

OCEANA GROUP LIMITED

Turning the Tide



A White Paper: The Fishing Industry's Role in Adapting to Climate Change

*"How inappropriate to call this planet earth
when it is quite clearly Ocean."*

**Arthur C. Clarke, British author, inventor and futurist
(1917 – 2008).**

Geoff Perrott, December 2009
(Updated May 2012)



A Global Carbon Exchange White Paper

Table of Contents

Acknowledgements	5
1. Executive Summary	6
1.1 The Current Reality	6
1.2 Breaking Bad News – Global and Business Risks	6
1.3 Response Strategies and Solutions	7
1.4 Towards Solutions and a Sustainable Future	8
2. Introduction	10
2.1 Climate Impacts	10
2.2 The State of Global Fisheries (2009)	11
2.3 Summary	16
3. The Concept of Adaptation	17
3.1 Adapting to change	17
3.2 Some useful definitions	18
4. Climate Change: General Trends and Future Projections	19
4.1 International context	19
4.2 The South African context	21
4.3 Timelines	22
5. Adaptation for the Fishing Industry	24
5.1 Historical overview	24
5.2 Background	24
5.3 Predicted Changes	25
5.4 The Vulnerability of the Sector (Risk and exposure)	29
5.5 Current Considerations in the International Context	42
5.6 Current Practice in Southern African Waters	54
5.7 Action and Risk Management	60
5.8 Recommendations – what more is needed?	63
6. The Business Case for Climate Change Adaptation	65
6.1 The Benefits of Early Action	65
6.2 The costs	66
6.3 Current & Future Adaption Strategies	67

7. Meeting the Challenge in South Africa	69
7.1 Moving forward in a climate-constrained world	69
7.2 The GCX Approach to Adaptation	70
8. GCX Resources Available	73
9. References and Further Readings	74
Glossary	78
Disclaimer	79

Figures

Figure 1: Global costs of extreme weather events (Munich Re, 2004).....	10
Figure 2: World fisheries and aquaculture production and utilization, excluding China (FAO, 2010).....	11
Figure 3: Marine fisheries capture: Exploitation of stocks (FAO, 2010).	12
Figure 4: Marine fisheries capture: Breakdown of overexploited, depleted or recovering stocks (FAO, 2010).	12
Figure 5: Tuna stocks, 2008, (FAO, 2010).	13
Figure 6: World production 2008 (FAO, 2010).	13
Figure 7: The expansion and impact of world fishing fleets in (a) 1950 and (b) 2006 (WWF, Living Planet Report, Summary, 2012.)	14
Figure 8: World utilization and supply, 2008 (FAO, 2010).....	15
Figure 9: Predicted global impacts (IPCC, 2007).....	19
Figure 10: The number of reported extreme climatic based disasters is increasing dramatically worldwide (IPCC, 2006).....	20
Figure 11: Headline expected impacts for Africa (IPCC, 2007).....	21
Figure 12: Stone Age fish hook made from bone (Wikipedia).....	24
Figure 13: Predicted changes to the oceans (IPCC, 2003). © GCX, 2009	26
Figure 14: Evidence of surface water temperatures rising	27
Figure 15: Impacts on marine fisheries/capture (Source: FOA, 2010). © GCX, 2012	30
Figure 16: Contributors to changing distribution and increased associated risks.....	32
Figure 17: The potential coupling effect of one severe weather event.....	33
Figure 18: Impacts on allied services and other business areas.	34
Figure 19: Dimensions of food security (FAO Technical paper 530, 2009). Adapted by GCX, 2012.	39
Figure 20: Climate change impacts (FAO, 2010). FAO Technical paper 530. Adapted by GCX, 2012.	40
Figure 21: Climate change impacts (Source: adapted from Allison <i>et al.</i> , 2005, FAO, 2009.) Adapted by GCX, 2012.	41
Figure 22: Climate related impacts (GCX, 2012).	42

