

# World Fisheries



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Fishing activity is very old. Probably primitive man caught the fish with hands, or pulling sticks and stones on the shoals. The animal bone hook seems to have been invented around 10.000AC. Man always exploited natural resources. Firstly through hunting and roots and seeds collection and later on by the development of agriculture and the domestication of animals. The first animals to be domesticated were sheep, goats (11,000 BC), dogs (9.000AC) and cows (8.000AC).

With domestication, some animals became very dependent on men. However, some of them were able to return to the wild when abandoned (eg bagual bull and pig montero in the Pantanal of Brazil and wild buffalo Marajo Island) .

Likewise, man led many animals to extinction (eg the Eskimos in the Bering Strait extincted a species of marine manatee). The Amerindians who came from Siberia by the land bridge through the Bering Strait (10.000AC) brought sophisticated hunting techniques and in just 1000 years three species of mammoth and one species of a giant bison where stinct. The Polynesians extincted 40 terrestrial bird species in Hawaii and 20 species in New Zealand when they came 1000 years ago.

Other animals were extincted due to the introduction of alien species (e.g. by abandoning cats and dogs in fragile oceanic islands far from the continents)

The Aku-aku in Pascoa Island.

Other animals and plants were extinct because man destroyed their habitat. Until the sixteenth century there was an extinction every 13 days. Now there is one every thirteen minutes, mostly of insects and terrestrial and aquatic microorganisms.

Extinction of two species of marine rays (probably extinct by fishing).

- Overfishing – by growth, recruitment
- Extinction – Commercial (may be reversible), biological (irreversible) and ecosystemic.
- WWII consequences – increasing world fisheries. North sea fish stocks biomass were down to 1939 levels as soon in 1947. Women started to work and so the frozen fish market increased (Birds Eye) although the Europeans have an old habit of accumulate food for the winter.
- Ration for pets - cheaper animal protein derived from fish.

Tragedy of the commons : Open resources , as fish stocks need management, otherwise go extinct.

Cod war – UK x –Iceland

Lobster war – Brazil x France



Thomas Huxley a distinguished XIX century zoologist, popularly known as Darwin's bulldog, mistakenly said that the sea fishing resources are inexhaustible due to fish high fertility, particularly cod, in the early 50s, there was an exaggerated optimism due to post-war reconstruction and some government officers (mostly economists) estimated that the potential sustainable sea fish stocks would reach a billion/year. Presently we perceive that there is an inherent uncertainty about the fish as they vary continuously. This uncertainty shall be taken into account when trying to model the aquatic ecosystem. This uncertainty may appear traversite in three different ways (i) – random fluctuations; (ii) - uncertainty about the model parameters and states of Nature (iii) - structural uncertainty, which may be a dissimulated jargon concerning our ignorance, as Fisheries Ecology is a “difficult” subject, where our object of study, the fish, is only seen when it is dead. The parameters uncertainty may be examined through different quantitative methods as non-estimation, statistics (frequentist and Bayesian), fuzzy logic, control theory, etc. When these gears fail to mimic the fish stock we must be humble, confess our ignorance and try to better understand the ecosystem.

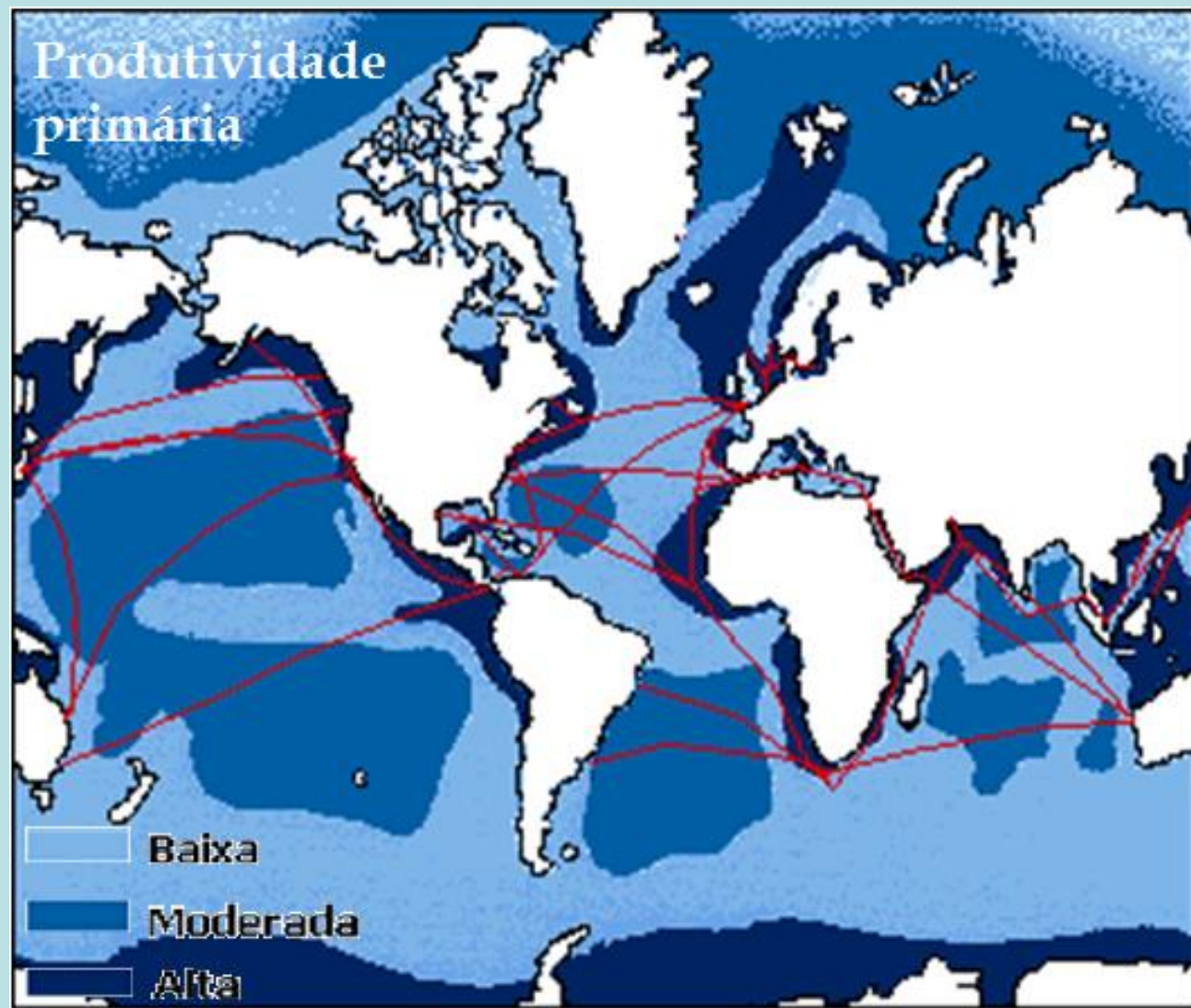
- According to FAO – UN there was a constant increase of the world catches up to the mid-90s when they began to stabilize, although Watson & Pauly suggested that in reality they are declining on average 10% / year since 1988. This apparent increase is due to the fact that the Chinese officials, under pressure from the central government are inflating the catches in order to show efficiency. FAO estimates that between 47-50% of the world's fish stocks are fully exploited, 15-18% and 9-10% "depleted". A sudden drop in landings occurred worldwide in 1998 due to El Niño which influenced mainly fisheries in the Southeast Pacific, a region very productive mainly due to the anchoveta *Engraulis ringens* and Chilean jack mackerel *Ttachurus murphyi*. In 1999 about 27 million fishers landed 92 million tonnes of fish (U.S. \$ 53.4 billion, captured by 23,014 boats above 100t - industrial fishing)
- The fish form an important part of the human diet. The average per capita consumption has increased considerably in the last 40 years, from 9kg/capita/yr in the 60 to 16 kg / capita / yr in 1997. In developed countries this rate rose from 19.7 to 27.7 kg / cap / year. In underdeveloped countries the rate increased from 4.9 to 7.8 kg / cap / year, showing here the imbalance. In poor countries the fish may be responsible for only 20% of protein intake, especially in the interior of NE Brazil. And yet some African s have even less access to fish.

Considering the productive terrestrial area occupation, the cultivated land currently covers about 12% (something compared to the size of South America) of ice-free land surface, while land devoted to cattle grazing covers about 38% (the size of Africa). The ever expanding agricultural activities already changed 70% of vegetations fields, 50% savannah, 45% of temperate deciduous forests and 27% of tropical forests, reducing biodiversity. This loss of biodiversity, reduce the services offered by wildlife to agriculture, resulting in lower yields and higher demand for clearing vegetated area in order to compensate it.

Total planet area = 510.072.000 km<sup>2</sup>

From these, 148,94 km<sup>2</sup> (29,2%) are land landscape and 361.132.000 km<sup>2</sup> (70,8%) are water. Approximately 0.5% of the terrestrial area was occupied by urban areas (including roads and highways) in 2002.

The most productive ocean areas tend to concentrate in coastal resurgency areas (continents west coast). Example the Humboldt current and Benguela current. They leak the ocean bed bringing the inactive phosphorous to the water surface enriching it. Desmineralização dos continentes, by waeathering (rains and winds)





