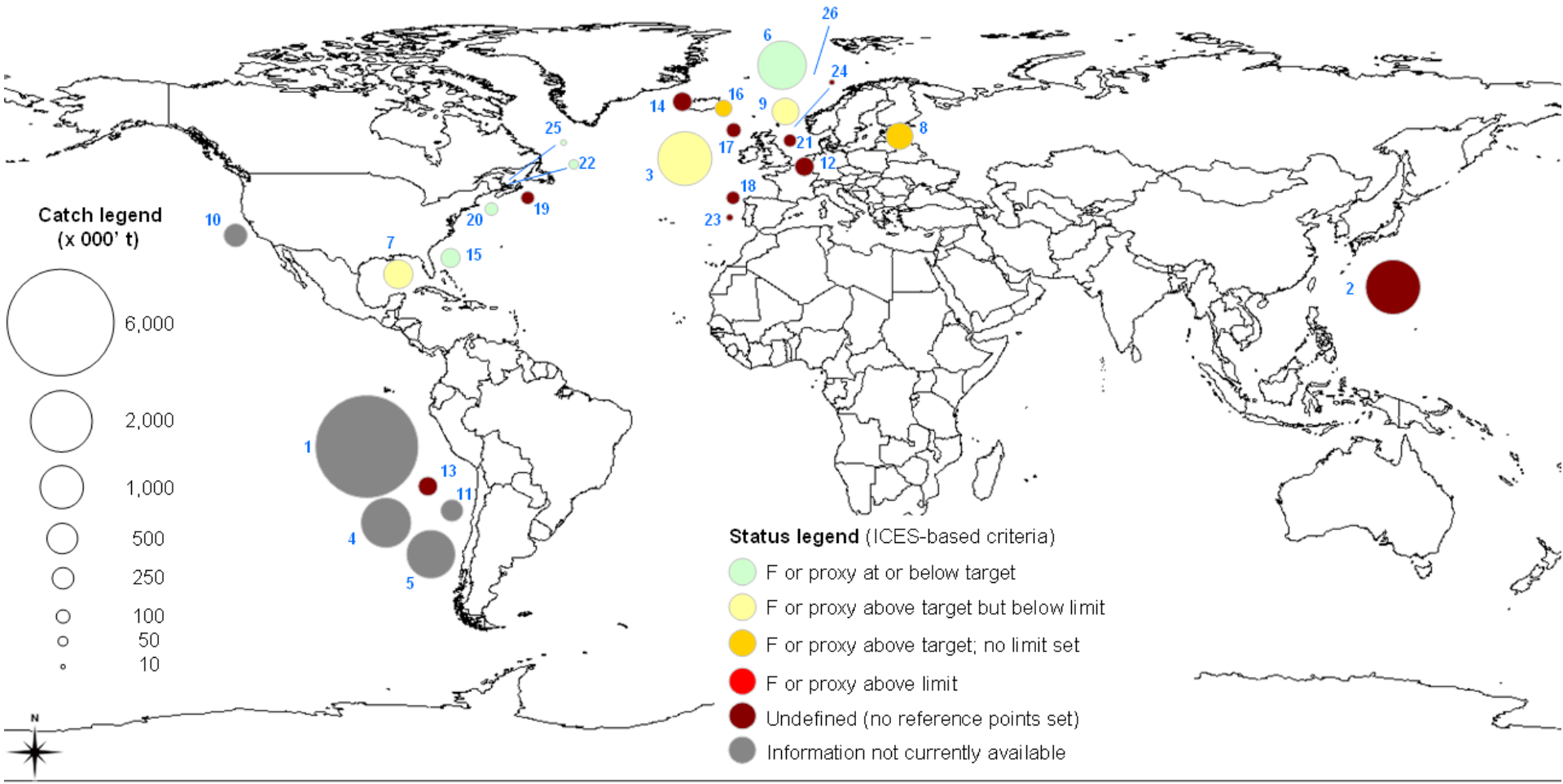
1	Peruvian anchovy	8	Sprat (Baltic Sea)	15	Menhaden (US, Atlantic)	22	Herring (Canada, NAFO 4TVn - Autumn spawner)
2	Japanese anchovy	9	Herring (North Sea)	16	Herring (Icelandic Summer-spawning)	23	Horse mackerel (S stock, NE Atlantic)
3	Blue whiting (NE Atlantic)	10	Pacific sardine (US, Mexico, Canada)	17	Horse mackerel (W stock, NE Atlantic)	24	Norway pout
4	Chilean anchovy	11	Chilean sardine	18	Iberian sardine	25	Herring (Canada, NAFO 4TVn - Spring spawner)
5	Chilean jack mackerel	12	Sandeels (North Sea)	19	Herring (Canada, NAFO 4VWX)	26	Capelin (Barents Sea)
6	Herring (Norwegian Spring-spawning)	13	Chilean chub mackerel	20	Herring (US, Atlantic)		
7	Menhaden (US, Gulf of Mexico)	14	Capelin (Icelandic)	21	Sprat (North Sea)		