Figure 23: Adaptation options for anticipated impacts 43

Figure 24: Adaptation options for other business-related impacts..... 44

Figure 25: Initiatives and Actions for the Fishing Industry..... 46

Figure 26: Conceptual model of vulnerability (adapted from Allison *et al*, 2005) 47

Figure 27: Impacts and threats in the southern African context..... 54

Figure 28: Sector preparedness – GCX estimated Fisheries sectors position..... 55

Figure 29: The cost of extreme weather events in the Western Cape compared to November 2008's extreme weather event 56

Figure 30: Agulhas Current (SARVA, 2010, adapted Lutjeharms (2006))..... 58

Figure 31: Oceana's leading approach..... 59

Figure 32: FAO's disaster cycle or emergency sequence..... 62

Figure 33: Specific adaptations to climate change for fisheries, FAO Technical Paper, 2009 64

Figure 34: Benefits of early action..... 65

Figure 35: The detrimental effects of inaction..... 66

Figure 36: Adaptation strategies..... 68

Figure 37: GCX Five Stage Approach to Climate Adaptation. 71

Figure 38: GCX Products and Services. 73

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"We, the human species, are confronting a planetary emergency - a threat to the survival of our civilization that is gathering ominous and destructive potential ... But there is hopeful news as well: we have the ability to solve this crisis and avoid the worst - though not all - of its consequences, if we act boldly, decisively and quickly."

Al Gore, Nobel Peace Prize Laureate, Lecture, 2007.

1. Executive Summary

"We are getting more and more alarming signals of dramatic changes in the oceans."

**Christian Nelleman, Team lead on the UN Report
"In Dead Water", 2007.**

1.1 The Current Reality

If only global warming were flavour of the month – or even decade for that matter. It is not only here to stay, it now forms an integral part of our lives. It impacts people, plants, animals, countries and business – including the fishing industry. There is no longer the option to sit in the stadium and decide whether or not to take part in this truly global "game" – we are the players and, contrary to popular belief, kick off has already happened and the game is in play.

Evidence of warming and the increasing risk of a dramatically changing climate, interspersed with amplified climate variability (e.g. extreme weather events) has mounted, and continues to do so. The strategy of passively anticipating outcomes no longer a viable option, as it misses two critical elements. Firstly, there are opportunities lying in wait for those who take on this challenge. Secondly, there are risks associated with a wait-and-watch approach. However, these risks offer potential advantages. Engaging them through time and finance bears the potential to offer both protection against their impacts, as well as open up opportunities for capitalising on the benefits of early action.

1.2 Breaking Bad News – Global and Business Risks

Globally fish stocks in the oceans and inland systems are under intense pressure. The rapidly increasing global population, improved fish locating and capturing equipment as well as a rising demand for the nutrition fish provides, all contribute towards use of the resource at unsustainable levels.

Climate change exacerbates the bad news as it adds a number of risks. Some are more manageable than others, as risks and impacts differ over time, by place as well as the nature of the threats. Risks associated with changes in the oceans include of the following:

- ❖ Thermal expansion (leading to sea level rise)
- ❖ Changes in the thermohaline circulation
- ❖ Changes in important cleansing currents
- ❖ Increasing acidification
- ❖ Loss of key biodiversity areas (warm and cold water reefs)
- ❖ Increasing severity of storms
- ❖ Coastal erosion
- ❖ Storm surges
- ❖ Changes in distribution of stocks and migratory routes
- ❖ Increased levels of damage to equipment, infrastructure

These threats and impacts translate directly to operational and business risk for the fishing industry potentially bear the following effects:

- ❖ Reduce the number of fishing days per year
- ❖ Increase costs per yield; time spent at sea and distances covered
- ❖ Increase costs associated with gear repairs/replacements
- ❖ Negatively impact on the location of facilities
- ❖ Require the relocation of facilities in some instances
- ❖ Increase fluctuations in catches
- ❖ Disrupt distribution and imports,
- ❖ Negatively impact on transportation and communication networks
- ❖ Compromised safety for employees in an already dangerous working environment

This all adds up to an overall impact on fisheries businesses and casts a gloomy shadow over the long-term future for many in the fishing industry worldwide.

