Europe's fisheries in a changing climate

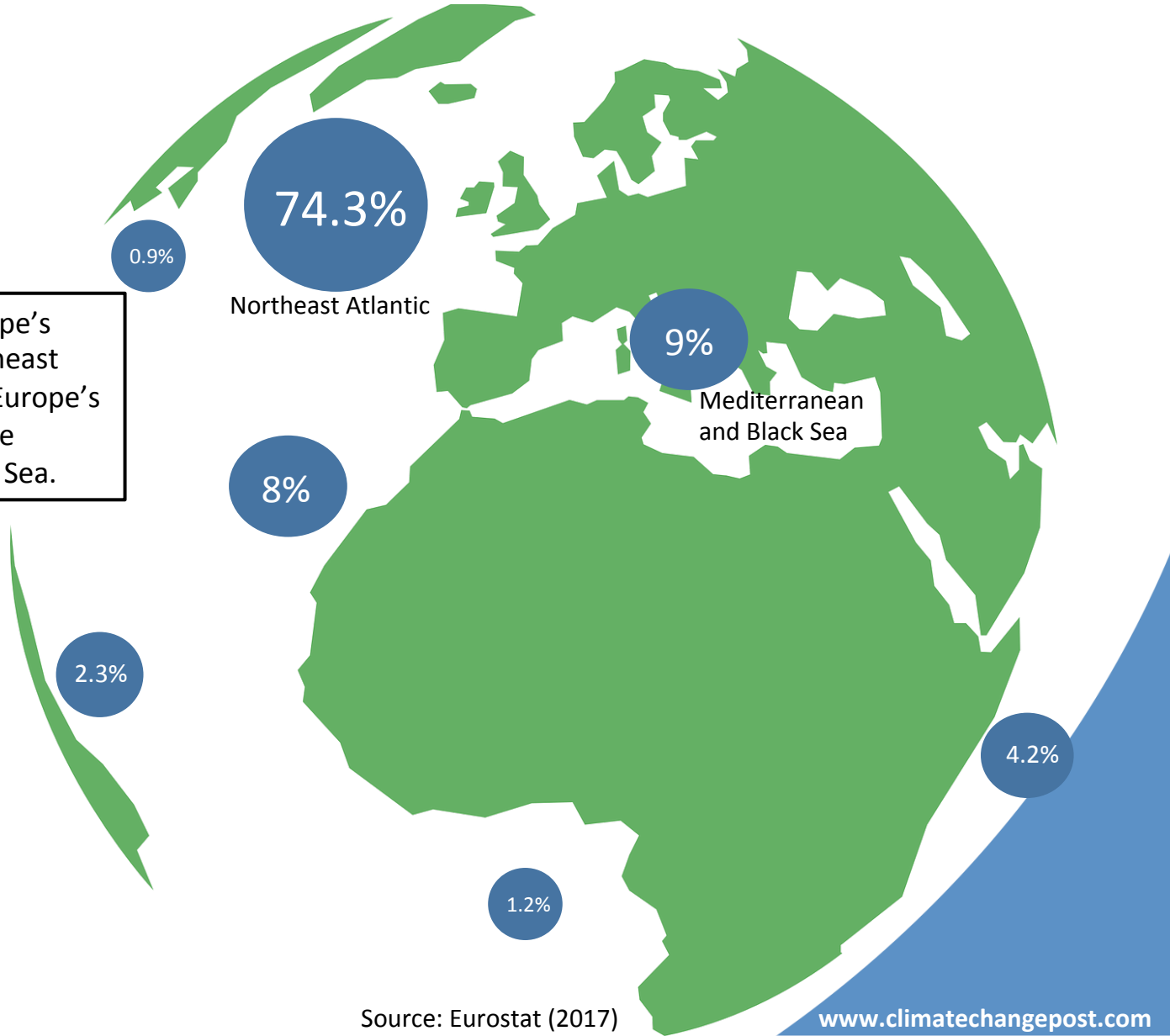
www.climatechangepost.com

Latest update: 6 December 2018

Where do the EU countries catch their fish?

Fisheries
EU fish catches across the globe

About 75% of the catches of Europe's fishing fleet is caught in the Northeast Atlantic. Number 2 on the list of Europe's fish production is the region of the Mediterranean Sea and the Black Sea.



Source: Eurostat (2017)

Which countries contribute most to fish production?

Fisheries
Fish production by country

Fish production (catches and aquaculture)
(% of EU + Norway + Iceland + Turkey):

- No data
- 0 – 2%
- 2 – 4%
- 4 –7%
- 7 – 10%
- 10 –15%
- > 15%

Norway is Europe's most important fishing nation by far. About 30% of Europe's fish production is caught and grown (aquaculture) by Norway. Iceland is second, Spain is third.