World catch split by biomass level status



Biomass level status	Fishery	2007 catch (t)
At or above Btrp	NE Atlantic blue whiting	1612000
	Chilean anchovy	1350246
	Atlantic herring (Norwegian spring-spawning)	1267000
	Sprat (E Baltic Sea)	388000
	North Sea sandeels	206000
	Atlantic menhaden	201200
	Atlantic herring (Icelandic summer-spawning)	159000
	Atlantic horse mackerel (Western)	123400
	Atlantic herring (US)	85819
	Atlantic herring (Canada - 4TVn - autumn spawner)	47600
	Norway pout	6000
	Total	**5446265**
Above Blrp but below Btrp	Gulf menhaden	456576
	Capelin (Barents Sea)	0
	Total	**456576**
Above Blrp; no Btrp set	Peruvian anchovy	5800000
	Japanese anchovy	1648000
	NE Pacific sardine (US, Mexico, Canada)	283000
	Total	**7731000**
Below Blrp	Chilean jack mackerel	1292391
	Atlantic herring (Canada - 4TVn - spring spawner)	3789
	Total	**1296180**
Undefined (no reference points set)	North Sea herring	388000
	Chilean chub mackerel	203216
	Capelin (Icelandic)	202000
	Iberian sardine	96000
	Atlantic herring (Canada - 4VWX)	92000
	Sprat (North Sea)	84000
	Atlantic horse mackerel (Southern)	23400
	Total	**1088616**
Info not available	Chilean pilchard	269816
	Total	**269816**

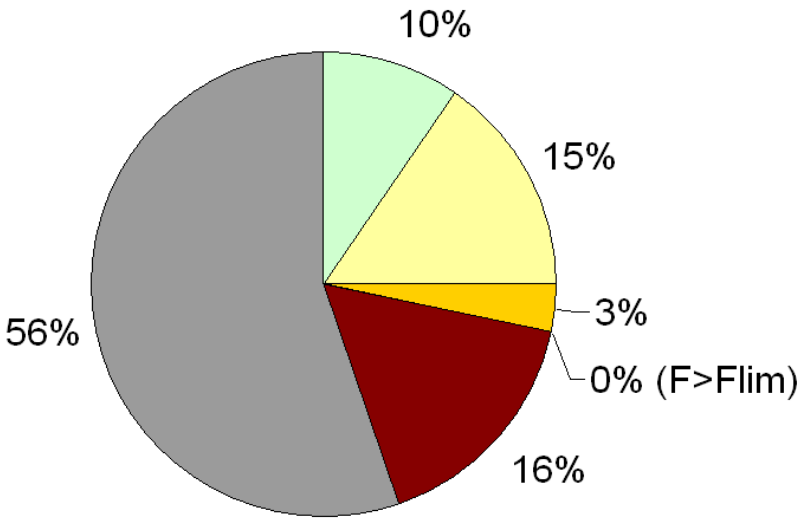
The status of fisheries – harvest levels



