World fisheries and aquaculture: patterns and trends_PART A

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UN Sustainable goals

The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. The Goals interconnect and in order to leave no one behind, it is important that we achieve each Goal and target by 2030. Click on any specific Goal below to learn more about each issue.

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"The 2030 Agenda for Sustainable Development (2030 Agenda for short) offers a vision of a fairer, more peaceful world in which no one is left behind.

The 2030 Agenda also sets aims for the contribution and conduct of fisheries and aquaculture towards food security and nutrition, and the sector's use of natural resources, in a way that ensures sustainable development in economic, social and environmental terms, within the context of the FAO Code of Conduct for Responsible Fisheries (FAO, 1995)."

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A major challenge to implementation of the 2030 Agenda is the sustainability divide between developed and developing countries which has partially resulted from increased economic interdependencies, coupled with limited management and governance capacity in developing countries. To eliminate this disparity while making progress towards the target for restoration of overfished stocks set by the 2030 Agenda, the global community needs to support developing nations to achieve their full fisheries and aquaculture potential".

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SOFIA, 2016

- Published by FAO
- Biennial periodicity
- Data provided by each country
- Heterogeneous methods

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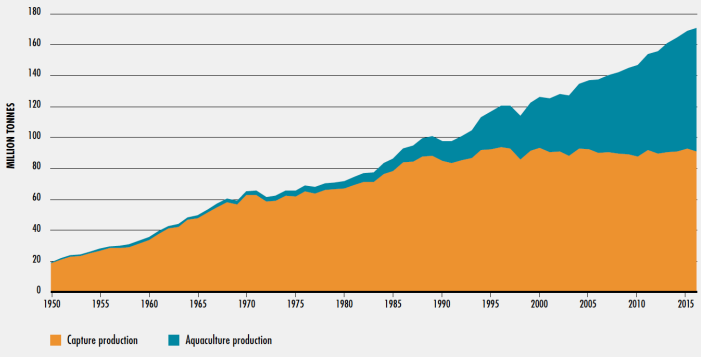
FIGURE 1
WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants

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. Global fish production peaked at about 171 million tonnes in 2016;

. Aquaculture ~47 %;

. All production (in 2016) was estimated at USD 362 billion, of which USD 232 billion was from aquaculture production;

. Capture fishery production static since the late 80s;

. Aquaculture has been responsible for the continuing impressive growth in the supply of fish for human consumption

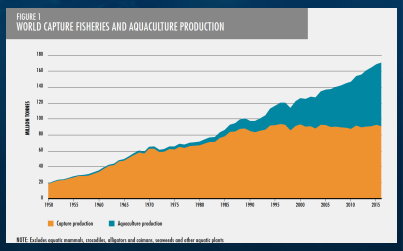

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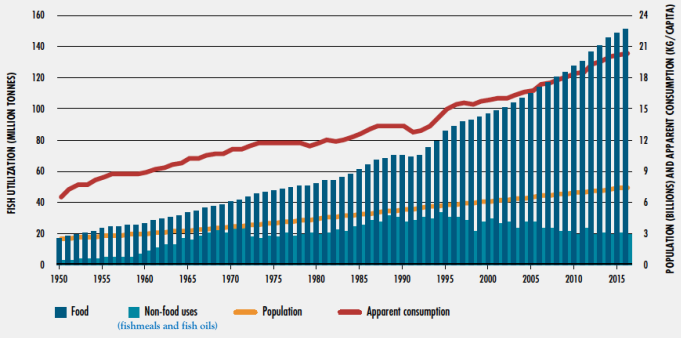
FIGURE 2
WORLD FISH UTILIZATION AND APPARENT CONSUMPTION



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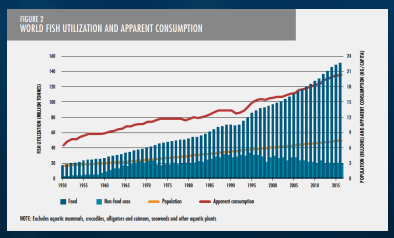
. Between 1961-2016 - the average annual increase in global food fish consumption (3.2 %) outpaced population growth (1.6 %);

. It exceeded that of meat from all terrestrial animals combined (2.8 %).

. Per capita terms, food fish consumption grew from 9.0 kg in 1961 to 20.2 kg in 2015, at an average rate of about 1.5 % per year.

. In 2015, fish accounted for about 17 % of animal protein consumed by the global population;

. Fish provided about 3.2 billion people with almost 20 percent of their average per capita intake of animal protein.



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. People in developing countries have a higher share of fish protein in their diets than those in developed countries;

. The lowest levels, just above 2 kg, are found in Central Asia and some landlocked countries.