Furthermore, fisheries and the fishing industry play a massive global role in many national and local economies, livelihoods, nutrition and protection of the natural environment. The industry, therefore, has a high level of responsibility to humankind and many will measure this responsibility by assessing the industry's efforts to address global climate change.

There is a possibility that the fishing industry may be held accountable to the citizens of many nations in (or near) which it operates for its contribution to the additional stress which climate change is expected to have on the marine (and inland water) environments.

1.3 Response Strategies and Solutions

Climate change is fast becoming one of the biggest issues on the global agenda. Its impacts are manifold and threaten the economic, social and environmental interests of most nations. Therefore, it is not surprising that strategies are being put in place to address this by governments, industry and individuals alike. The insurance industry is currently leading efforts to address climate change, a strong indicator of the severity with which climate change will impact businesses and livelihoods in the future.

Others are also beginning to address the issues and impacts associated with climate change and variability. The fishing industry is at the start of this process and Oceana have shown strong initiative to move climate change issues swiftly to the top of the business agenda.

There is no one approach to such a complex and multi-levelled issue as climate change. Multiple responses are the only sensible approach to addressing multiple risks. These strategies must be based on a good understanding of areas of vulnerability, as well as the probability and effects of impact.

Addressing these "high-impact, high-probability" areas first provides a sound basis for beginning adaptation implementation strategies. The following approaches are currently being employed or considered in a variety of global industries, as pertinent to the fishing trade.

- Increase fishing effort
- Increase efficiencies across the board
- Increase imported fish to meet demand through contracts
- Insure against losses (e.g. equipment, infrastructure and supply)

- Diversify business where possible
- Align capacity with changes
- Shift targeted species (if/where appropriate)
- Move fishing fleets , relocation of facilities
- Improve coastal defences
- Investment in improved early warning systems, other safety and training
- Consider indirect impacts on the business and include in planning processes
- Develop contingency plans and alternative options for main distribution networks
- Manage and reduce in-house GHG emissions and declare emissions
- Engage and influence national and international policy discussions
- Address legal responsibilities to shareholders and employees

The industry must demonstrate leadership by both taking adaptive action and mitigating climate change through the reduction of its own carbon emissions.

1.4 Towards Solutions and a Sustainable Future

Armed with the scientific evidence, expectation and an increasing number of generic good practice examples, the fishing industry has plenty of resources from which to draw in order to face the challenges presented by global climate change.

The industry's ability to adapt and innovate lies at the heart of managing its response and guiding fishing as a whole towards sustainable and appropriate solutions.

The solutions exist, but it is necessary to act quickly in order to minimise the impacts. There is no panacea, but rather a combination of solutions which, acting together, provide a path towards a more sustainable future for the industry.

The fishing industry has an important role to play in addressing the impacts of climate change and helping to deliver this global objective, which is inextricably linked to other major issues such as poverty, food security, economic development and environmental conservation.

Below are some of the benefits and opportunities that exist for companies in the fishing industry:

- ✓ Reduce climate risks for industry players
- ✓ Incentivise risk reduction through careful management planning
- ✓ Manage these risks (litigation, reputation, regulation)
- ✓ Reduce operational costs through cutting carbon emissions in-house. This also is an opportunity to lead by example
- ✓ Raise awareness and educate others in the sector and further afield
- ✓ Market differentiation as an environmentally sensitive and active industry;
- ✓ Counter the global financial crisis through leadership and innovation
- ✓ Engage with new markets and potentially new fish species
- ✓ Create positive preferences for society, which lead towards a low carbon future
- ✓ Forge partnerships to share/pool risks with government and other relevant stakeholders

- ✓ Establish the industry as a climate change leader in international climate discourse and negotiations
- ✓ Be seen as an industry which works for the good of society, and add to Corporate Social Responsibility (CSR) contributions
- ✓ Position industry players as low carbon or carbon neutral. This is seen very positively by employees, clients and suppliers alike
- ✓ Contribute towards combating global climate change
- ✓ Become the stewards of the oceans for future generations;

Climate change is certainly not the only issue facing the fishing industry at present. There are other major risks and stressors such as the current economic climate, decreasing stocks from over-exploitation, the nature of the industry being in the *high risk* category already and transgression of sustainable fishing guidelines, to mention but a few.