Legend of fisheries

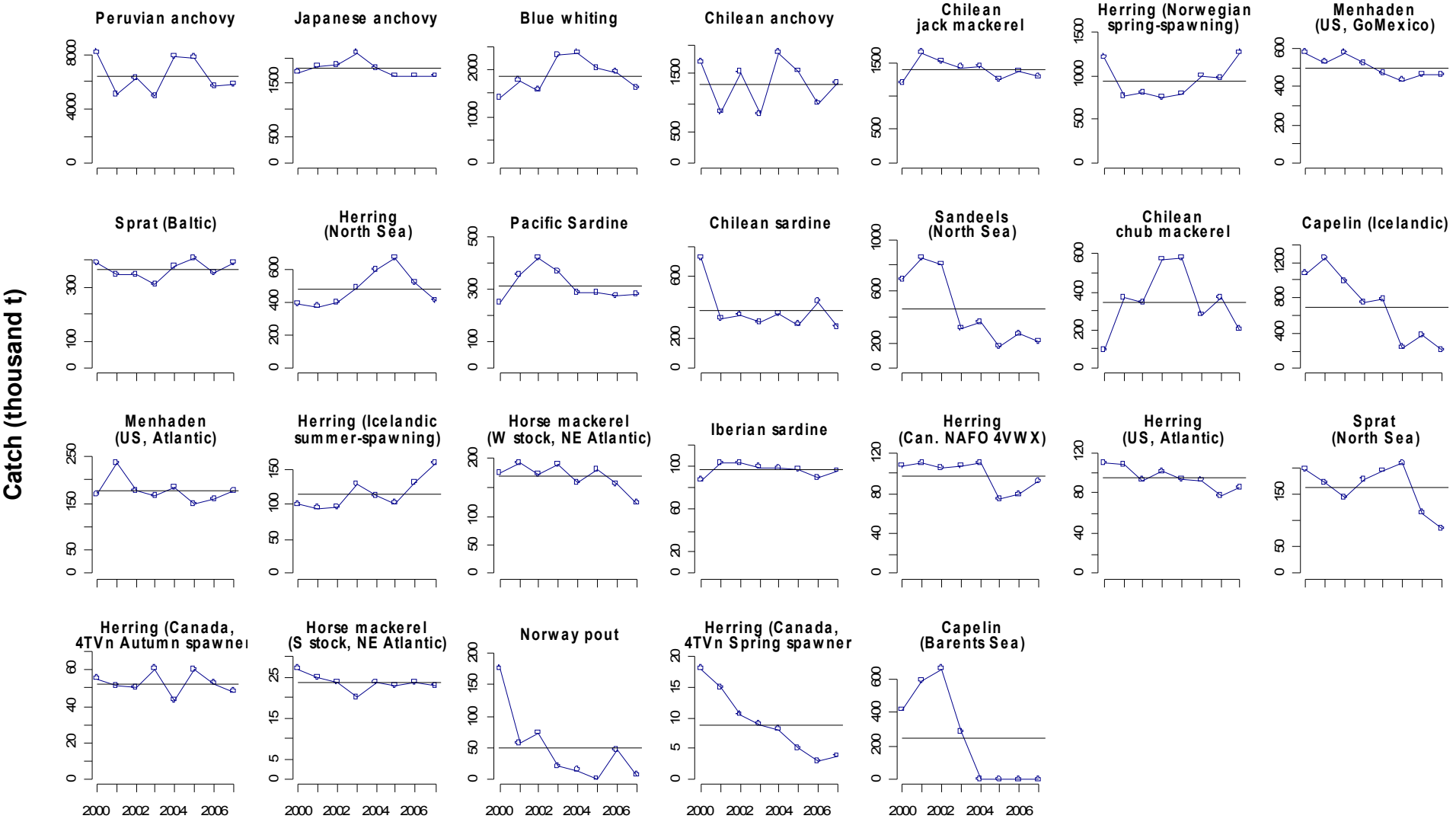
1 Peruvian anchovy
2 Japanese anchovy
3 Blue whiting (NE Atlantic)
4 Chilean anchovy
5 Chilean jack mackerel
6 Herring (Norwegian Spring-spawning)
7 Menhaden (US, Gulf of Mexico)
8 Sprat (Baltic Sea)
9 Herring (North Sea)
10 Pacific sardine (US, Mexico, Canada)
11 Chilean sardine
12 Sandeels (North Sea)
13 Chilean chub mackerel
14 Capelin (Icelandic)
15 Menhaden (US, Atlantic)
16 Herring (Icelandic Summer-spawning)
17 Horse mackerel (W stock, NE Atlantic)
18 Iberian sardine
19 Herring (Canada, NAFO 4VWX)
20 Herring (US, Atlantic)
21 Sprat (North Sea)
22 Herring (Canada, NAFO 4TVn - Autumn spawner)
23 Horse mackerel (S stock, NE Atlantic)
24 Norway pout
25 Herring (Canada, NAFO 4TVn - Spring spawner)
26 Capelin (Barents Sea)