North Sea

Baltic Sea

Atlantic Ocean

Black Sea

Mediterranean Sea

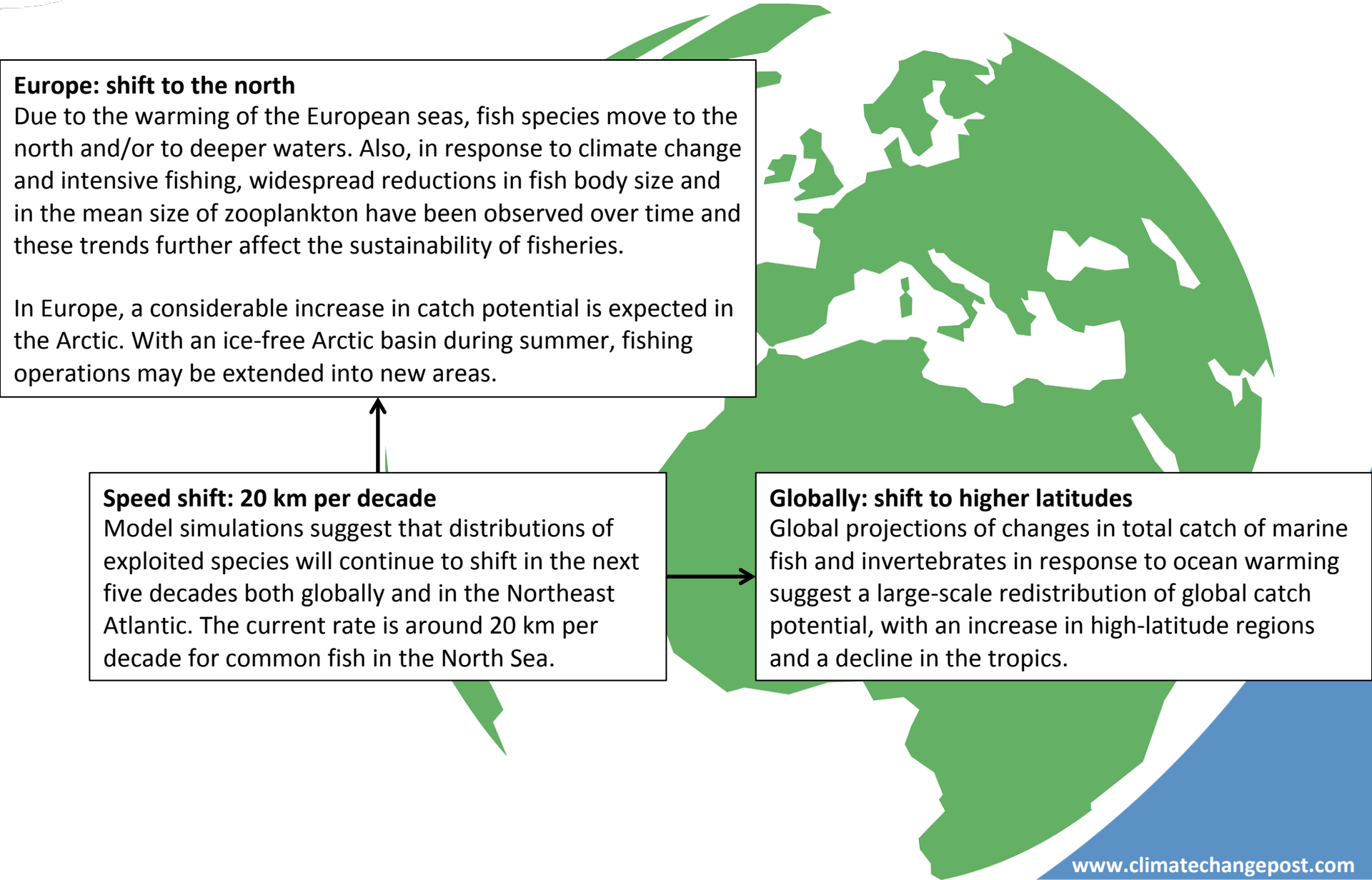
Source: Eurostat (2017)

Climate change is affecting fish species distribution and body size

Fisheries
Redistribution of species

Europe: shift to the north
Due to the warming of the European seas, fish species move to the north and/or to deeper waters. Also, in response to climate change and intensive fishing, widespread reductions in fish body size and in the mean size of zooplankton have been observed over time and these trends further affect the sustainability of fisheries.

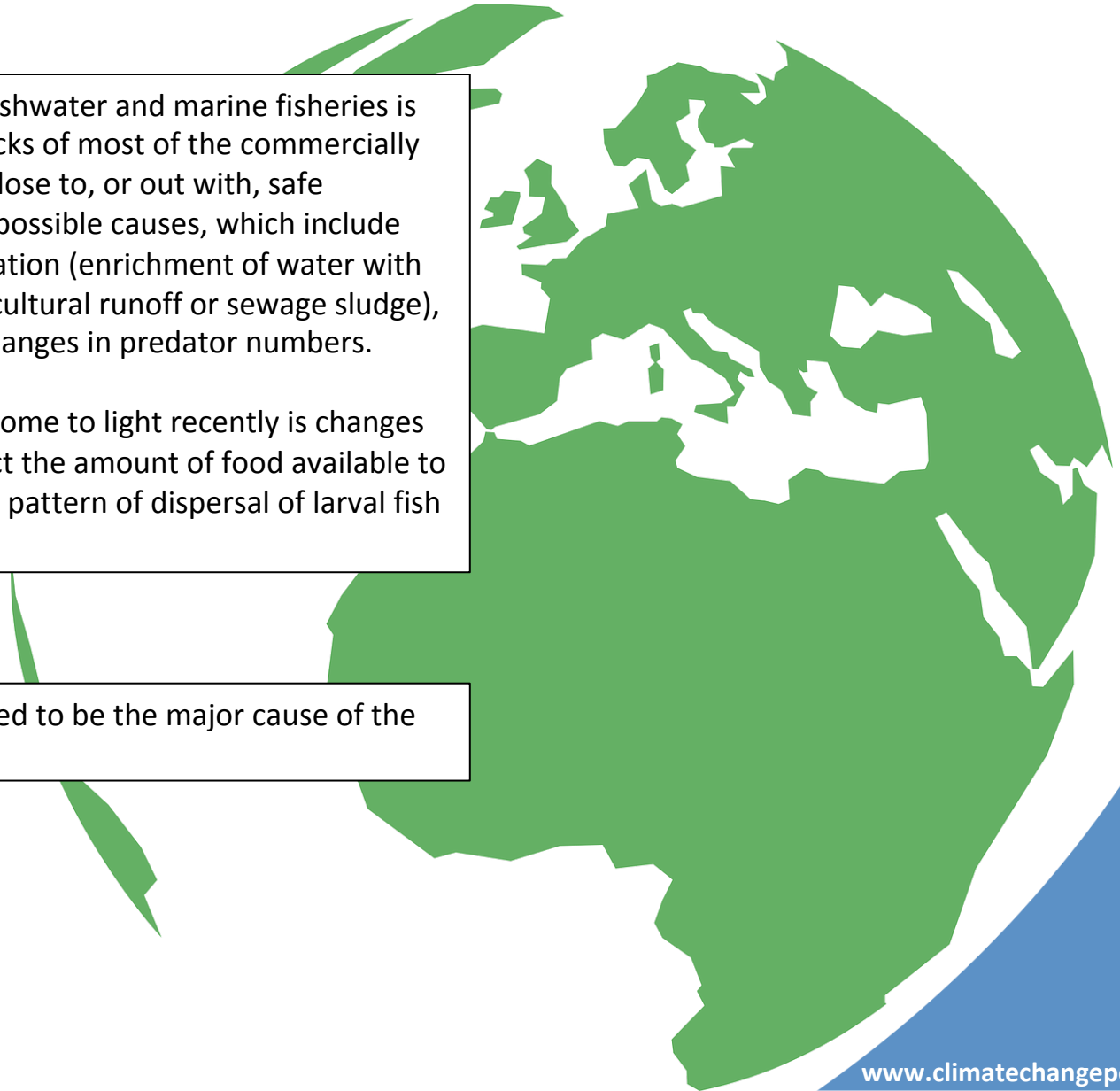
In Europe, a considerable increase in catch potential is expected in the Arctic. With an ice-free Arctic basin during summer, fishing operations may be extended into new areas.