Possibly the most important aspect of future climate change and increasing climate variability is the fact that it will make all of the above stressors more difficult and costly to manage and mitigate. It is, therefore, critically important that climate change not be placed into a box labelled "Global Warming" and dealt with as a separate entity. It permeates issues, compounds risks, and increases vulnerabilities. It requires decisive and immediate action.

The way ahead is through somewhat uncharted waters. However, the rising temperatures and sea levels will surely overwhelm those who stand still for fear of action and will provide great incentives to those brave enough to turn the tide and make tomorrow's climate their responsibility.

*"Only when the last tree has been cut down,
Only when the last river has been poisoned,
Only when the last fish has been caught,
Only then will you find that money cannot be eaten."*

Cree Indian Prophecy



2. Introduction

“We are now observing [in the world's oceans] what may become, in the absence of policy changes, a collapsing ecosystem with climate the final coup de grace.”

**Achim Steiner, Executive Director, UNEP
United Nations Environment Programme**

2.1 Climate Impacts

Adaptation to climate change is fast becoming the key issue at global climate conventions and policy forums and is now acknowledged to be as important as mitigation in the global efforts to address climate change. The impacts of climate change are becoming increasingly apparent, as are the human and financial costs.

An interesting place to start is to look at the importance of the fishing industry. It is estimated that over half a billion people are dependent on fisheries world-wide and that about one third of the global population rely on aquatic products for about 15-20% of their protein intake in a year (Dulvy, N & Allison E, Nature, 2009). There are a number of predicted climate impacts which would negatively affect the fishing industry such as reduced yields, increased variability of yields, changes in fish distribution, vulnerability of equipment and infrastructure, as well as the knock-on effects on post-harvest activities in allied services such as storage and distribution.

Climate impacts are uncertain to some degree. However, there is growing evidence that impacts will increase in frequency and intensity over time. Currently, the insurance industry is one of the leading sectors to understand and act on climate change. This is because they have witnessed firsthand the impact a fast-changing climate is having on our planet. Whilst the graph below is insurance industry-orientated, consider how these losses have impacted the fishing industry – and, if inflexible approaches to fishing and allied services are maintained, the impact may be worse in years to come.