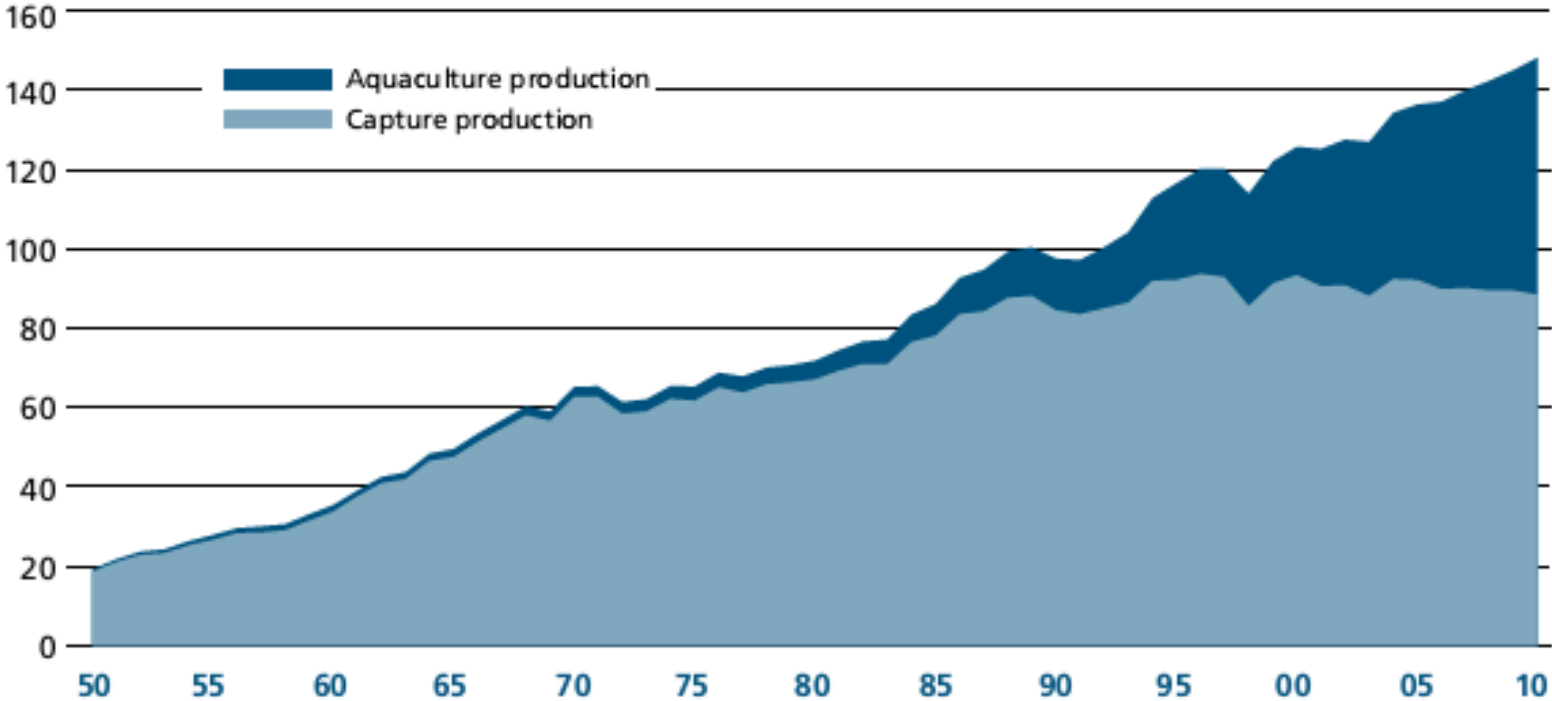
# PRODUÇÃO DE PESCADO NO MUNDO

Fonte: FAO (2012)	2006	2007	2008	2009	2010	2011
	<i>(Million tonnes)</i>					
<b>PRODUCTION</b>						
<b>Capture</b>						
Inland	9.8	10.0	10.2	10.4	11.2	11.5
Marine	80.2	80.4	79.5	79.2	77.4	78.9
<b>Total capture</b>	<b>90.0</b>	<b>90.3</b>	<b>89.7</b>	<b>89.6</b>	<b>88.6</b>	<b>90.4</b>
<b>Aquaculture</b>						
Inland	31.3	33.4	36.0	38.1	41.7	44.3
Marine	16.0	16.6	16.9	17.6	18.1	19.3
<b>Total aquaculture</b>	<b>47.3</b>	<b>49.9</b>	<b>52.9</b>	<b>55.7</b>	<b>59.9</b>	<b>63.6</b>
<b>TOTAL WORLD FISHERIES</b>	<b>137.3</b>	<b>140.2</b>	<b>142.6</b>	<b>145.3</b>	<b>148.5</b>	<b>154.0</b>
<b>UTILIZATION</b>						
Human consumption	114.3	117.3	119.7	123.6	128.3	130.8
Non-food uses	23.0	23.0	22.9	21.8	20.2	23.2
Population ( <i>billions</i> )	6.6	6.7	6.7	6.8	6.9	7.0
Per capita food fish supply ( <i>kg</i> )	17.4	17.6	17.8	18.1	18.6	18.8

Notes: Excluding aquatic plants. Totals may not match due to rounding. Data for 2011 are provisional estimates.

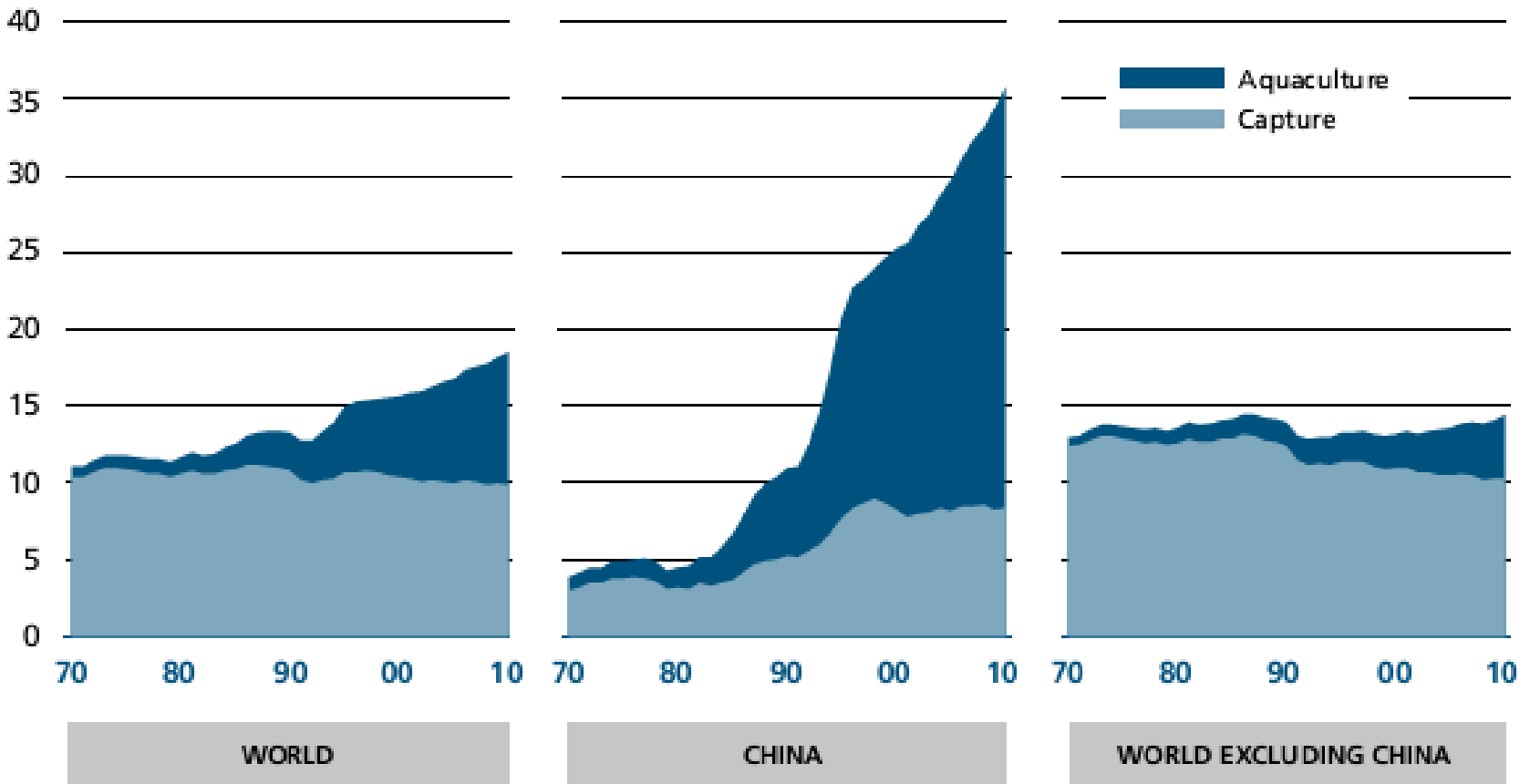
# World capture fisheries and aquaculture production

Million tonnes

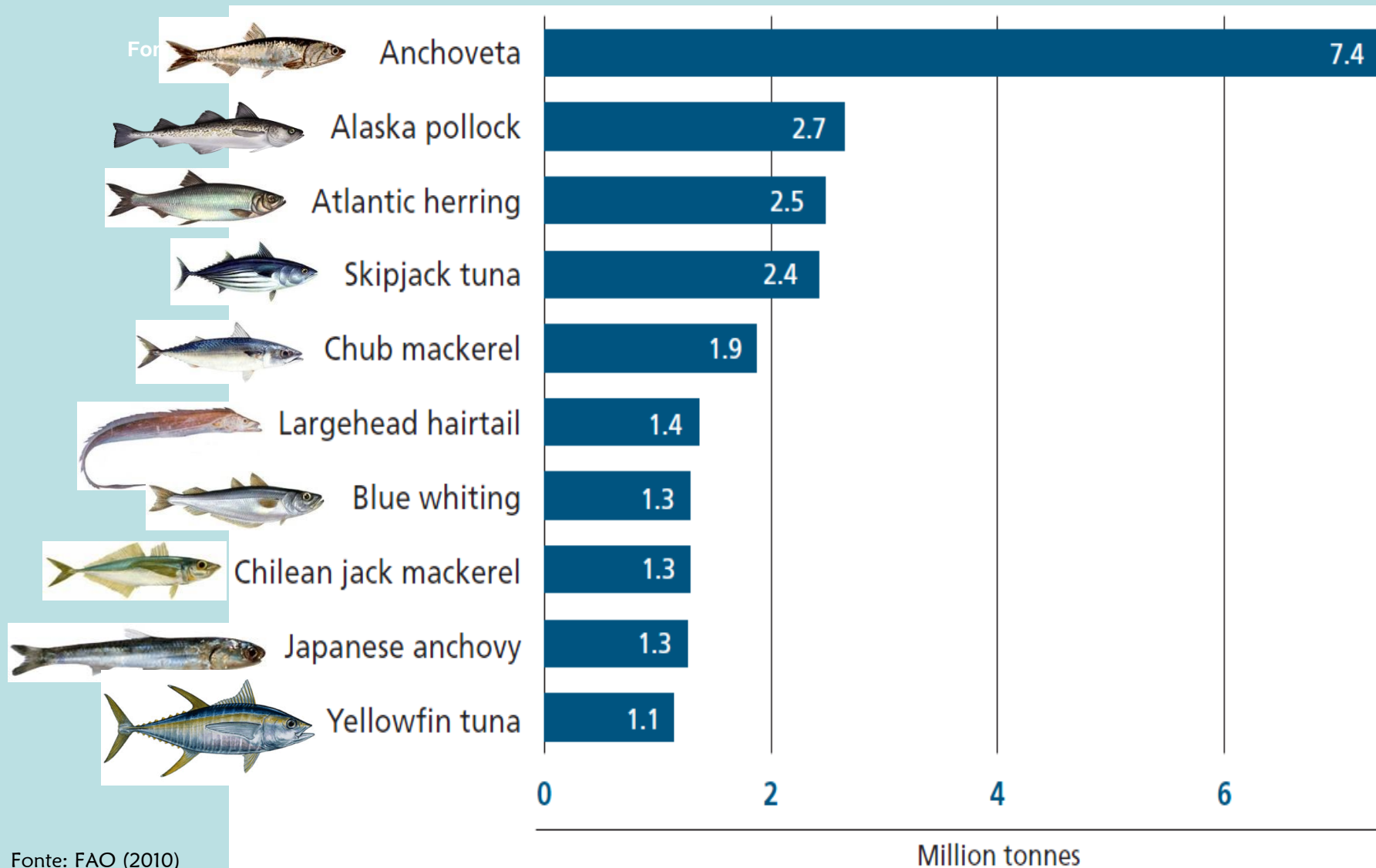


## Relative contribution of aquaculture and capture fisheries to food fish consumption

Fishery food supply (kg/capita)