Speed shift: 20 km per decade
Model simulations suggest that distributions of exploited species will continue to shift in the next five decades both globally and in the Northeast Atlantic. The current rate is around 20 km per decade for common fish in the North Sea.

Globally: shift to higher latitudes
Global projections of changes in total catch of marine fish and invertebrates in response to ocean warming suggest a large-scale redistribution of global catch potential, with an increase in high-latitude regions and a decline in the tropics.

Climate change is not the only pressure affecting fish stocks



The major issue faced by both freshwater and marine fisheries is the decline in fish stocks. The stocks of most of the commercially exploited species of sea fish are close to, or out with, safe biological limits. There are many possible causes, which include over-fishing, pollution, eutrophication (enrichment of water with nutrients from, for example, agricultural runoff or sewage sludge), acidic runoff from forestry and changes in predator numbers.

Another possible cause that has come to light recently is changes in ocean currents: these can affect the amount of food available to adult fish, and disrupt the normal pattern of dispersal of larval fish to the main fishing areas.

Over-fishing is generally considered to be the major cause of the decline in sea fisheries.

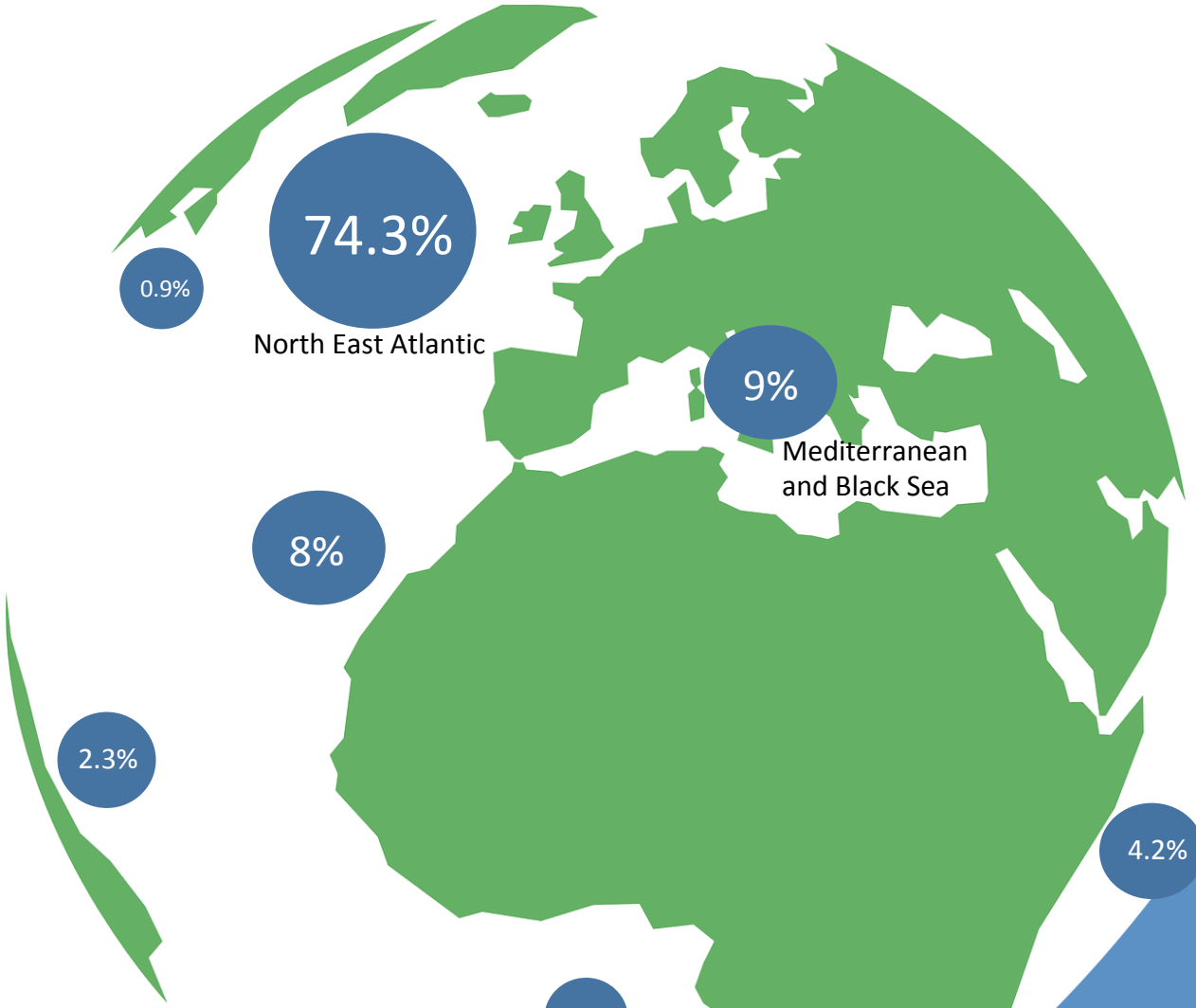
Global business: marine fisheries can ‘follow’ redistribution of fish species