World catch split by harvest level status



Harvest level status	Fishery	2007 catch (t)
F or proxy below Ftrp	Atlantic herring (Norwegian spring-spawning)	1267000
	Atlantic menhaden	201200
	Atlantic herring (US)	85819
	Atlantic herring (Canada - 4TVn - autumn spawner)	47600
	Atlantic herring (Canada - 4TVn - spring spawner)	3789
	total	**1605408**
F or proxy above target but below limit	NE Atlantic blue whiting	1612000
	Gulf menhaden	456576
	North Sea herring	388000
	total	**2456576**
F or proxy above target; no limit set	Sprat (E Baltic Sea)	388000
	Atlantic herring (Icelandic summer-spawning)	159000
	total	**547000**
F or proxy above limit	NA	**0**
Undefined (no reference points set)	Japanese anchovy	1648000
	North Sea sandeels	206000
	Chilean chub mackerel	203216
	Capelin (Icelandic)	202000
	Atlantic horse mackerel (Western)	123400
	Iberian sardine	96000
	Atlantic herring (Canada - 4VWX)	92000
	Sprat (North Sea)	84000
	Atlantic horse mackerel (Southern)	23400
	Norway pout	6000
	Capelin (Barents Sea)	0
	total	**2684016**
Info not available	Peruvian anchovy	5800000
	Chilean anchovy	1350246
	Chilean jack mackerel	1292391
	NE Pacific sardine (US, Mexico, Canada)	283000
	Chilean pilchard	269816
	total	**8995453**

The status of reduction fisheries: individual catch trends (2000-07)



The status of reduction fisheries: individual catch trends (2000-07) – notes

- Declining catches may indicate declining biomass, or they may indicate management measures are being taken to reduce fishing mortality and allow fisheries to rebuild. Thus this slide should not be used to infer trends in the status of the fisheries. However, the trends do provide valuable information in explaining past supplies and likely supplies in the immediate future.

- The 2007 catch for 18 of the 26 fisheries was below average 2000-2007 levels. 10 fisheries exhibit a downward trend in recent years, while 14 show little or no trend over the period. Only 2 (Icelandic and Norwegian herring) exhibit an upward trend.

Anticipating 2009 – NE Atlantic

- Major changes on global production are anticipated for 2009 in line of both advised and set quotas

- Increasing: the 2009 quota for **NSS herring** increased by 30% and 74% comparing to 2007 catch and to the 2000-2007 average catch, respectively; the 2009 quota for **Baltic sprat** increased by 3% and 10%, using the same reference for comparison.