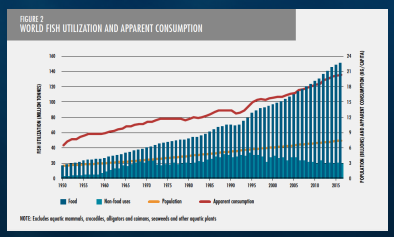

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TABLE 1
WORLD FISHERIES AND AQUACULTURE PRODUCTION AND UTILIZATION (MILLION TONNES)[a]

Category	2011	2012	2013	2014	2015	2016
Production						
Capture						
Inland	10.7	11.2	11.2	11.3	11.4	11.6
Marine	81.5	78.4	79.4	79.9	81.2	79.3
Total capture	**92.2**	**89.5**	**90.6**	**91.2**	**92.7**	**90.9**
Aquaculture						
Inland	38.6	42.0	44.8	46.9	48.6	51.4
Marine	23.2	24.4	25.4	26.8	27.5	28.7
Total aquaculture	**61.8**	**66.4**	**70.2**	**73.7**	**76.1**	**80.0**
Total world fisheries and aquaculture	**154.0**	**156.0**	**160.7**	**164.9**	**168.7**	**170.9**
Utilization[b]						
Human consumption	130.0	136.4	140.1	144.8	148.4	151.2
Non-food uses	24.0	19.6	20.6	20.0	20.3	19.7
Population (*billions*)[c]	7.0	7.1	7.2	7.3	7.3	7.4
Per capita apparent consumption (*kg*)	18.5	19.2	19.5	19.9	20.2	20.3

[a] Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants.
[b] Utilization data for 2014–2016 are provisional estimates.
[c] Source of population figures: UN, 2015e.

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World total marine catch was 79.3 million tonnes in 2016, representing a decrease of almost 2 million tonnes from the 81.2 million tonnes in 2015.

NOTE: Catches of anchoveta by Peru and Chile, which are often substantial yet highly variable because of the influence of El Niño, accounted for 1.1 million tonnes of this decrease.

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What is El Niño?

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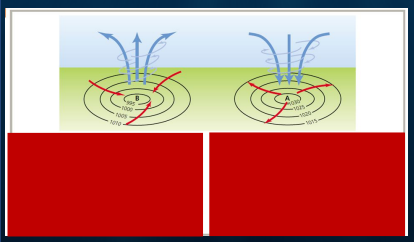
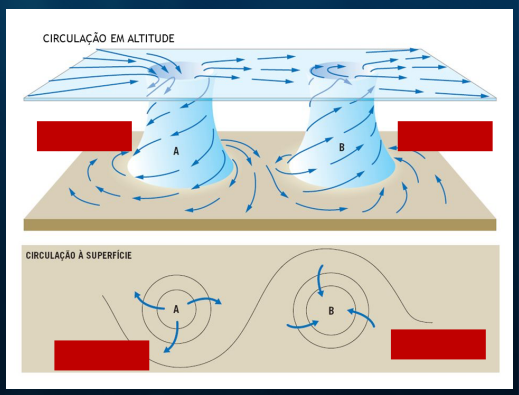
Basic concepts first!





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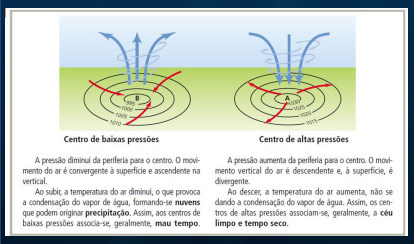
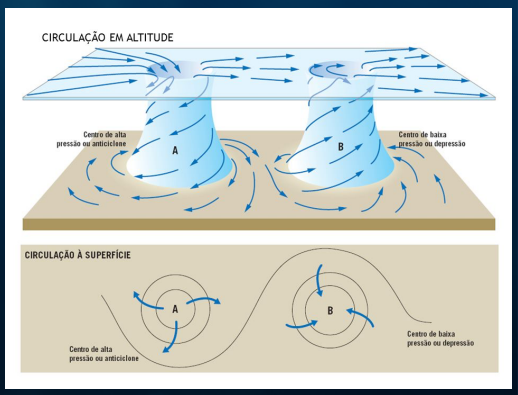
Basic concepts first!





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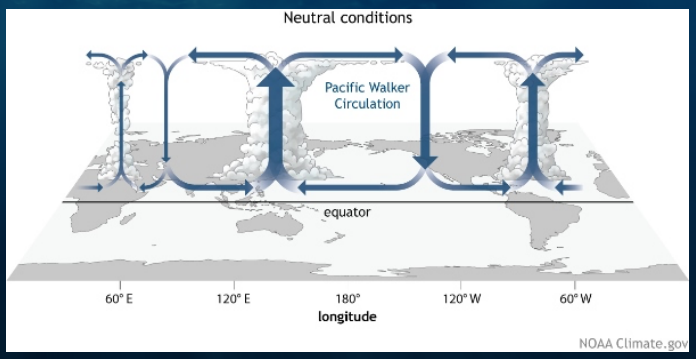
What is El Niño?



"Normal" (or neutral) conditions – When the Walker cell is normally functioning (driven by temperature and pressure gradients). Areas of high-pressure form over the cooler eastern Pacific waters, while areas of low-pressure form over the warmer western Pacific. Near-surface winds near the equator flow from areas of high pressure (east) to low pressure (west). In the west, the warm air rises and forms clouds (losing its moisture as precipitation). Afterwards, the dry air travels back (along the top of the troposphere) towards the eastern Pacific. This cool air then converges with cool continental air and sinks along the eastern Pacific coast - creating a loop. Because the air is cool and dry, there are fewer rainstorm events in this high-pressure region.

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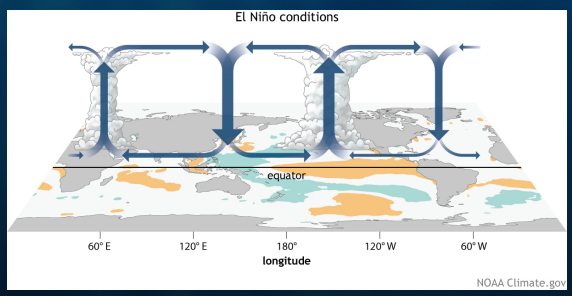
What is El Niño?