Fisheries Economics

The distribution changes of fish species as a response to warming oceans not necessarily affects fish available for human consumption. Fish are often transported long distances from where they are caught to where they are marketed. The prices of fish may change if certain species that are common today become less common.

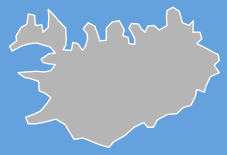
Changes in distribution may affect the management of fisheries. Fisheries regulations in the EU include allocations of quotas based on historic catch patterns, and these may need to be revised.

In general it is not possible to predict whether northward shifts in distribution will have a positive or a negative effect on total fisheries production.



Source: Eurostat (2017)

Fisheries
Northeast Atlantic



Northeast Atlantic

Northward shift fish species

In the Northeast Atlantic Ocean, 72% of commonly observed fish species have responded to warming waters by changing their abundance and/or distribution. Traditionally exploited fish species have moved further northwards in the region, while new species have moved in from the south.

Fisheries increase

A moderate warming is likely to improve survival of larvae and juveniles of most species and thereby contribute to increased abundance of commercial stocks in general. A general increase in North Atlantic and Arctic fisheries is likely, based on traditional species as well as the influx of more southerly species. This will affect East Greenland, Iceland, Norway, Sweden, Finland, Northwest Russia, and adjacent seas.

Northward shift fish food

During the past 40 years there has been a northerly movement of warmer-water plankton by 10° latitude (1100 km) in the Northeast Atlantic and a similar retreat of colder-water plankton to the north. This northerly movement has continued over the past few years and appears to have accelerated since 2000.

Related to warmer water

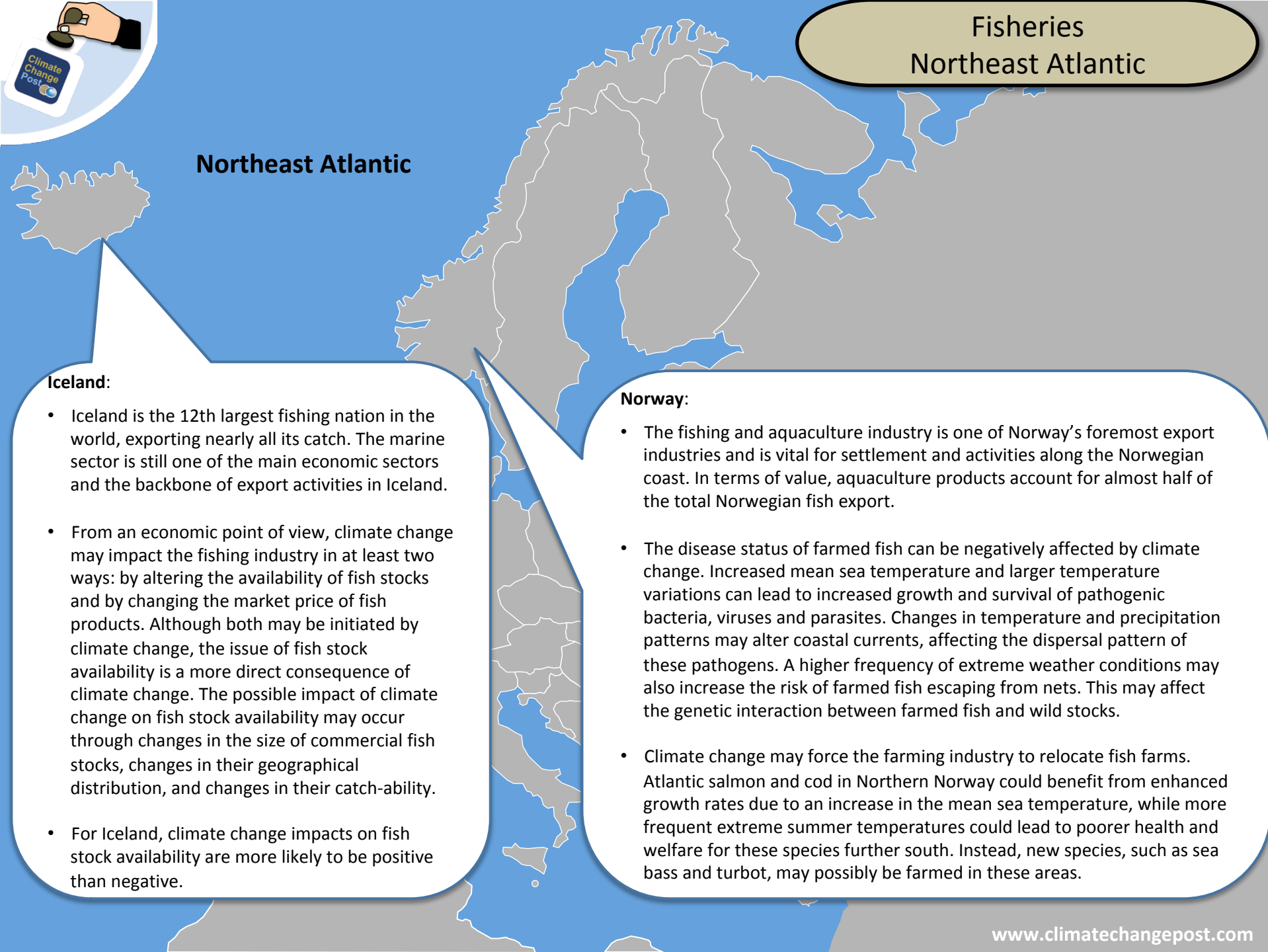
Identifying impacts of warming oceans on sea fauna and flora populations is difficult because natural changes, fishery and eutrophication are also taking place. The causal relationship of changes in temperature and fish distribution and abundance is quite strong, however.