- Decreasing: the 2009 quota for **blue whiting**, a major source of fish for reduction purposes was cut down by 62% comparing to 2007 catch; cuts will apply to **North Sea herring** (48% comparing to 2007) and **Icelandic capelin** (to zero catch – if managers comply with the scientific advice). The **Barents Sea capelin** fishery has not reopened in 2009.

Anticipating 2009 – NE Atlantic

(the base for calculations is the set TAC when available; the advised TAC is used otherwise)

Fisheries within the ICES area (NE Atlantic)	TAC 2009 ('000 t)		Percentage to	
	Advised	Set	2007 catch	2000-2007 average catch
Blue whiting (NE Atlantic)	*384*	**606**	**-62%**	**-68%**
Herring (Norwegian Spring-spawning)	*1643*	**1643**	**30%**	**74%**
Sprat (Baltic Sea)	*291*	**400**	**3%**	**10%**
Herring (North Sea)	*184.5*[*1]	**209.6**	**-48%**	**-56%**
Sandeels (North Sea)	[*3]	*NA*	*NA*	*NA*
Capelin (Icelandic)	**0**	*NA*	**-100%**	**-100%**
Herring (Icelandic Summer-spawning)	**131**	*NA*	**-17%**	**14%**
Horse mackerel (W stock, NE Atlantic)	*180*	**170**	**38%**	**1%**
Iberian sardine	**71**	*NA*	**-26%**	**-26%**
Sprat (North Sea)	*NA* [*2]	**170**[*2]	**102%**	**6%**
Horse mackerel (S stock, NE Atlantic)	*25*	**57.8**	**151%**	**143%**
Norway pout	*35*	**28.3**	**371%**	**-43%**
Capelin (Barents Sea)	*390*	**0**	-	-

[1]Average of advised TAC: 180-189kt; [2] Advice not yet available / set TAC is provisional; [3] ICES advice is that "the fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to B_{pa} by 2010".

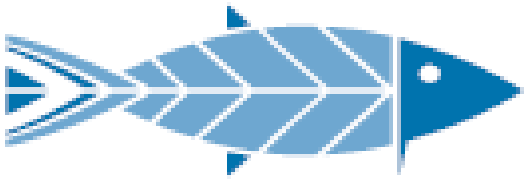
Anticipating 2009 – South America

- In **Peru** an individual vessel quota system (IVQ) will apply for the 2009 fishing season for the Northern-Central anchovy stock and a TAC will apply (Nb a similar quota system is anticipated for the Southern stock fishery).
  - First season TAC is routinely set in April and the IVQ system and the Southern TAC could result in decreased landings but improved control and management of both fisheries.
- In **Chile**, the 2009 quotas for the main reduction fisheries were cut by 19% and 12% (compared to 2008 and 2007 respectively). However, catches were below the TAC in previous years. If the TAC is caught this year, then actual catches would increase by 18% relative to 2008.

Conclusions

- **Northeast Atlantic**: if scientific advice is followed, catches from the 13 fisheries within the ICES area will drop by 725,000 t in 2009 compared to 2007, and by 1,510,500 t compared to the 2000-2007 average global production due to these fisheries.

- **South America**: Major positive changes are expected to occur in the management of the Peruvian anchovy fishery, with a slight drop in landings. In Chile, the outlook for 2009 catches is unclear. TACs are not a reliable predictor of catches. 2009 TACs are down compared to TACs last year, but potentially 500,000 tons above the recent landings.



This presentation is an excerpt from

SFP, 2009. *Sustainability overview of world fisheries used for reduction purposes: based on information from FishSource.org*, by P. Sousa, D. Beveridge, D. Anggraeni, E. Godelman, and J. Cannon. Sustainable Fisheries Partnership Report Series, *SFP Technical Report*, 1: 40 p. *(in preparation)*

SFP Mission

The mission of the Sustainable Fisheries Partnership is to maintain healthy ocean and aquatic ecosystems, enhance fishing and fish-farming livelihoods, and secure food supplies. More at http://www.sustainablefish.org.