El Niño conditions – When the trade winds weaken, or even cease, the warmer water from the Australian region (i.e., western Pacific) surges back towards the east; the upwelling of cooler water along the eastern Pacific slows or stops entirely.

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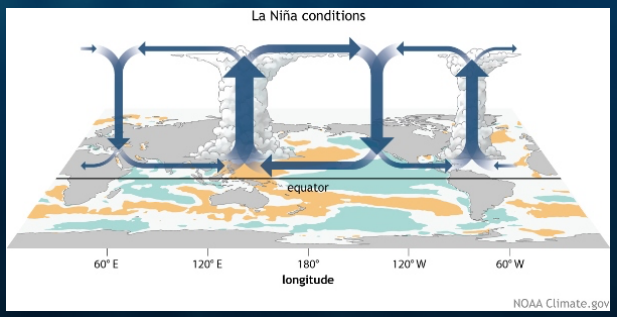
What is El Niño?



La Niña conditions - When trade winds are stronger than normal, causing increased upwelling of cool waters along the eastern Pacific (and more cold water being pushed further across the middle Pacific).

See ENSO also in : https://www.youtube.com/watch?v=iVCviVp4rLU

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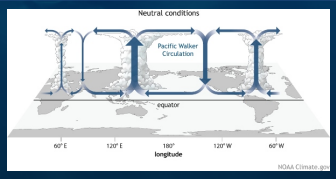

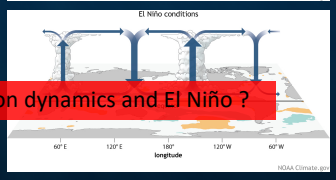

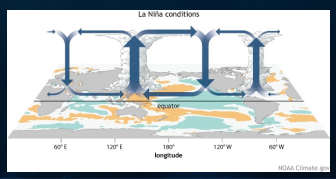

So what is relation between anchovies' population dynamics and El Niño ?

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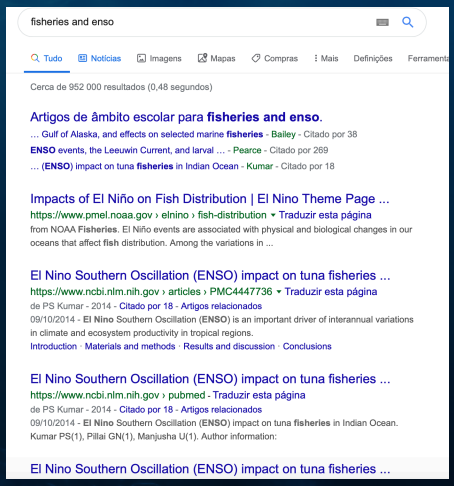

See ENSO also in : https://www.youtube.com/watch?v=iVCviVp4rLU

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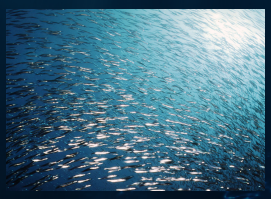
So what is relation between these two groups of figures ?



White Gold ? Séc XIX..

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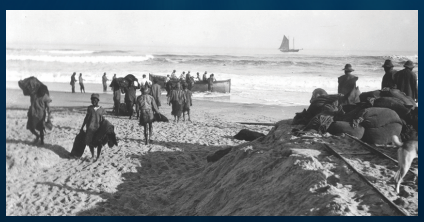

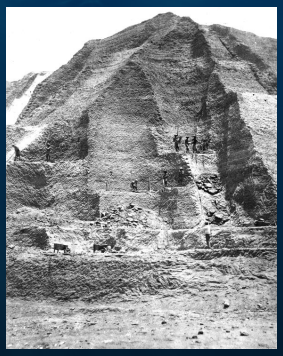

https://www.youtube.com/watch?v=DKz_2Fhy9NM

White Gold (if we have time…)

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Besides El Niño ...

What is PDO?

What is NAO?

What is AO?

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What is PDO?

Pacific Decadal Oscillation (PDO) (periods of 20-30 years)

https://www.youtube.com/watch?v=Sc3tOEcM0YE

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Sardinops sagax, Californian pilchard, Peruvian pilchard

(PDO)

(periods of 20-30 years)

Engraulis ringens, Peruvian anchoveta

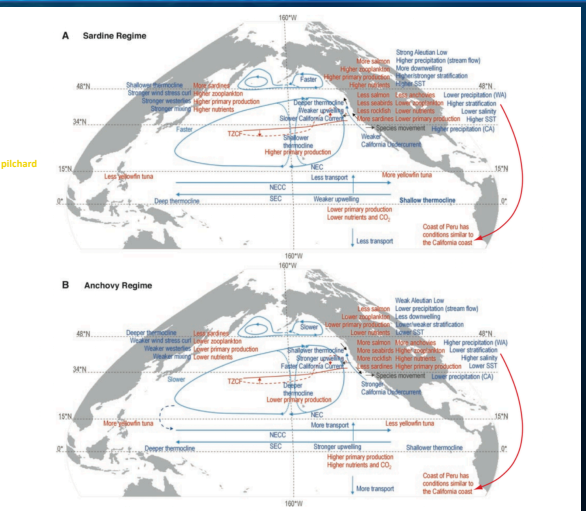

Fig. 3. Synthesis of Pacific conditions during the (**A**) sardine and (**B**) anchovy regimes. Physical changes are in blue, and biological and chemical changes are in red.

from Chavez et al. (2003) Science: Changes in the abundance of anchovy and sardine are only a few of many biological perturbations associated with regime shifts in the Pacific. From Anchovies to sardines and Back: Multidecadal Change in the Pacific Ocean

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Besides El Niño …

What is PDO?