Diseases are shifting too

The apparent spread of toxic phytoplankton species, and the possible movement of pathogenic microorganisms and disease agents, with consequences for aquaculture and fisheries, is of particular concern.

Fisheries
Northeast Atlantic

Northeast Atlantic



Iceland:

- Iceland is the 12th largest fishing nation in the world, exporting nearly all its catch. The marine sector is still one of the main economic sectors and the backbone of export activities in Iceland.
- From an economic point of view, climate change may impact the fishing industry in at least two ways: by altering the availability of fish stocks and by changing the market price of fish products. Although both may be initiated by climate change, the issue of fish stock availability is a more direct consequence of climate change. The possible impact of climate change on fish stock availability may occur through changes in the size of commercial fish stocks, changes in their geographical distribution, and changes in their catch-ability.
- For Iceland, climate change impacts on fish stock availability are more likely to be positive than negative.

Norway:

- The fishing and aquaculture industry is one of Norway's foremost export industries and is vital for settlement and activities along the Norwegian coast. In terms of value, aquaculture products account for almost half of the total Norwegian fish export.
- The disease status of farmed fish can be negatively affected by climate change. Increased mean sea temperature and larger temperature variations can lead to increased growth and survival of pathogenic bacteria, viruses and parasites. Changes in temperature and precipitation patterns may alter coastal currents, affecting the dispersal pattern of these pathogens. A higher frequency of extreme weather conditions may also increase the risk of farmed fish escaping from nets. This may affect the genetic interaction between farmed fish and wild stocks.
- Climate change may force the farming industry to relocate fish farms. Atlantic salmon and cod in Northern Norway could benefit from enhanced growth rates due to an increase in the mean sea temperature, while more frequent extreme summer temperatures could lead to poorer health and welfare for these species further south. Instead, new species, such as sea bass and turbot, may possibly be farmed in these areas.

Fisheries
Northeast Atlantic

Northeast Atlantic

Ireland:

- For salmon production, climatic changes may have serious consequences. Salmon are near the southern range of their distribution and any increases in water temperature could result in farms becoming less commercially viable, subject to increased harmful algal bloom events and a number of pests and diseases.

Portugal:

- The species richness of the Portuguese coast is generally higher than that found in northern Europe and similar to that of the Mediterranean, since many species have their southern or northern distribution limits along the Portuguese coast. Over the last 100 years in this area, species with affinity for temperate waters generally presented a decreasing trend, whereas species with affinity for subtropical/tropical waters showed an increasing trend. In this period, sea surface temperature along the Portuguese coast has increased.

- As the sea surface temperature of the Iberian-Atlantic fishing-grounds rises, lower sardine biomass and catch levels are obtained, and as a result, the economic yield also decreases. If the current trend in rising sea surface temperature remains the same (0.27°C per decade), the profits will decrease by 1.27% annually between now and 2030.

Fisheries
North Sea

Northward shift fish species

Future warming is expected to increase biodiversity in the North Sea, mainly because warmer waters tend to suit more species. New species will arrive either as vagrants from more southern European waters or in the form of non-indigenous species from warm marine regions elsewhere in the world.

Throughout northwest Europe, the number of warm-water species with smaller maximum body size is increasing while the number of cold-water, large-bodied species is decreasing. According to recent estimates two thirds of the most common bottom dwelling fishes have moved to cooler waters, going north or to deeper waters. In parallel, southern species such as sardine and anchovy are increasingly being observed in the North Sea.

North Sea

Related to warmer water

The North Sea has witnessed significant warming over the past century at a rate of around 0.3 °C per decade. Projections suggest that the region will continue to experience warming, by around 2 - 3 °C over the next 100 years.

Socio-economic consequences

The climate change-induced shift is likely to reduce the value of North Sea fisheries. Fishes from warm waters are often commercially less valued than cold water species. The three large species that have decreased their range the most in the North Sea are all commercially relevant, while only one of the five most increasing species and less than half of all the species that expanded their range are of commercial value.

The vulnerability of North Sea countries to climate change impacts on fisheries is considered to be very low, largely due to low rates of fish consumption in the surrounding countries, highly diversified economies and only moderate exposure to future climate change.