## PRINCIPAIS PEIXES MARINHOS CAPTURADOS NO MUNDO



Fonte: FAO (2010)

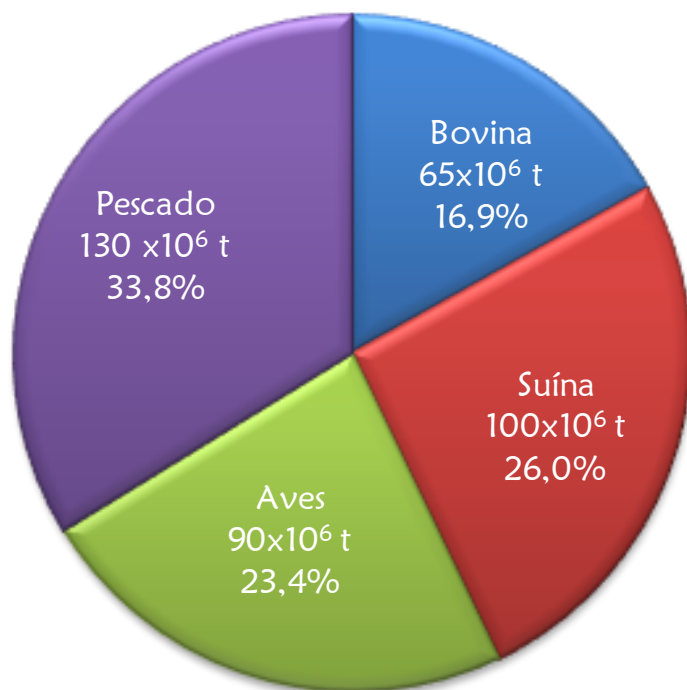
**Cardume de anchoveta do Pacífico – ordem de magnitude – trilhões de indivíduos – provavelmente o vertebrado mais abundante da Natureza!**



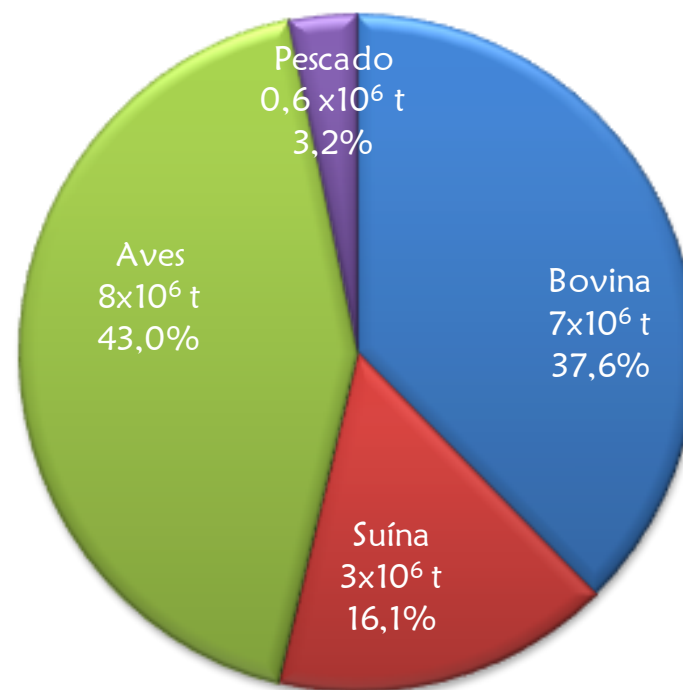
## REPRESENTATIVIDADE DO PESCADO NO MUNDO

The world fish production (fising + aquaculture) in 2010 employed directly/indirectly around 80 million people, about 10% of the world population.

Mundo



Brasil



Fontes de proteína animal para o consumo humano - 2011

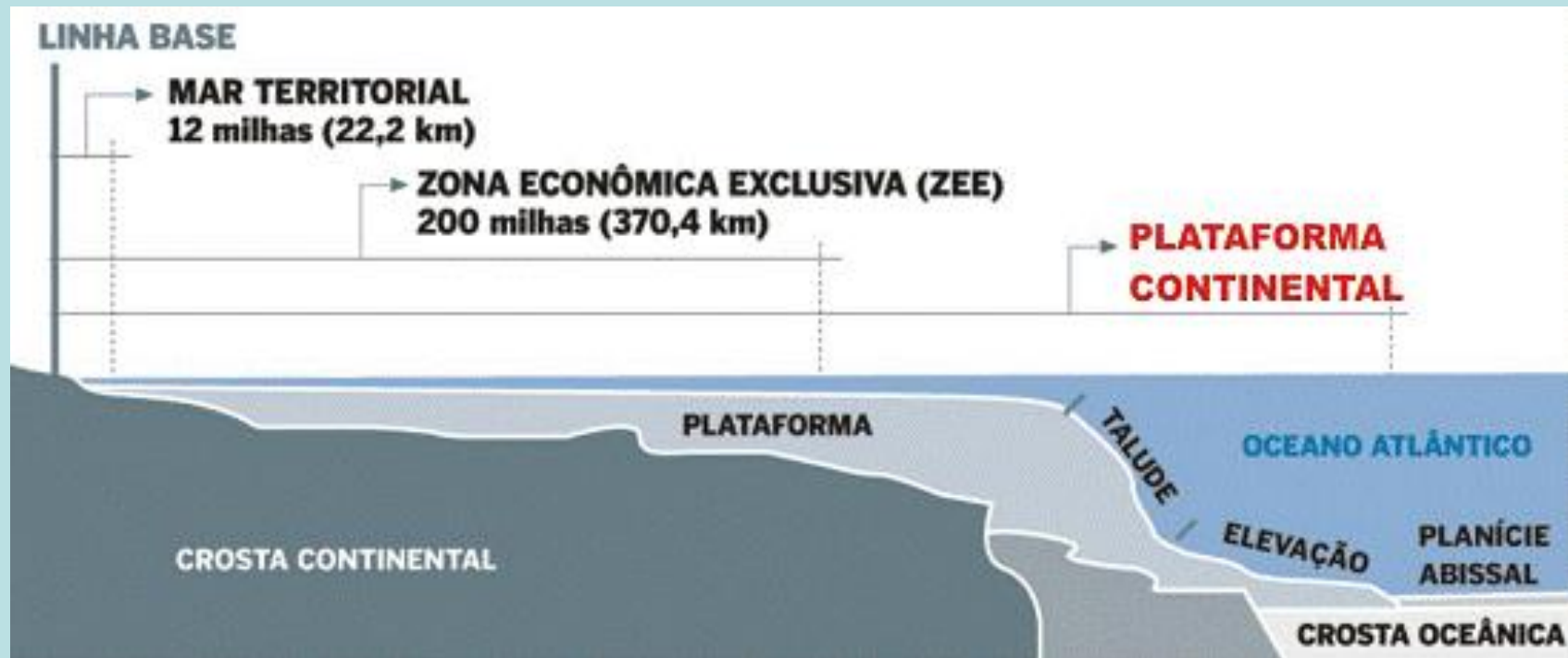
## O AMBIENTE MARINHO BRASILEIRO



Sistema de circulação oceânica no Brasil

## O AMBIENTE MARINHO BRASILEIRO

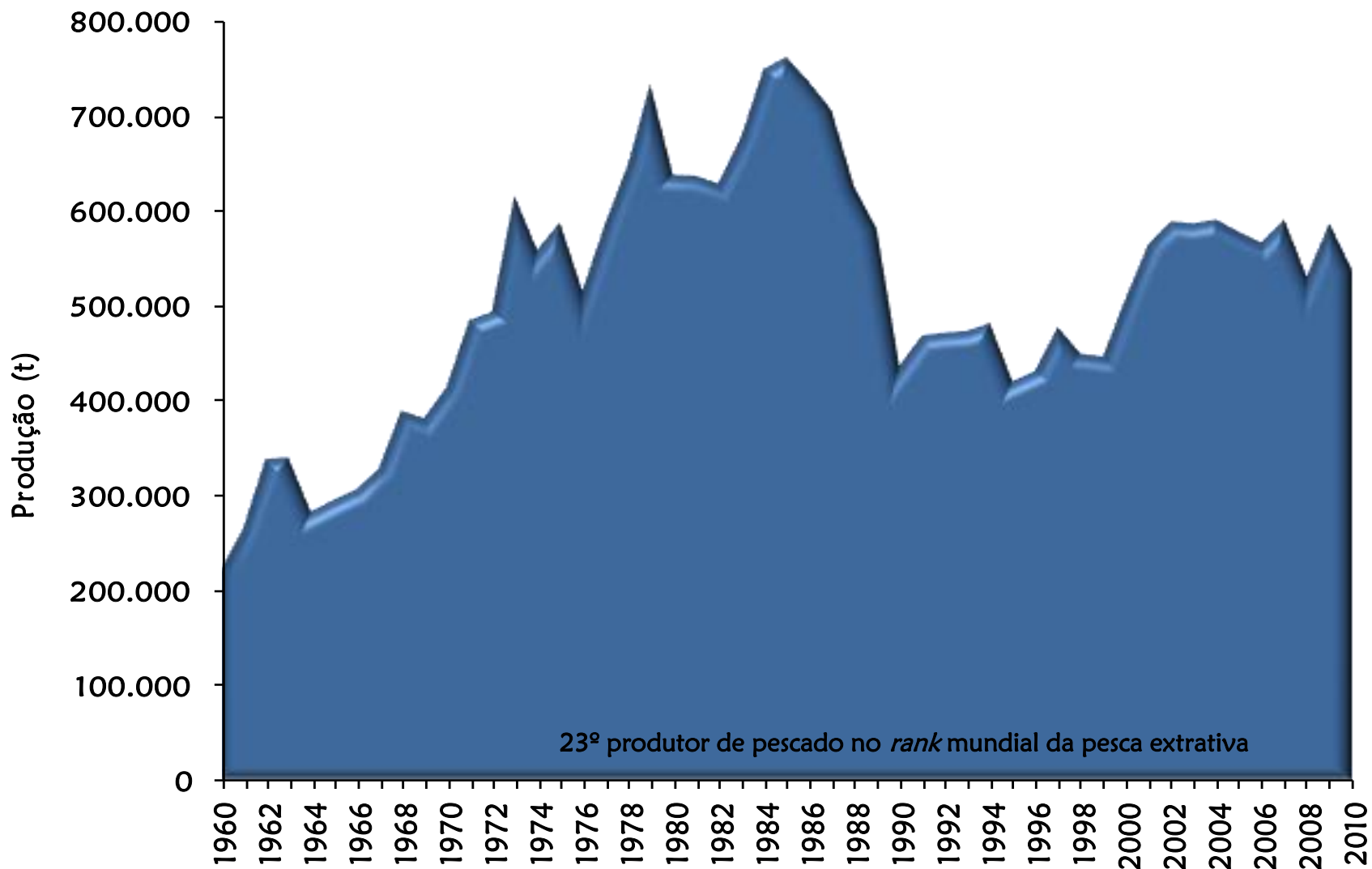
A Convenção das Nações Unidas sobre o Direito do Mar (CNUDM), em 1988, determina os limites marítimos em relação aos quais os Estados costeiros exercem jurisdição, consagrando os conceitos de mar territorial, zona contígua, zona econômica exclusiva.