What is NAO?

What is AMO?

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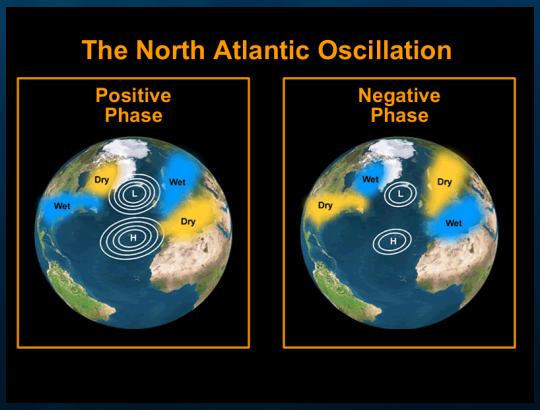
What is NAO?
Refers to pressure variations associated with the Icelandic low and subtropical high pressure near the Azores

If the Icelandic low and Azores subtropical high are stronger than normal, then the NAO is positive

results in more and stronger storms crossing the Atlantic on a more northerly track
eastern US will experience mild and wet winter conditions



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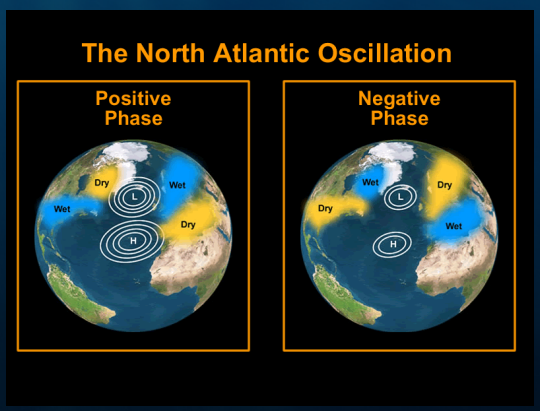
If the Icelandic low and Azores subtropical high are weaker than normal, then the NAO is negative

results in fewer and weaker storms crossing the Atlantic
eastern US experiences more cold-air outbreaks and snowy weather conditions



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THE STATE OF WORLD FISHERIES AND AQUACULTURE

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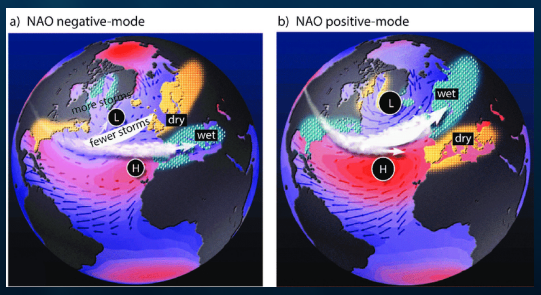

See also: https://www.youtube.com/watch?v=KOYJG7j4Iy8

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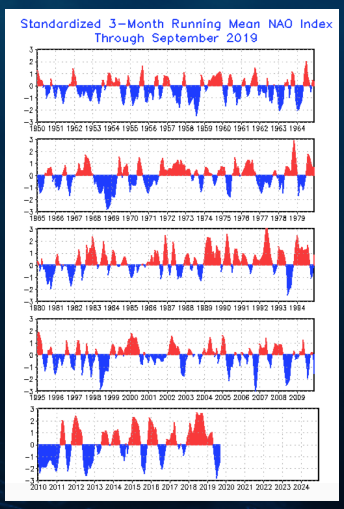
Type of data we get



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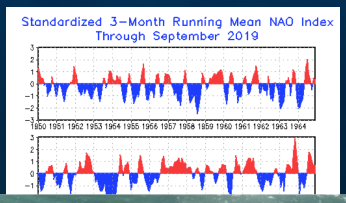
Vol. 564: 77–86, 2017 | MARINE ECOLOGY PROGRESS SERIES | Published February 3
doi: 10.3354/meps12007 | Mar Ecol Prog Ser

Occurrence of basking shark *Cetorhinus maximus* in southern Portuguese waters: a two-decade survey

Ana Couto[1,2], Nuno Queiroz[2], Paulo Relvas[3], Miguel Baptista[1,2], Miguel Furtado[1,2], Joana Castro[1], Maria Nunes[4], Hirofumi Morikawa[4], Rui Rosa[1,*]

[1]Marine and Environmental Sciences Centre (MARE), Universidade de Lisboa, Laboratório Marítimo da Guia, 2750-374 Cascais, Portugal
[2]CIBIO/InBIO, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal
[3]CCMAR, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
[4]Unuipex, Porto de Pesca de Olhão, 8700-914 Olhão, Portugal