Fisheries
North Sea

United Kingdom:

Marine fisheries

- According to Scottish and English commercial catch data in the North Sea spanning the period 1913-2007, catches of cod seem to have shifted steadily north-eastward and towards deeper water in the North Sea and this reflects both climatic influences and intensive fishing. Plaice distribution has shifted north-westward towards the central North Sea, again reflecting climatic influences, in particular sea surface temperature.
- Trawl data from Scottish research vessels dating from January 1925 show that catches of the warm water species anchovy and sardine increased suddenly after 1995. These long-term changes are thought to be due to rising sea temperatures.

North Sea

United Kingdom:

Inland fisheries

- In the rivers, higher temperatures and lower oxygen concentration are unfavourable to salmon, sea-trout and trout, and might tip the competitive balance towards less valuable coarse fish, such as pike, allowing both native species and those introduced by anglers to extend their ranges.
- Increasing pollutants from concentrated river flow during droughts and from leaching of agricultural land during high rainfall may lead to poorer inshore water quality. The remobilisation of metalliferous mine and industrial wastes due to storms and increased winter rainfall may pollute inshore waters and have potential impacts on fisheries (larvae), and shellfish stocks.
- In recent years salmon and sea-trout numbers have fallen, particularly in the rivers of the west coast of Scotland.

Fisheries
North Sea

North Sea

The Netherlands:

- The temperature of North Sea water has risen by 0.5°C and the Wadden Sea by a whole degree; cod and flatfish move away.
- Exotics in the absence of natural enemies can be invasive and thus cause ecological and economic damage. A familiar example is the Japanese Oyster, which in the Zeeland delta and in the Wadden Sea invades mussel beds. Already present exotics (in small numbers) may still become invasive as a result of climate change.

Belgium:

- The lower limit of the range of shrimps is moving to the north: catches of common shrimps in the southern part of the North Sea (in the vicinity of Belgium) have decreased in recent years. The spatial distribution and/or recruitment of species important for the Belgian fisheries like sole, plaice, and cod were already negatively affected by climate change.
- Species which had their northern range limit in the English Channel or extreme south of the North Sea are more regularly found near Belgium. More southern commercial species, like red mullet and John Dory, which are currently not important for Belgian fisheries but have a high economic value, are likely to increase their northerly presence in response to climatic warming.

Fisheries
Mediterranean Sea

Warmer water

The Mediterranean Sea is warming in both shallow and deep waters. Fisheries landings of the seven Mediterranean EU member states (Spain, France, Italy, Slovenia, Greece, Malta and Cyprus) during 1985 - 2008 showed significant year-to-year correlations with temperature for nearly 60 % of the most abundant commercial species. From these, the majority (~70 %) were negatively related and showed a reduction. Increasing trends were found, mainly in the landings of species with short life spans, which seem to have benefited from the increase in water temperature.

Shift fish species

Due to faster biological processes at all levels of marine ecosystems, the growth rate of fish should be higher and reproduction seasons should be longer for most species. As a result, the recruitment of species that thrive in warm water should be significantly better.
The opposite is likely to occur with species that thrive in cold water, such as prawn. These species will migrate to colder areas, either horizontally (moving north, south, east or west) or vertically (moving to deeper levels).

Diseases are shifting too

The introduction of new organisms that transmit disease or exotic or undesired species is likely to occur due to increased sea temperatures.

Other pressures

Anthropogenic stress strengthens the consequences of climate change; overfishing, pollution, human-induced fragmentation and loss of habitat, and tourism activities already jeopardise the sustainability of Mediterranean fisheries.

Mediterranean Sea

Fisheries
Mediterranean Sea

Croatia:

- Tuna is the most important economic product within the fishery sector and is a warm-water species. As such, tuna farming in the Eastern Adriatic will probably benefit from climate change.
- The arrival of new species in the Adriatic Sea has resulted in both positive and negative impacts economically. However, it is highly troubling from an environmental standpoint, as the indigenous species are now under significant threat.
- Two potentially poisonous fish species have also been recorded in the Adriatic Sea: the oceanic puffer fish and the blunthead puffer fish.

Mediterranean Sea

Fisheries
Baltic Sea

Unique but threatened

The Baltic Sea is a unique inland sea with brackish water and special ecosystems. The sea water temperature is affected directly by a rising air temperature. Salinity and oxygen content are affected by the turnover of water, which in turn is controlled by precipitation and wind conditions.

The Baltic is considered a threatened sea. The temperature in the Baltic Sea will rise by several degrees and the extent of ice cover will decrease substantially. With increasing westerly winds and a substantial increase in precipitation, the salt level will be almost halved. If this happens, dramatic changes will occur in which almost all marine species will disappear. Even more modest effects on salt levels, together with the rise in temperature and increased input of nutrients, will probably lead to large-scale consequences and an increased burden on an already polluted sea.

Baltic Sea

Decreasing species richness

Living space for marine species in the Baltic Sea is expected to decrease due to the reduction in salinity. The extent of the changes will depend on the extent of the reduction in salinity. In a long-term perspective, there is an unequivocal trend towards increasingly low oxygen levels across all major areas.

In particular, the stocks of cod in the Baltic Sea, the Kattegat and the North Sea are threatened with collapse. The high pressure from fishing has resulted in a reduction in the average size of the fish, and adult fish now constitute a smaller proportion of the total biomass. The majority of the Baltic Sea will be dominated by ecosystems that are more reminiscent of inland lake conditions, and the level of biodiversity will decrease. Generally, eutrophication increases the total fish biomass, but decreases species richness.

Fisheries
Baltic Sea

Finland:

- Cold water species may decline particularly in small and shallow waters in southern Finland, while warm water species will benefit and spread further north.
- The most important cultivated fish is the rainbow trout, for which warming could be more a disadvantage than an advantage. If the climate warms significantly, there might be a need to farm a different fish species.