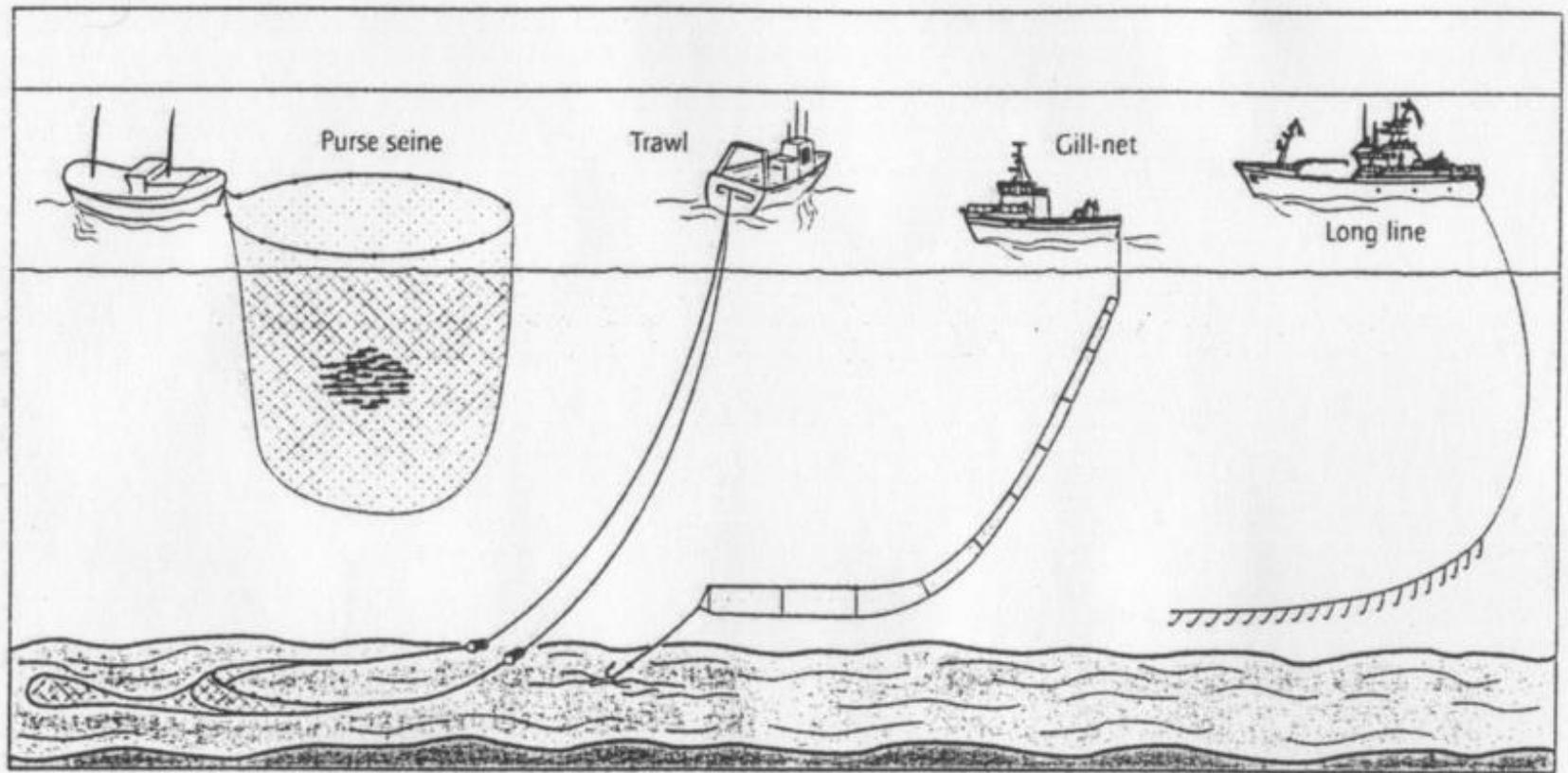


Limites marítimos do Brasil



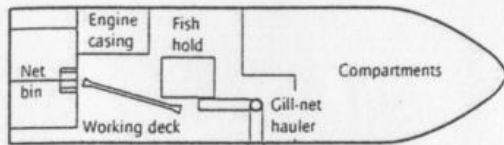
## PRODUÇÃO DA PESCA EXTRATIVA MARINHA NO BRASIL



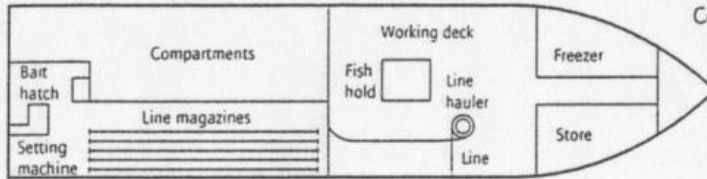


**Fig. 2.1** Main fishing capture techniques. From left to right: surrounding of fish shoals by purse seine, filtration of water masses by trawl at a higher speed than the fish are able to endure, gilling of fish that move into a net, attraction and hooking of fish by baited long line.

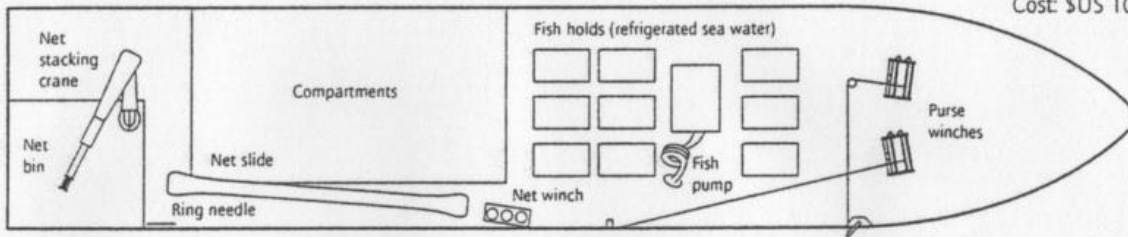
**Gill-netter**  
 24 × 7 m  
 500hp  
 Cost: \$US 2 million



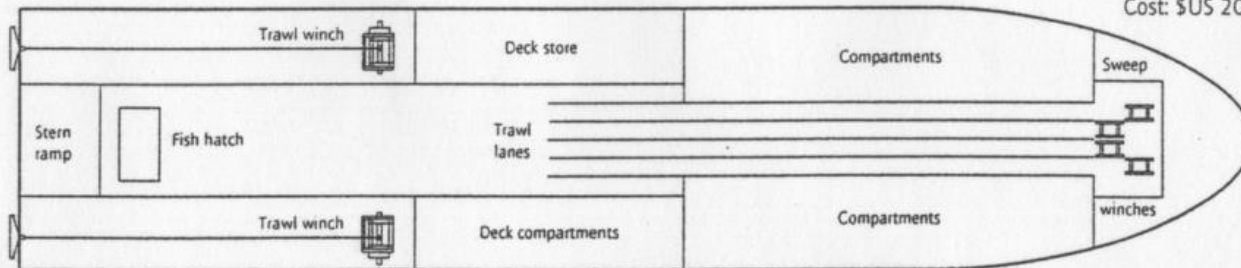
**Long liner**  
 34 × 8 m  
 800hp  
 Cost: \$US 5 million



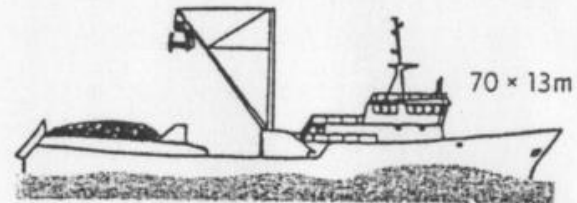
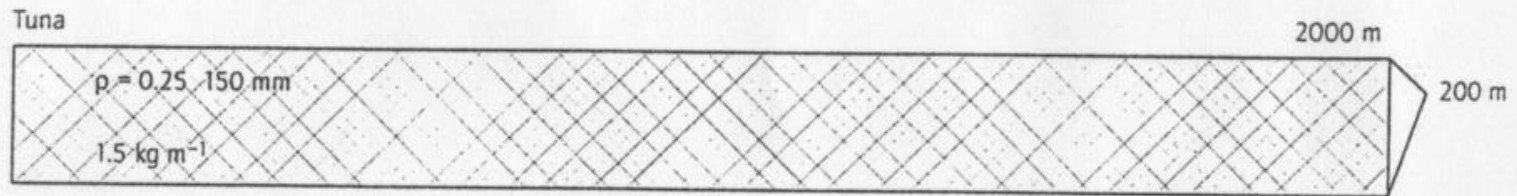
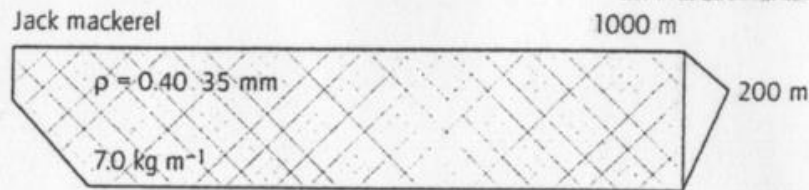
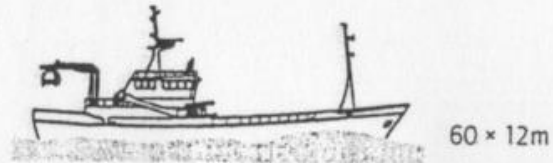
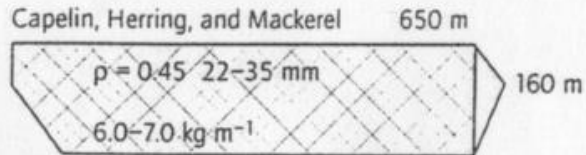
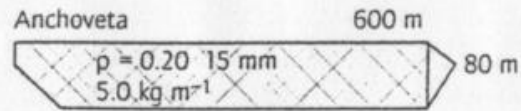
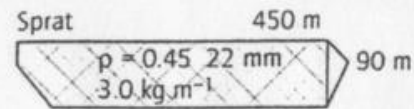
**Purse seiner**  
 55 × 11 m  
 3000hp  
 Cost: \$US 10 million



**Bottom trawler**  
 60 × 13 m  
 5000hp  
 Cost: \$US 20 million



**Fig. 2.2** Principal deck layout of main types of fishing vessels (provisional vessel size, engine power and building costs are indicated).



**Fig. 2.3** Relationships between fish species, vessel size and purse seine characteristics (length, depth, hanging ratio ( $\rho$ ), mesh size in mm and lead weight on ground rope are indicated).






