ABSTRACT: There is a general consensus that many shark species are declining in numbers. However, effective management measures often depend on knowing how trends in abundance and distribution are influenced by environmental conditions. Several efforts to describe the occurrence and distribution of basking sharks *Cetorhinus maximus* have been made in northern Europe, particularly around the UK, but nothing is known regarding their occurrence in southern areas, such as the south of Portugal. Using 2 decades of observational data collected in the south of Portugal, we show that the occurrence of basking sharks in the area was highly seasonal, with individuals being observed mainly during spring. Based on *in situ* and satellite-derived environmental variables and climate indices, we also demonstrate that temporal trends were associated with the beginning of the upwelling season and that the inter-annual changes were related to lower values of sea surface temperature, North Atlantic Oscillation index, upwelling index, 2-mo lagged chlorophyll *a* and 3-mo lagged Atlantic Multidecadal Oscillation index, and higher values of 2-mo lagged upwelling index. These findings suggest that basking sharks are associated with the expansion of cold waters following upwelling events in the region, probably due to the aggregation and increase of zooplankton. Although the temperature recorded during our study years ranged from 14 to 24°C, sharks were mainly observed when temperatures were lower than 20°C, corroborating their preference for colder water. This study provides the first knowledge on the habitat use of basking sharks in southern European Atlantic areas.



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Besides El Niño ...

What is PDO?

What is NAO?

What is AMO?

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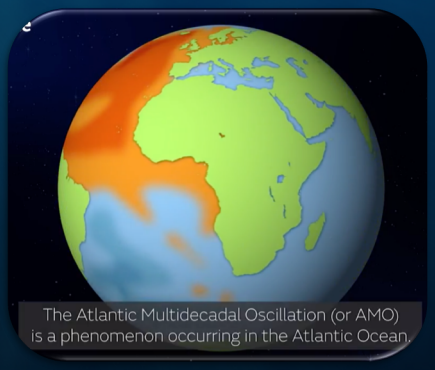
Atlantic Multidecadal Oscillation (AMO)



https://www.youtube.com/watch?v=a0KIOA22ne4

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TABLE 2
MARINE CAPTURE PRODUCTION: MAJOR PRODUCER COUNTRIES

Country	Production (tonnes)			% Variation		Variation, 2015 to 2016 (tonnes)
	Average 2005–2014	2015	2016	2005–2014 (average) to 2016	2015 to 2016	
China	13 189 273	15 314 000	15 246 234	15.6	–0.4	–67 766
Indonesia	5 074 932	6 216 777	6 109 783	20.4	–1.7	–106 994
United States of America	4 757 179	5 019 399	4 897 322	2.9	–2.4	–122 077
Russian Federation	3 601 031	4 172 073	4 466 503	24.0	7.1	294 430
Peru Total	6 438 839	4 786 551	3 774 887	–41.4	–21.1	–1 011 664
Excluding anchoveta	989 918	1 016 631	919 847	–7.1	–9.5	–96 784
India	3 218 050	3 497 284	3 599 693	11.9	2.9	102 409
Japan*	3 992 458	3 423 099	3 167 610	–20.7	–7.5	–255 489
Viet Nam	2 081 551	2 607 214	2 678 406	28.7	2.7	71 192
Norway	2 348 154	2 293 462	2 033 560	–13.4	–11.3	–259 902
Philippines	2 155 951	1 948 101	1 865 213	–13.5	–4.3	–82 888
Malaysia	1 387 577	1 486 050	1 574 443	13.5	5.9	88 393
Chile Total	3 157 946	1 786 249	1 499 531	–52.5	–16.1	–286 718
Excluding anchoveta	2 109 785	1 246 154	1 162 095	–44.9	–6.7	–84 059
Morocco	1 074 063	1 349 937	1 431 518	33.3	6.0	81 581
Republic of Korea	1 746 579	1 640 669	1 377 343	–21.1	–16.0	–263 326
Thailand	1 830 315	1 317 217	1 343 283	–26.6	2.0	26 066
Mexico	1 401 294	1 315 851	1 311 089	–6.4	–0.4	–4 762
Myanmar*	1 159 708	1 107 020	1 185 610	2.2	7.1	78 590
Iceland	1 281 597	1 318 916	1 067 015	–16.7	–19.1	–251 901
Spain	939 384	967 240	905 638	–3.6	–6.4	–61 602
Canada	914 371	823 155	831 614	–9.1	1.0	8 459
Taiwan, Province of China	960 193	989 311	750 021	–21.9	–24.2	–239 290
Argentina	879 839	795 415	736 337	–16.3	–7.4	–59 078
Ecuador	493 858	643 176	715 357	44.9	11.2	72 181
United Kingdom	631 398	65 451 506	701 749	11.1	–0.4	–2 753
Denmark	735 966	868 892	670 207	–8.9	–22.9	–198 685
Total 25 major countries	**65 451 506**	**66 391 560**	**63 939 966**	**–2.3**	**–3.7**	**–2 451 594**
Total other 170 countries	**14 326 675**	**14 856 282**	**15 336 882**	**7.1**	**3.2**	**480 600**
World total	**79 778 181**	**81 247 842**	**79 276 848**	**–0.6**	**–2.4**	**–1 970 994**
Share of 25 major countries	*82.0%*	*81.7%*	*80.7%*			