Baltic Sea

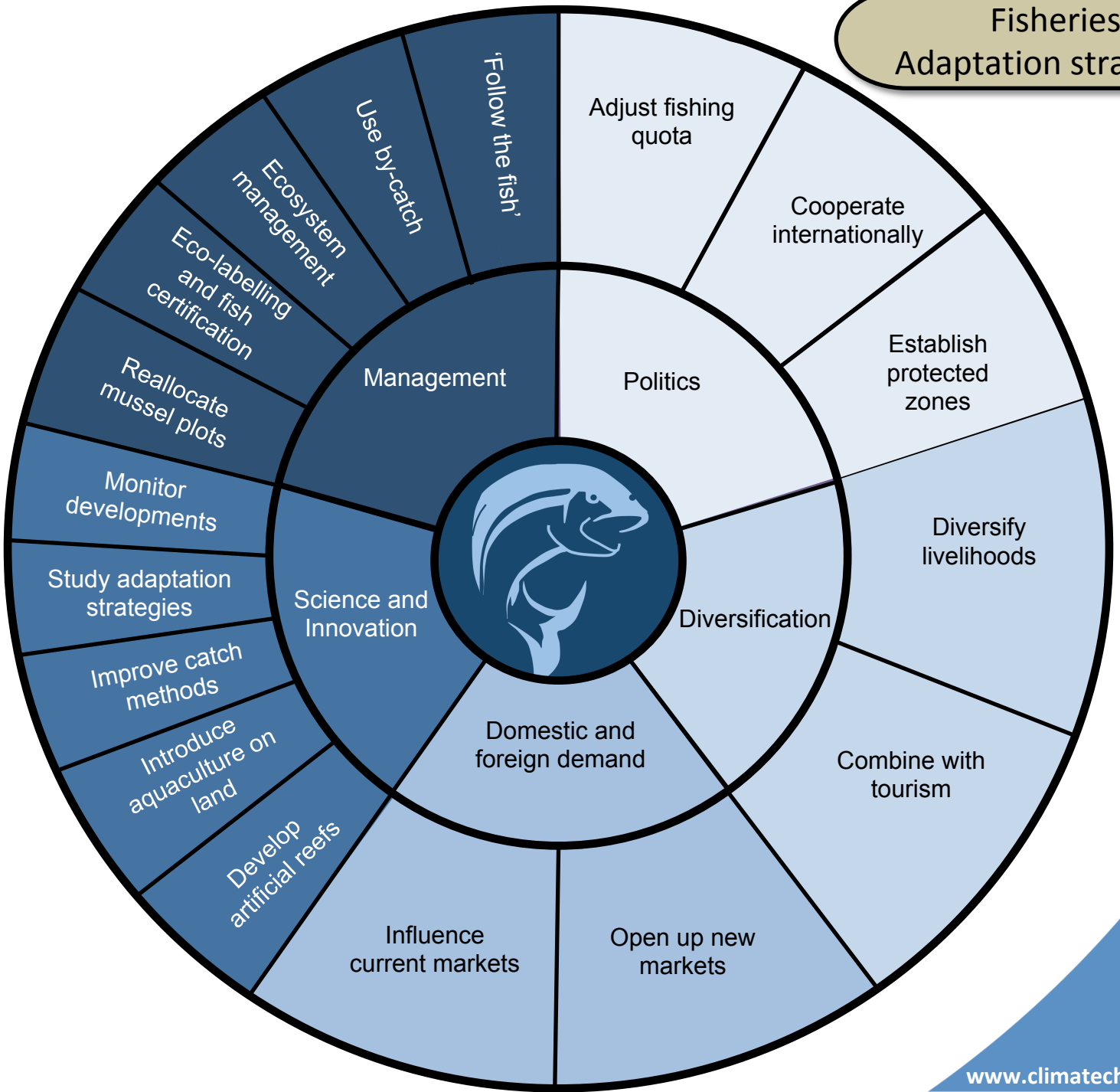
Sweden:

- The total loss of cod fishing in the Baltic Sea may have a very serious impact on a large proportion of the Swedish fishing industry, as the leading value-creating species in the Baltic may be lost. New species will gradually colonise Swedish waters and may seriously disrupt ecosystems.
- The eutrophication of lakes and watercourses increases. Fish are seriously affected through changes in species composition and a shift towards warm-water species. Foreign species will also spread out further. Overall, fish catches in lakes may increase.
- Despite the negative consequences for especially cod, total fish production will probably increase in fresh water, as the warm-water species, including commercially important species such as pike, zander and perch, will be able to spread further across the country due to higher temperatures and an increased supply of nutrients to watercourses as a result of increased runoff.