FishSource

FishSource is an online information resource about the status of fish stocks and the environmental performance of fisheries. FishSource is a Program of the Sustainable Fisheries Partnership. More at http://www.fishsource.org.

Glossary

B20%: Level of spawning stock corresponding to a fraction (here 20%) of the unexploited biomass. Virgin biomass is estimated as the point where the replacement line for F=0 intersects the stock-recruitment relationship or as the biomass from a spawning stock per recruit curve when F=0 and average recruitment is assumed.

Blim: Limit reference point for spawning stock biomass (SSB) or minimum biomass. Below this value recruitment is expected to be 'impaired' or the stock dynamics are unknown. Below Blim there is a higher risk that the stock could "collapse". The meaning of "collapse" is that the stock has reached a level where it suffers from severely reduced productivity.

Blrp: a lower limit reference point for spawning stock biomass (SSB) used in fisheries management. Several measures can be used to define Blrp (e.g., Blim, B20%)

Bmsy: Biomass at MSY. Biomass corresponding to Maximum Sustainable Yield from a production model or from an age-based analysis using a stock recruitment model. Often used as a biological reference point in fisheries management, it is the calculated long-term average biomass value expected if fishing at FMSY.

Bpa: precautionary reference point for spawning stock biomass (SSB). It is precautionary buffer to avoid that true SSB is at Blim when the perceived SSB is at Bpa. In general, management advice is aimed at avoiding the risk that the spawning stock falls below Bpa.

Btrp: an upper target reference point for spawning stock biomass used in fisheries management. Several measures can be used to define Btrp (e.g., Bmsy, B40%).

Flim: limit reference point for fishing mortality (mean over defined age range). The limit reference point for fishing mortality Flim is the fishing mortality that is expected to drive the stock to the biomass limit when it is maintained over time. This is the exploitation rate that is expected to be associated with stock 'collapse' if maintained over a longer time.

Fpa: precautionary reference point for fishing mortality (mean over defined age range). This is a precautionary buffer to avoid that true fishing mortality is at Flim when the perceived fishing mortality is at Fpa. In general, management advice is aimed at avoiding the risk that fishing mortality rate increases above Fpa.

Ftrp: target fishing mortality in a management plan or management strategy.

Harvest Rate: (= harvest ratio) ratio between landings or catch in weight and stock (spawning, fishable/total) abundance.

ICES: The International Council for the Exploration of the Sea (ICES), which is a network of more than 1600 scientists from 200 institutes linked by an intergovernmental agreement (the ICES Convention) to add value to national research efforts. ICES is the prime source of scientific advice on the marine ecosystem to governments and international regulatory bodies that manage the North Atlantic Ocean and adjacent seas.

MSC Full Assessment: an assessment process for getting global certification and eco-label for sustainable and well managed fisheries. If the fisheries pass the assessment, they will be awarded MSC certification. The MSC is the world's leading certification and ecolabelling program for sustainable seafood.

TAC: Total Allowable Catch. The TAC is the total catch allowed to be taken from a resource in a specified period (usually a year), as defined in the management plan. The TAC may be allocated to the stakeholders in the form of quotas as specific quantities or proportions.

Trash Fish: Discarded fish. Fish with little or no commercial value and not sorted by species before landing. Usually part of the trawlers' by-catch. In the Gulf of Thailand, trash fish is used for aquaculture. It can also be used for fishmeal production. In many developing countries (e.g. China, India) it is used extensively for human consumption.

Sources:

FAO. Undated. Fishery Glossary. http://www.fao.org/fi/glossary/

ICES. 2008. Report of the ICES Advisory Committee, 2008. Book 1. Introduction, Overviews and Special Requests. http://www.ices.dk/products/icesadvice/2008/ICES%20ADVICE%202008%20Book%201.pdf

ICES. Undated. ICES-Fish Map Glossary. http://www.ices.dk/marineworld/fishmap/pdfs/glossary.pdf

MSC homepage. http://www.msc.org/