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THE STATE OF WORLD FISHERIES AND AQUACULTURE

TABLE 2
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Country	Production (tonnes) Average 2005–2014	2015	2016	% Variation 2005–2014 (average) to 2016	2015 to 2016	Variation, 2015 to 2016 (tonnes)
China	13 189 273	15 314 000	15 246 234	15.6	–0.4	–67 766
Indonesia	5 074 932	6 216 777	6 109 783	20.4	–1.7	–106 994
United States of America	4 757 179	5 019 399	4 897 322	2.9	–2.4	–122 077
Russian Federation	3 601 031	4 172 073	4 466 503	24.0	7.1	294 430
Peru Total	6 438 839	4 786 551	3 774 887	–41.4	–21.1	–1 011 664
Excluding anchoveta	989 918	1 016 631	919 847	–7.1	–9.5	–96 784
India	3 218 050	3 497 284	3 599 693	11.9	2.9	102 409
Japan*	3 992 489	4	3	–24.7	–7.5	–291 489
Norway	2 348 154	2 293 462	2 033 560	–13.4	–11.3	–259 902
Philippines	2 155 951	1 948 101	1 865 213	–13.5	–4.3	–82 888
Malaysia	1 387 577	1 486 050	1 574 443	13.5	5.9	88 393
Chile Total	3 157 946	1 786 249	1 499 531	–52.5	–16.1	–286 718
Excluding anchoveta	2 109 785	1 246 154	1 162 095	–44.9	–6.7	–84 059
Morocco	1 074 063	1 349 937	1 431 518	33.3	6.0	81 581
Republic of Korea	1 746 579	1 640 669	1 377 343	–21.1	–16.0	–263 326
Thailand	1 830 315	1 317 217	1 343 283	–26.6	2.0	26 066
Viet Nam	1 601 294	1 315 831	1 190 089	–25.7	–9.6	–125 742
Iceland	1 281 597	1 318 916	1 067 015	–16.7	–19.1	–251 901
Spain	939 384	1	8	–6.4	–61 602	
Canada	914 371	9	9	1.0	8 459	
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Decreasing catches affected 64% of the 25 top producer countries, but only 37% of the remaining 170 countries.

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THE STATE OF WORLD FISHERIES AND AQUACULTURE

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Share of 25 major countries	*82.0%*	*81.7%*	*80.7%*			

* Production figures for 2015 and 2016 are FAO estimates.

Total marine catches by China, by far the world's top producer, were stable in 2016, but the inclusion of a progressive catch reduction policy in the national Thirteenth Five-Year Plan for 2016–2020 is expected to result in significant decreases in coming years, with a predicted reduction of more than 5 million tonnes by 2020