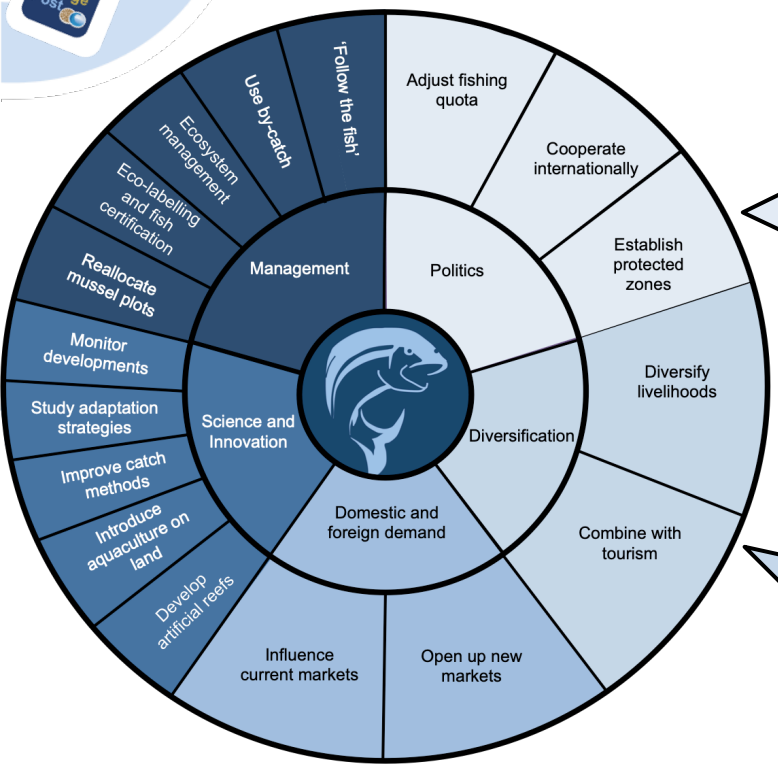
Denmark:

- In Denmark, it is expected that there will be a need to restructure fish and shellfish cultivation in both fresh and salt water.

Fisheries
Adaptation strategies



Fisheries
Adaptation strategies



Politics

- **Adjust fishing quota.** Fishing quota should not only be based on the actual levels of fish stocks and fish capture, but also on the expected shifts in species ranges.
- **Cooperate internationally.** Effective cooperation between the different countries fishing the same stocks, covering both agreeing the policy setting, such as maximum catches, and effective enforcement.
- **Establish protected zones.**

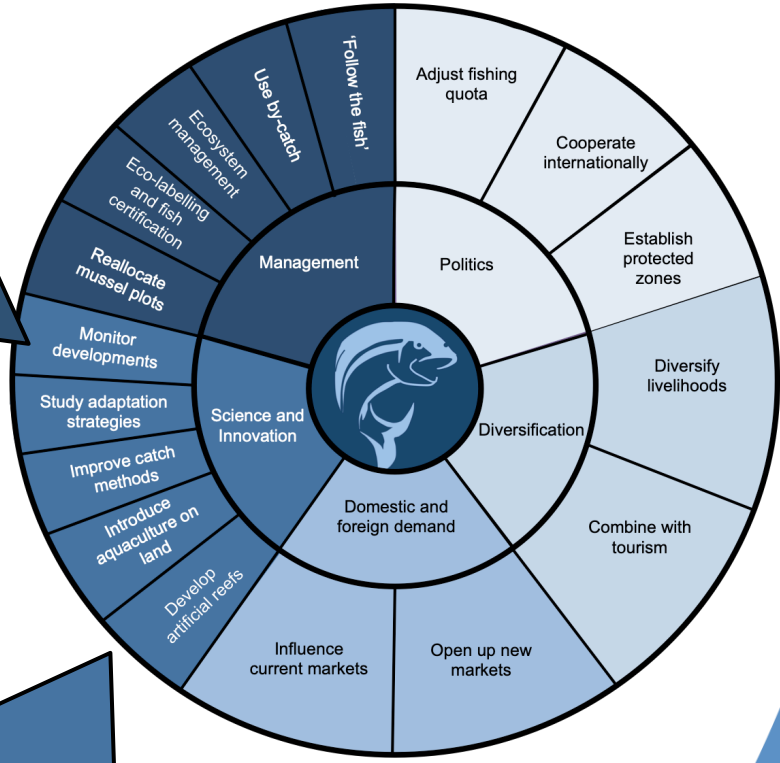
Diversification

- **Diversify livelihoods.** Diversifying the livelihoods of port communities, this may include recreational fishing where popular angling species become locally more abundant.
- **Combine with tourism.** Fishing personnel should be more closely integrated in tourism so that they can find new sources of income.

Domestic and foreign demand

- **Open up new markets.** Developing routes to export markets to match the changes in catch supplied. These routes may be to locations (such as southern Europe), which currently eat the fish stocks which may move into northern waters.
- **Influence current markets.** Stimulating domestic demand for a broader range of species, through joined-up retailer and media campaigns.

Fisheries
Adaptation strategies



Management

- **'Follow the fish'.** Travel further to fish for current species, if stocks move away from existing ports.
- **Use by-catch.** Incentives should be created to prevent throwing unwanted by-catch overboard as waste.
- **Introduce ecosystem management.** Ecosystem management in fisheries should include biodiversity conservation plans for freshwater and marine fish and shellfish at the genetic, species and ecosystem levels.
- **Introduce eco-labelling and certification of fish.** These demand side strategies aim to raise recognition by policy makers and the public at large of the necessity of sustainable use of fish resources.
- **Reallocate mussel nursery plots.** The dynamic reallocation of mussel nursery plots after storms avoids loss of productivity. The underwater foundation of offshore windmill has proven to be a suitable place to grow mussels. This strategy offers the possibility to combine mussel production with the production of electricity.

Science and Innovation

- **Monitor.** Scientists should keep developments under observation.
- **Study adaptation strategies.** Develop more knowledge to formulate adequate adaptation strategies. Moving to aquaculture may be necessary to meet increasing demand for fisheries products in a sustainable way.
- **Improve catch methods.** Catch methods must be improved so that only specific fish are caught in the nets.
- **Introduce aquaculture on land.** Fish production by means of aquaculture in seawater basins on former grassland may increase the economic value of otherwise inundated grassland. Aquaculture in basins on land is happening in the Netherlands for sole and turbot.
- **Develop artificial reefs.** Artificial reefs should be developed to capitalize on the appearance of exotic species for diving and recreational fishery.


Climate
Change
Post