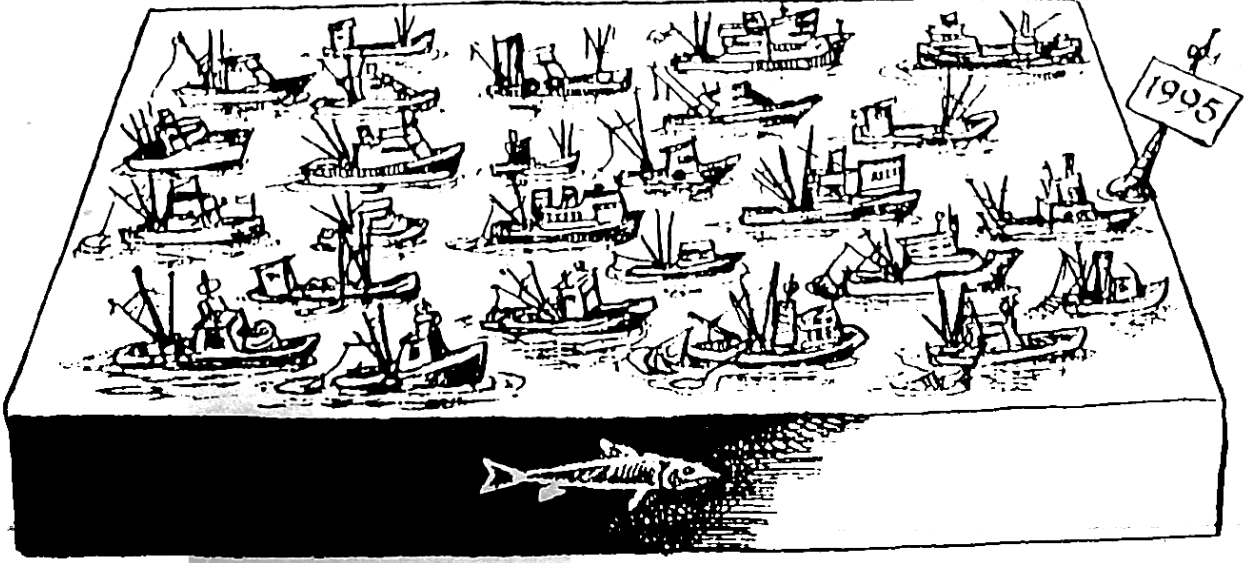
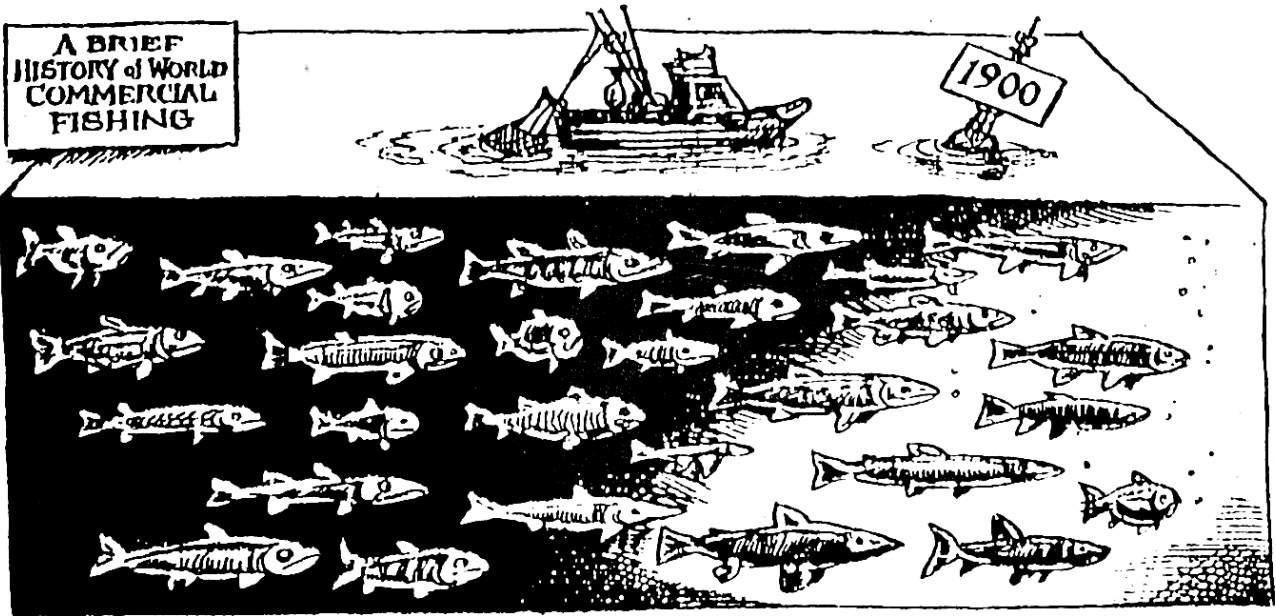
	Large-scale company-owned 	Small-scale artisanal 
Number of fishermen employed	 Around 450 000	  Over 12 000 000
Marine fish caught for human consumption	 Around 24 million tonnes annually	 Around 20 million tonnes annually
Capital cost of each job on fishing vessel	 \$\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$\$ \$10 000 to \$100 000	 \$ \$100 to \$1000
Bycatch discarded at sea	 Around 20 million tonnes annually	 Around 1 million tonnes annually
Marine fish caught for industrial reduction to meal and oil, etc.	 Around 19 million tonnes annually	 Almost none
Fuel oil consumption	 10 to 14 million tonnes annually	 1 to 2 million tonnes annually
Fish landed per tonne of fuel consumed	 =  2 to 5 tonnes	 =  10 to 20 tonnes
Fishermen employed for each \$1 million invested in fishing vessels	 10 to 100	 1000 to 10 000

Fig. 2.4 Comparison of large-scale commercial fisheries with small-scale artisanal fisheries. (Source: modified from Thomson 1980.)

# Pequeno barco de pesca artesanal



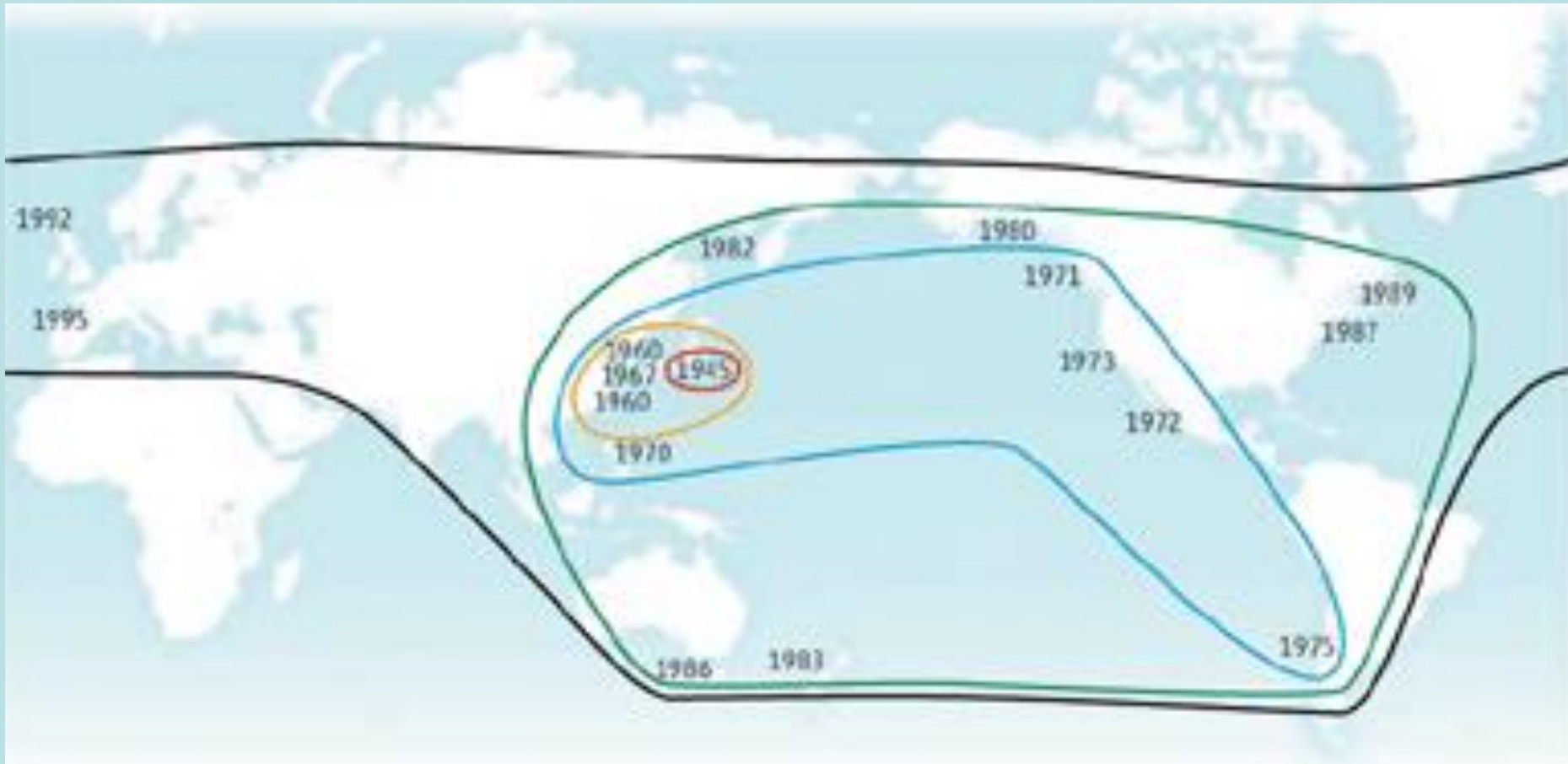
A BRIEF HISTORY of WORLD COMMERCIAL FISHING



Cartoonists & Writers Syndicate

**GUERRA DEL BACALAO Y DE LA GRILLO (LAGOSTA) CHINOS EN CHILE**

Marine resource exploitation can deplete stocks faster than regulatory agencies can respond. Institutions with broad authority and a global perspective are needed to create a system with incentives for conservation.



Exploração seqüencial do Ouriço-verde-do-mar (*Strongylocentrotus droebachiensis*) à partir de 1945, mostrando o efeito da globalização dos “bandidos errantes” na busca de novos estoques pesqueiros.