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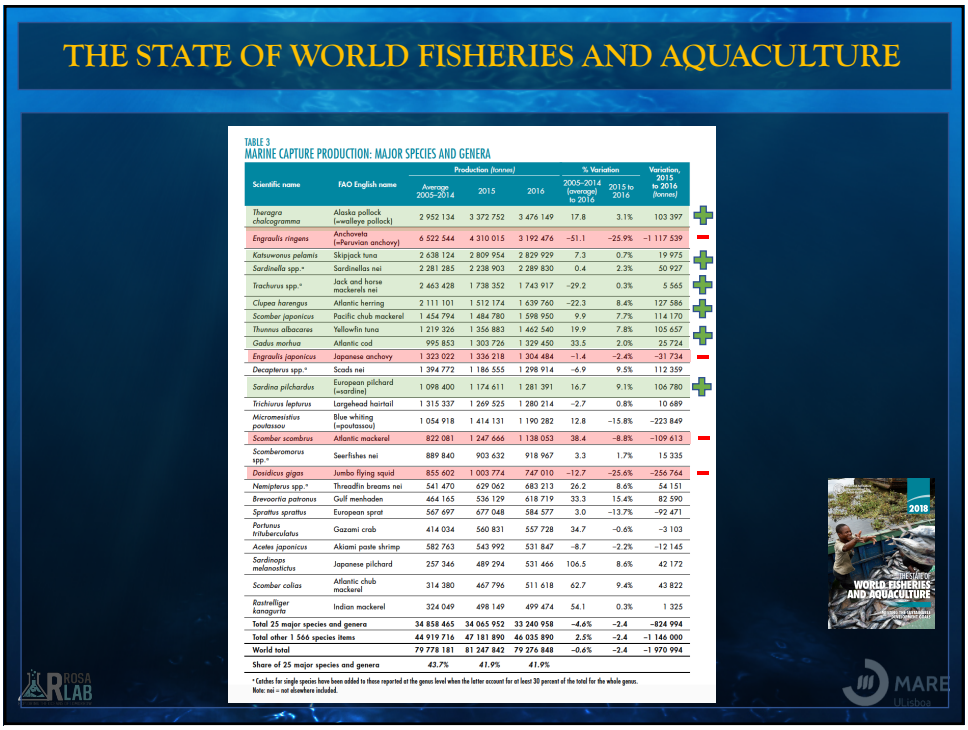
THE STATE OF WORLD FISHERIES AND AQUACULTURE
TABLE 3
MARINE CAPTURE PRODUCTION: MAJOR SPECIES AND GENERA
Production (tonnes)
% Variation
Variation, 2015 to 2016 (tonnes)
Scientific name
FAO English name
Average 2005-2014
2015
2016
2005-2014 (average) to 2016
2015 to 2016
Theragra chalcogramma
Alaska pollock (=walleye pollock)
2 952 134
3 372 752
3 476 149
17.8
3.1%
103 397
Engraulis ringens
Anchoveta (=Peruvian anchovy)
6 522 544
4 310 015
3 192 476
–51.1
–25.9%
–1 117 539
Katsuwonus pelamis
Skipjack tuna
2 638 124
2 809 954
2 829 929
7.3
0.7%
19 975
Sardinella spp.*
Sardinellas nei
2 281 285
2 238 903
2 289 830
0.4
2.3%
50 927
Trachurus spp.*
Jack and horse mackerels nei
2 463 428
1 738 352
1 743 917
–29.2
0.3%
5 565
Clupea harengus
Atlantic herring
2 111 101
1 512 174
1 639 760
–22.3
8.4%
127 586
Scomber japonicus
Pacific chub mackerel
1 454 794
1 484 780
1 598 950
9.9
7.7%
114 170
Thunnus albacares
Yellowfin tuna
1 219 326
1 356 883
1 462 540
19.9
7.8%
105 657
Gadus morhua
Atlantic cod
995 853
1 303 726
1 329 450
33.5
2.0%
25 724
Engraulis japonicus
Japanese anchovy
1 323 022
1 336 218
1 304 484
–1.4
–2.4%
–31 734
Decapterus spp.*
Scads nei
1 394 772
1 186 555
1 298 914
–6.9
9.5%
112 359
Sardina pilchardus
European pilchard (=sardine)
1 098 400
1 174 611
1 281 391
16.7
9.1%
106 780
Trichiurus lepturus
Largehead hairtail
1 315 337
1 269 525
1 280 214
–2.7
0.8%
10 689
Micromesistius poutassou
Blue whiting (=poutassou)
1 054 918
1 414 131
1 190 282
12.8
–15.8%
–223 849
Scomber scombrus
Atlantic mackerel
822 081
1 247 666
1 138 053
38.4
–8.8%
–109 613
Scomberomorus spp.*
Seerfishes nei
889 840
903 632
918 967
3.3
1.7%
15 335
Dosidicus gigas
Jumbo flying squid
855 602
1 003 774
747 010
–12.7
–25.6%
–256 764
Nemipterus spp.*
Threadfin breams nei
541 470
629 062
683 213
26.2
8.6%
54 151
Brevoortia patronus
Gulf menhaden
464 165
536 129
618 719
33.3
15.4%
82 590
Sprattus sprattus
European sprat
567 697
677 048
584 577
3.0
–13.7%
–92 471
Portunus trituberculatus
Gazami crab
414 034
560 831
557 728
34.7
–0.6%
–3 103
Acetes japonicus
Akiami paste shrimp
582 763
543 992
531 847
–8.7
–2.2%
–12 145
Sardinops melanostictus
Japanese pilchard
257 346
489 294
531 466
106.5
8.6%
42 172
Scomber colias
Atlantic chub mackerel
314 380
467 796
511 618
62.7
9.4%
43 822
Rastrelliger kanagurta
Indian mackerel
324 049
498 149
499 474
54.1
0.3%
1 325
Total 25 major species and genera
34 858 465
34 065 952
33 240 958
–4.6%
–2.4
–824 994
Total other 1 566 species items
44 919 716
47 181 890
46 035 890
2.5%
–2.4
–1 146 000
World total
79 778 181
81 247 842
79 276 848
–0.6%
–2.4
–1 970 994
Share of 25 major species and genera
43.7%
41.9%
41.9%
* Catches for single species have been added to those reported at the genus level when the latter account for at least 30 percent of the total for the whole genus.
Note: nei = not elsewhere included.
2018
THE STATE OF WORLD FISHERIES AND AQUACULTURE
ROSA LAB
MARE Ulisboa

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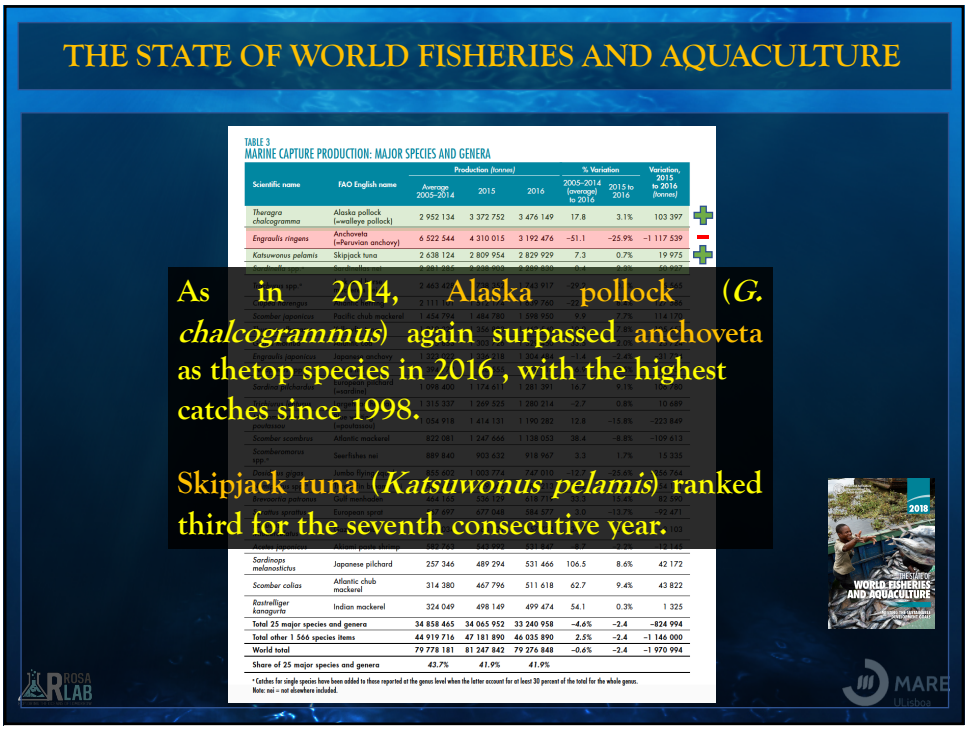
THE STATE OF WORLD FISHERIES AND AQUACULTURE
As in 2014, Alaska pollock (*G. chalcogrammus*) again surpassed anchoveta as thetop species in 2016 , with the highest catches since 1998.
Skipjack tuna (*Katsuwonus pelamis*) ranked third for the seventh consecutive year.
2018
THE STATE OF WORLD FISHERIES AND AQUACULTURE
ROSA LAB
MARE Ulisboa

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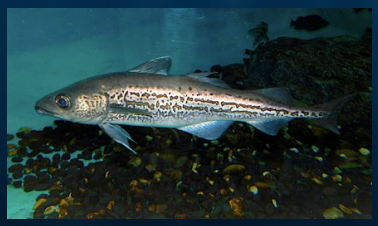
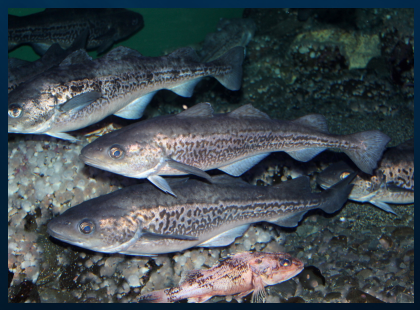
THE STATE OF WORLD FISHERIES AND AQUACULTURE

Alaska pollock ("*escamudo ou paloco*")? What can you tell me about it based on the photo below?





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THE STATE OF WORLD FISHERIES AND AQUACULTURE

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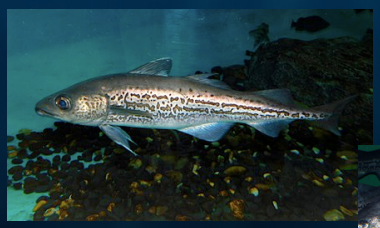

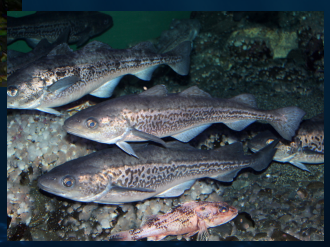

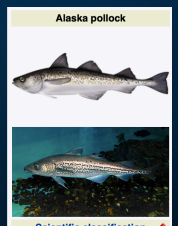

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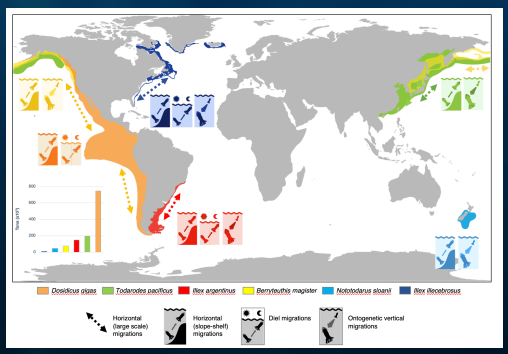
THE STATE OF WORLD FISHERIES AND AQUACULTURE

After five years of continuous growth that started in 2010, catches of cephalopods were stable in 2015 but dropped in 2016.

The three major squid species – jumbo flying squid (*Dosidicus gigas*), Argentine shortfin squid (*Illex argentinus*) and Japanese flying squid (*Todarodes pacificus*) – decreased by 26, 86 and 34 %, respectively.

(combined loss of 1.2 million tonnes between 2015 and 2016)



Henk-Jan, (...) & Rosa (unpublished work) The biogeochemical role of cephalopods in the world's ocean

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THE STATE OF WORLD FISHERIES AND AQUACULTURE

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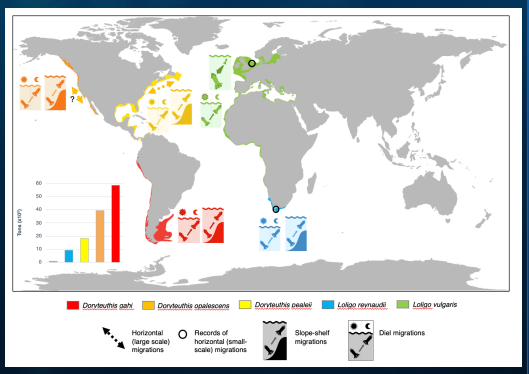

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THE STATE OF WORLD FISHERIES AND AQUACULTURE

Capture production of other mollusc groups started declining much earlier:

. oysters in the early 1980s,
. clams in the late 1980s,
. mussels in the early 1990s

. while catches of scallops reached the maximum ever in 2011 but have since
declined by one-third.

. Negative trends of bivalve species groups could be a result of pollution and
degradation of marine environments,

. As well as trends favouring aquaculture production for some of these species.

ROSA LAB

MARE ULisboa

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