# Estado atual da exploração dos estoques pesqueiros mundiais

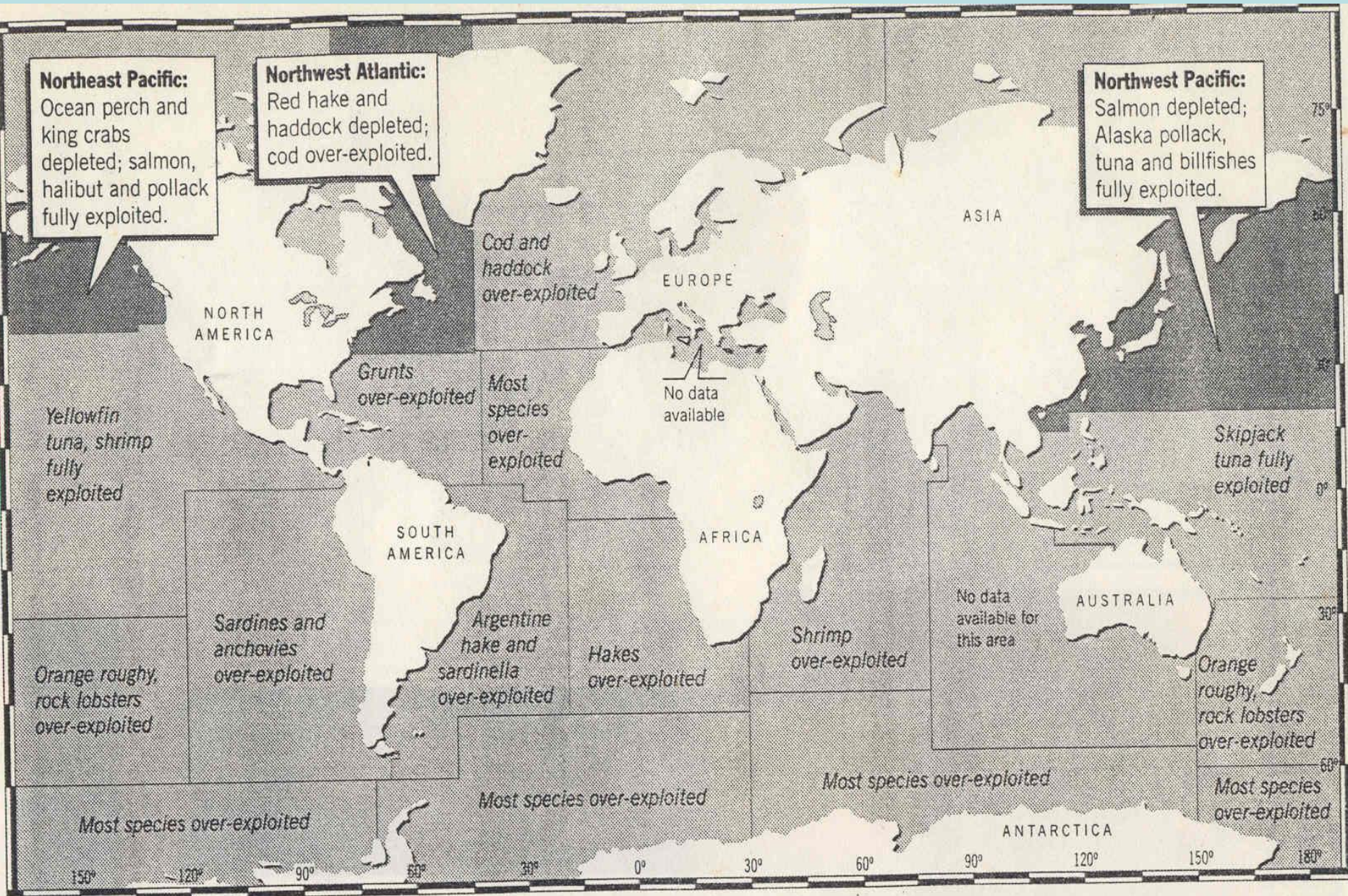


TABLE 1.1 Some Depleted Marine Resource Stocks

Stock	Peak Catch (year)	1981 Catch	Reference
Antarctic blue whales	29,000 whales (1931)	Nil	FAO <sup>a</sup> (1979)
Antarctic fin whales	27,000 whales (1938)	Nil	FAO <sup>a</sup> (1979)
Hokkaido herring	850,000 tons (1913)	Nil	Murphy (1977)
Peruvian anchoveta	12.3 million tons (1970)	0.3 million tons	IMARPE <sup>b</sup> (1974)
Southwest African pilchard	1.4 million tons (1968)	Nil	Butterworth (1980)
North Sea herring	1.5 million tons (1962)	Negligible	Saville (1980)
California sardine	640,000 tons (1936)	Nil	Murphy (1977)
Georges Bank herring	374,000 tons (1968)	Nil	Sinderman (1979)
Japanese sardine	2.3 million tons (1939)	17,000 tons (1973)	Murphy (1977)

<sup>a</sup>United Nations Food and Agriculture Organization.

<sup>b</sup>Institut del Mar del Peru.

## SUSTENTABILIDADE DA EXPLORAÇÃO PESQUEIRA

Áreas marinhas protegidas

Áreas de pesca comunitárias

Áreas para a pesca artesanal

Gestão ecossistêmica e multiespecífica

Co-gestão comunitária

Gestão compartilhada

Acordos de pesca

Etnoecologia

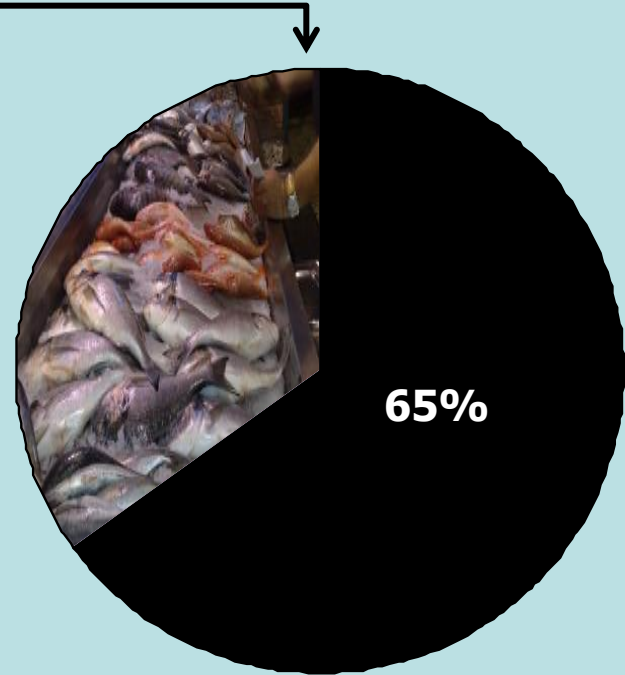
# PRODUÇÃO DA PESCA EXTRATIVA MARINHA POR REGIÃO NO BRASIL



**Produção de  
pescado  
marinho no  
Brasil**

**Pesca de  
pequena  
escala**

**Pesca  
industrial**



## PRINCIPAIS RECURSOS PESQUEIROS MARINHOS DA REGIÃO NORDESTE DO BRASIL

sardinha-bandeira



dourado



albacora-laje



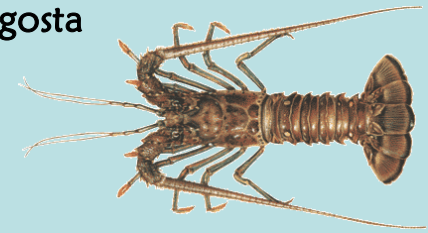
cavala



serra



lagosta



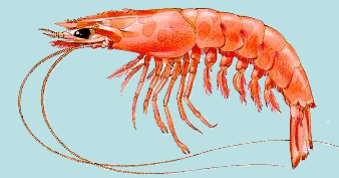
guaiúba



arraia



camarão sete-barbas



albacora-bandolim



ostra



tainha



## PRINCIPAIS RECURSOS PESQUEIROS MARINHOS/ESTUARINOS DA REGIÃO NORTE DO BRASIL

piramutaba



corvina



caranguejo-uçá



gurijuba



serra



camarão-rosa



pescada-amarela



pargo



tainha



## PRINCIPAIS RECURSOS PESQUEIROS MARINHOS DA REGIÃO SUDESTE/SUL DO BRASIL

sardinha-verdadeira



corvina



bonito-listrado



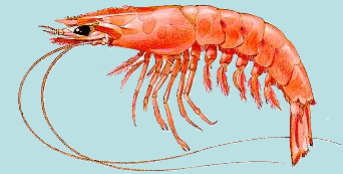
albacora-laje



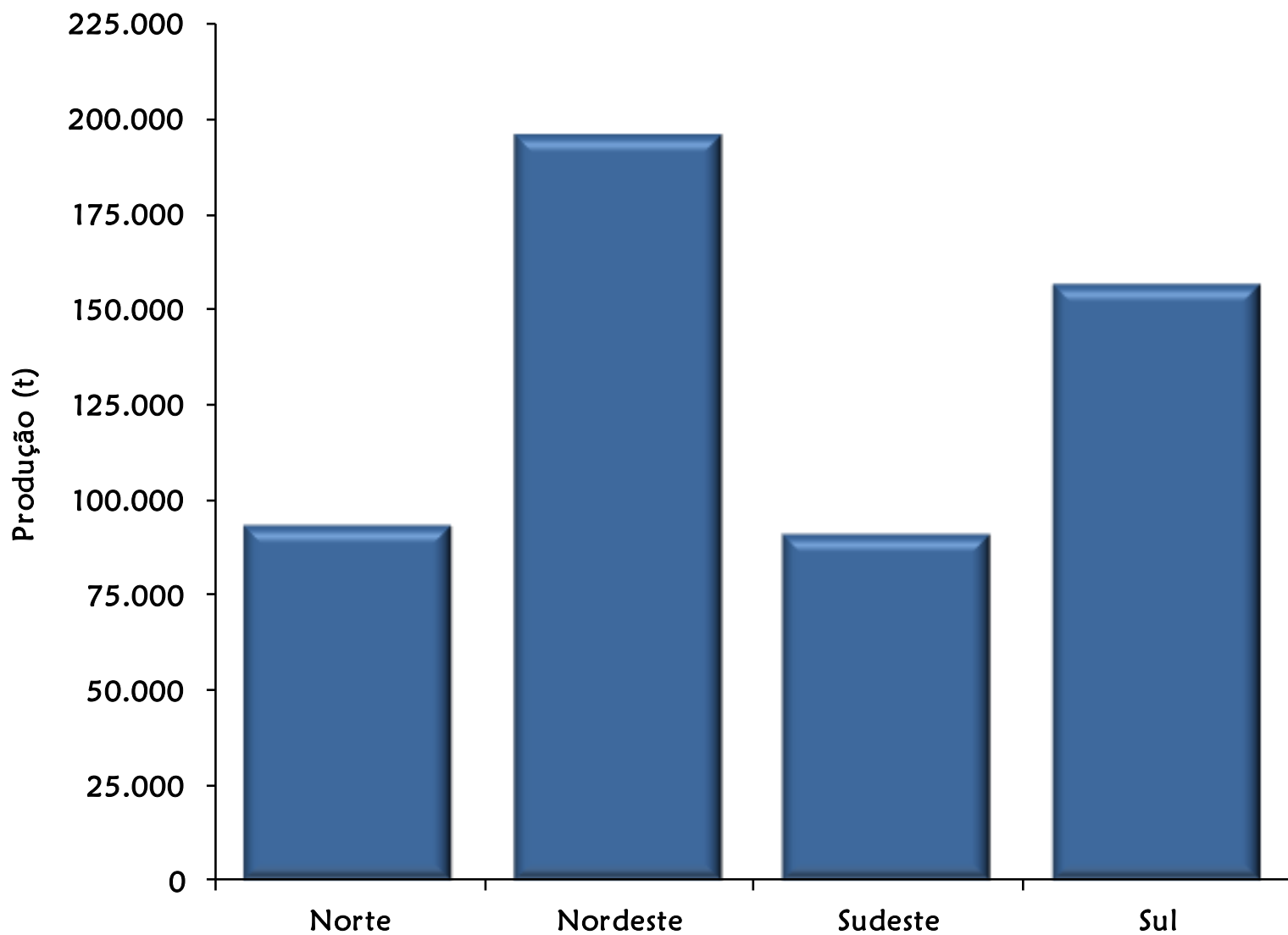
tainha



camarão sete-barbas



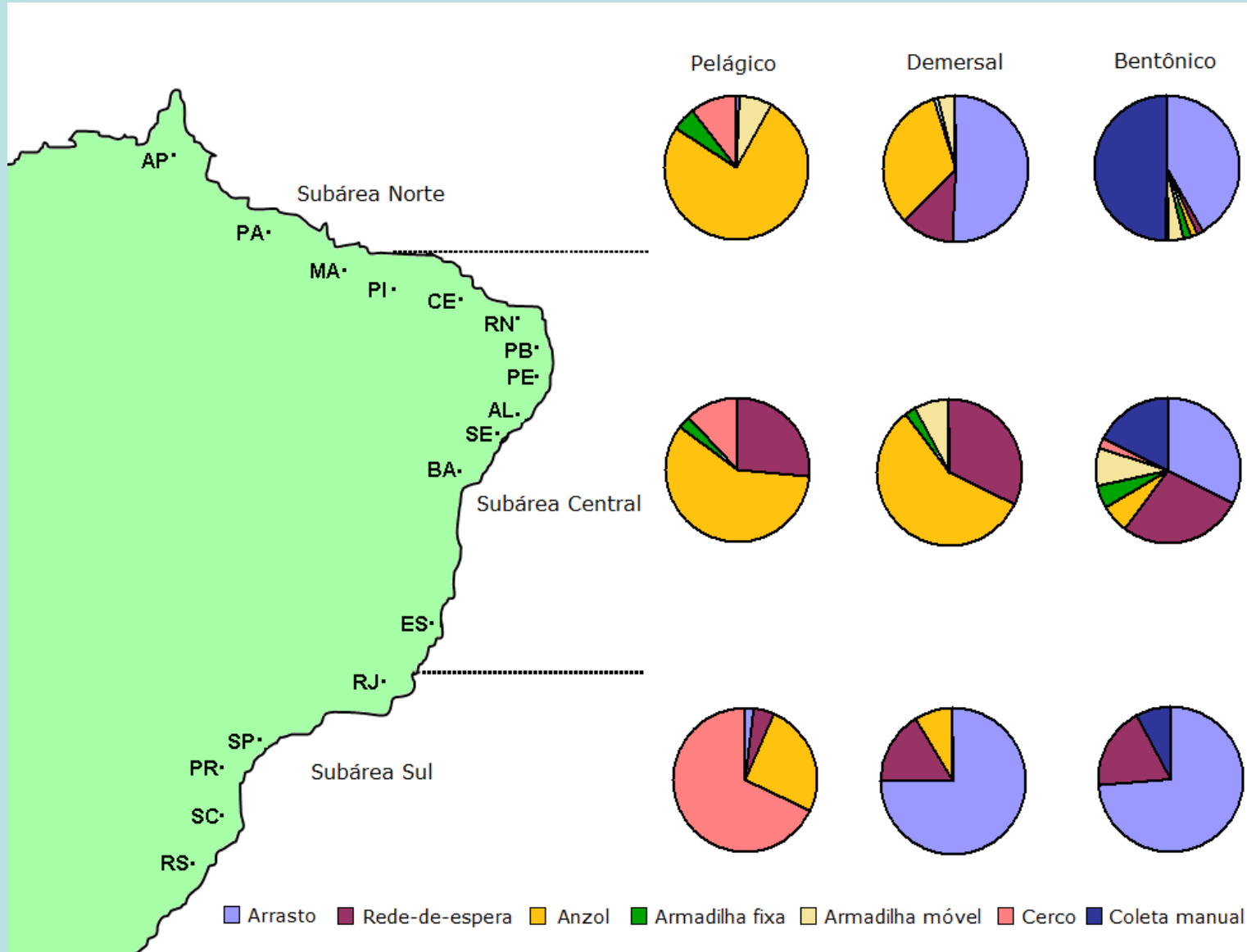
## PRODUÇÃO DA PESCA EXTRATIVA MARINHA POR REGIÃO NO BRASIL



FONTE: MPA (2010)

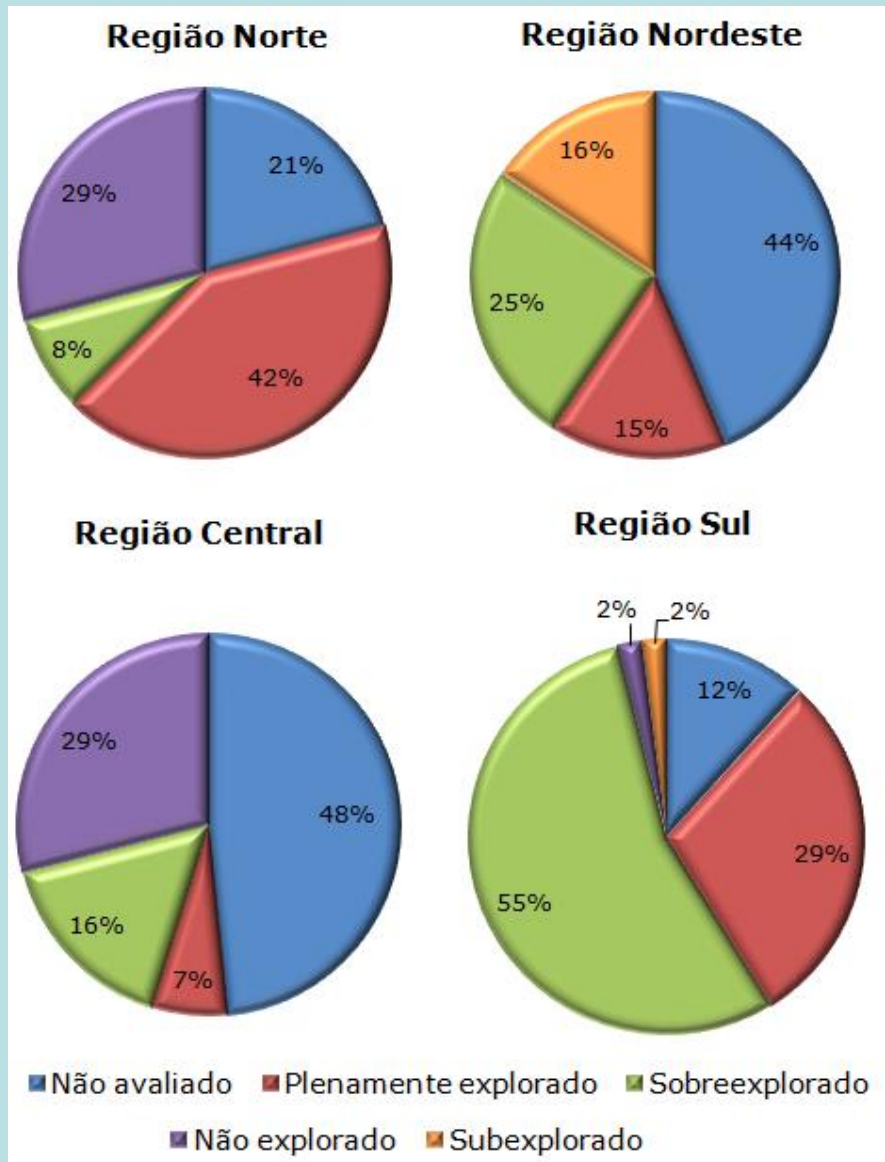


PRINCIPAIS PETRECHOS UTILIZADOS NAS PESCARIAS BRASILEIRAS



FONTE: Fonteles-Filho (2011)

ESTADO DE EXPLORAÇÃO DOS RECURSOS PESQUEIROS MARINHOS DO BRASIL



FONTE: Fonteles-Filho (2011)

## ESTADO DE EXPLORAÇÃO DOS RECURSOS PESQUEIROS MARINHOS DO BRASIL

Situação dos principais recursos pesqueiros marinhos do Brasil

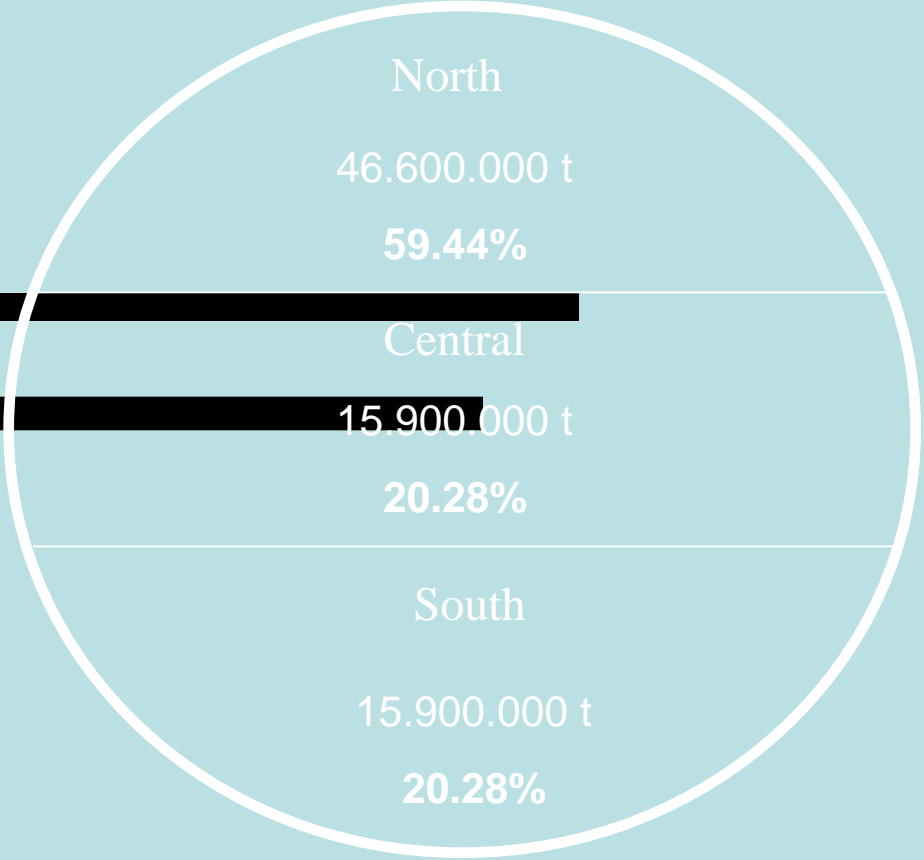
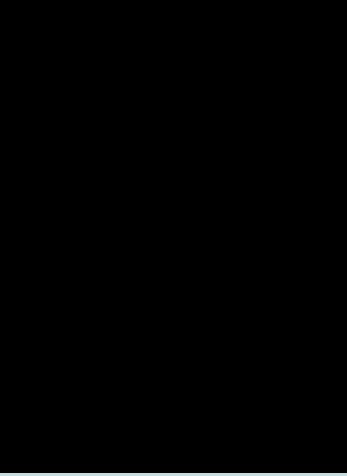
Recurso	Área de ocorrência	Captura máxima sustentável/ ano (t)	Produção máxima obtida (t)	Produção em 2007 (t)	Situação de uso do recurso
Bonito	Sudeste/Sul		26.564 em 1997	24.390	Plenamente explorado
Atuns	Atlântico sudoeste	-	8.898 em 2001	7.061	Plenamente explorado
Afins	Atlântico sudoeste	-	5.744 em 1999	4.700	Sobreexplorado
Sardinha	Sudeste/Sul	180.000	228.037 em 1973	55.940	Sobreexplorado
Demersais de plataforma <sup>1</sup>	Sul	51.490	53.872 em 1977	55.088	Sobreexplorado
Anchova	Sul	-	8.986 em 1978	3.926	Plenamente explorado
Demersais de profundidade <sup>2</sup>	Sudeste/Sul	-	22.882 em 2002	12.557	Sobreexplorado
Camarão-rosa	Norte	9.000	6.950 em 1999	2.763	Sobreexplorado
	Sudeste/sul	2.117	16.629 em 1972	5.403	Sobreexplorado
Lagosta	Norte/Nordeste	9.000	11.032 em 1979	6.479	Sobreexplorado
Pargo	Norte/Nordeste	6.790	9.790 em 1999	3.694	Sobreexplorado
Piramutaba	Norte	20.900	28.190 em 2006	23.557	Sobreexplorado

<sup>1</sup>corvina, castanha, pescada e pescadinha.

<sup>2</sup>merluza, peixe-sapo, abrótea.

Número de barcos atuando na pesca marinha no Brasil

Região	Pesca desembarcada	Frota veleira	Frota motorizada			Total
			Pequena (< 12 m)	Média (12 a 18 m)	Grande (> 18 m)	
Norte	297	1.961	2.538	414	267	5.477
Nordeste	-	29.321	8.706	271	85	38.383
Sudeste/Sul	2.246	2.634	7.721	2.528	1.349	16.478
<b>Total</b>	<b>2.543</b>	<b>33.916</b>	<b>18.965</b>	<b>3.213</b>	<b>1.701</b>	<b>60.338</b>



Captura nominal total de pescado em 2003: 90.000.000 t

1 carreta = 40 t (20 m) → 2.250.000 carretas com peixe

→ 1.12 voltas na terra

Marinho: 81.300.000 t

Água doce: 9.000.000 t

Oceano	Área (km <sup>2</sup> )	Captura (t)	kg/ km <sup>2</sup>
Pacífico	165.384.000	50.400.000	304.74
Índico	73.481.000	9.300.000	126.56
Atlântico	82.217.000	18.700.000	227.45



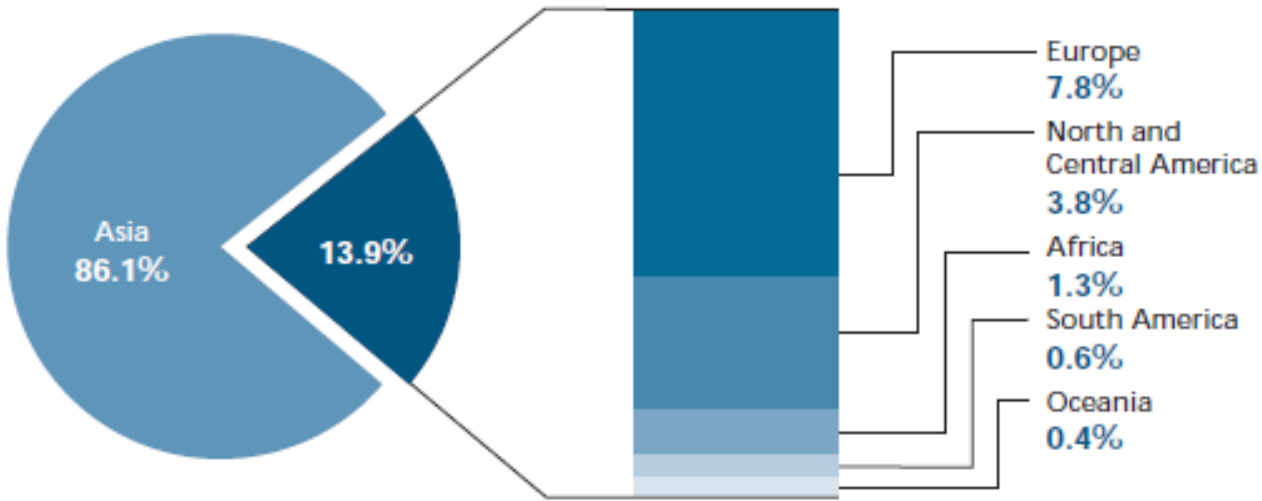


浙江近海漁場





Distribution of decked fishing vessels by continent





The chambira (*Hydrolycus armatus*), a huge canine-toothed predator, is a potential sport species in the rio Madre de Dios headwaters region. Elsewhere in the Amazon Basin flyfishing is used to capture the species in sport fishing.









Paco migrate to headwaters, such as the rio Távora where the fish shown here was captured.



Gamitana is the favorite species produced in fish farms in the Amazon. The fish shown here is from a fish farm near Puerto Maldonado.





A Mekong giant catfish captured in Chiang Khong district in northern Thailand by the Mekong Giant Catfish Fishermen's Association of Chiang Khong  
PHOTO: SUTHEP KRITSANAVARIN



## Pescadores artesanais

- Ribeirinhos, jangadeiros, índios, caiçaras, caboclos, quilombolas, pantaneiros e gente das cidades - identidade sócio-cultural;
- 10 milhões de pessoas envolvidas na atividade de economia familiar – informalidade e estatística;
- 600 mil registrados – 98,86%;
- ≈ 80% são analfabetos + exclusão diversa;
- Obsolescência e conflito organizacional (Colônias, Federações e Confederação X Associativismo/Cooperativismo/Sindicalismo);
- Precariedade da cadeia produtiva;
- **Fortalecer a identidade.**





## Amanhã ?

- 24.8 kg/pessoa/ano (5x 1960)
- Crescimento da pesca 1.2% ao ano
- 2030 demanda de 90 milhões de toneladas/ano
- **Aqüicultura e pesca responsável - 2048**



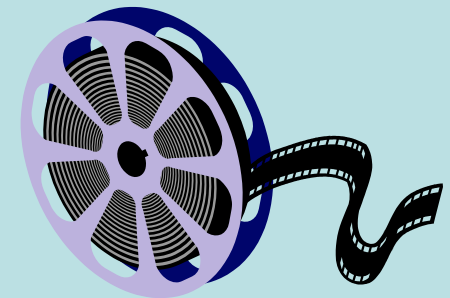
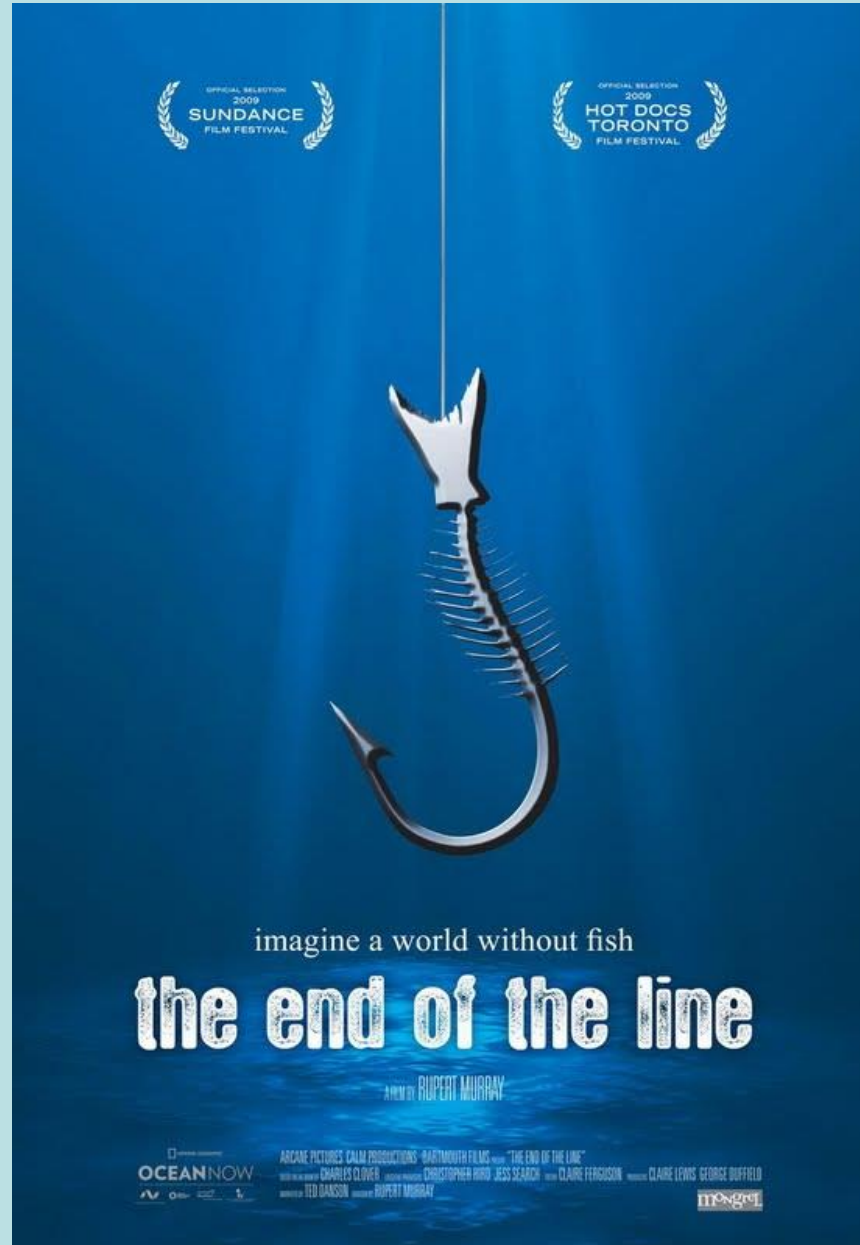
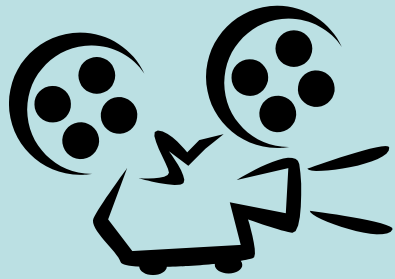
Lago Victoria/Tanzânia – apenas carcaças de “perca do Nilo” são disponibilizadas para os moradores do entorno – Fonte National Geographic





A large meander and associated floodplain of the rio Manu in the proximity of the National Park.





90 minutos

Thank you!