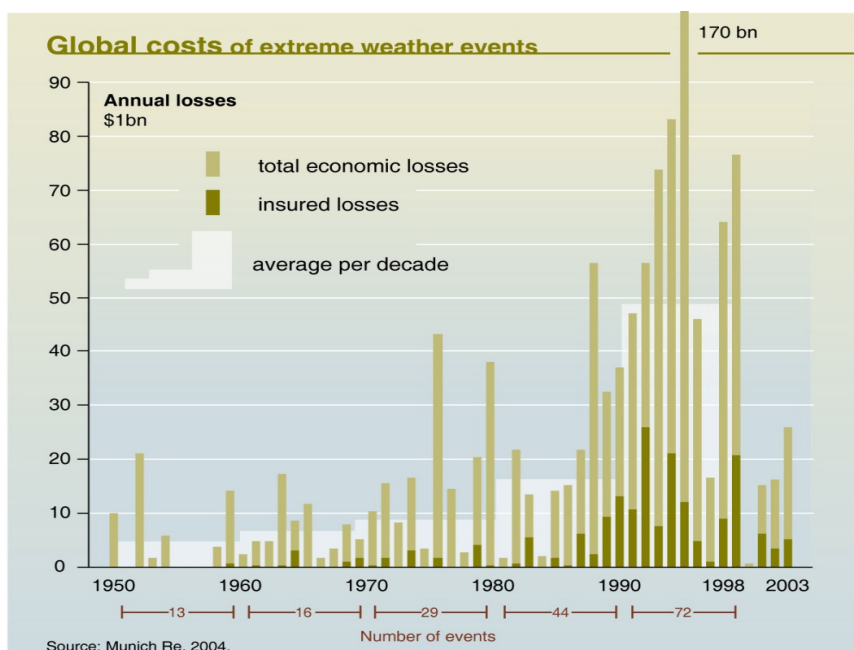


Figure 1: Global costs of extreme weather events (Munich Re, 2004).

Climate change brings a lot of bad news, most of which is perfectly justified. However, adaptation is not simply about addressing the potential negative impacts of climate change. It is also about looking for the opportunities that may arise as a result of changes in climate and the associated changes in both financial and market practices and preferences.

Whilst the absence of climate change would be a far preferable situation, the reality is that it is here and the risks are increasing each day. Therefore, taking the “ostrich” approach to climate change is not appropriate, nor is it sustainable.

2.2 The State of Global Fisheries (2009)

One of the key points of interest is the seemingly relentless increase (on average 1.5% annually) in production from a global perspective, increasing from about 134.3 million tonnes in 2004 to 145 (144.6) million tonnes in 2009 (FAO, Year Book, 2009). This may be due to the fact that fish provides about 43% of the global population with 15% of their animal protein intake. The table below illustrates this point by showing the steady increase in total world fisheries. However, what is interesting to note is the marine capture figures are relatively stable over the last five years of records. Whilst some argue that capture fisheries appear stable over the last decade, there are clearly specified concerns about the state of the stocks that are being exploited by marine capture fisheries. Furthermore, it can be seen that the per capita amount of 17.2kg (live weight equivalent) is the highest on record to date. China remains the world's leading fish-producing country with 47.5 million tonnes in 2008, 14.8 million of which was from capture fisheries (State of World Fisheries and Aquaculture, 2010).

	2004	2005	2006	2007	2008	2009
<i>(Million tonnes)</i>						
PRODUCTION						
INLAND						
Capture	8.6	9.4	9.8	10.0	10.2	10.1
Aquaculture	25.2	26.8	28.7	30.7	32.9	35.0
Total inland	33.8	36.2	38.5	40.6	43.1	45.1
MARINE						
Capture	83.8	82.7	80.0	79.9	79.5	79.9
Aquaculture	16.7	17.5	18.6	19.2	19.7	20.1
Total marine	100.5	100.1	98.6	99.2	99.2	100.0
TOTAL CAPTURE	92.4	92.1	89.7	89.9	89.7	90.0
TOTAL AQUACULTURE	41.9	44.3	47.4	49.9	52.5	55.1
TOTAL WORLD FISHERIES	134.3	136.4	137.1	139.8	142.3	145.1
UTILIZATION						
Human consumption	104.4	107.3	110.7	112.7	115.1	117.8
Non-food uses	29.8	29.1	26.3	27.1	27.2	27.3
Population (<i>billions</i>)	6.4	6.5	6.6	6.7	6.8	6.8
Per capita food fish supply (<i>kg</i>)	16.2	16.5	16.8	16.9	17.1	17.2

Note: Excluding aquatic plants. Data for 2009 are provisional estimates.

Figure 2: World fisheries and aquaculture production and utilization, excluding China (FAO, 2010).

Below is a comparison of exploitation of stocks between 1974 and 2008 (FAO, 2010). The comparison shows that the percentage of fully exploited stocks remained similar, but the changes in underexploited or moderately exploited stocks have decreased dramatically (63% reduction). Correspondingly, there was a significant increase (220%) in overexploited, depleted or recovering stocks.

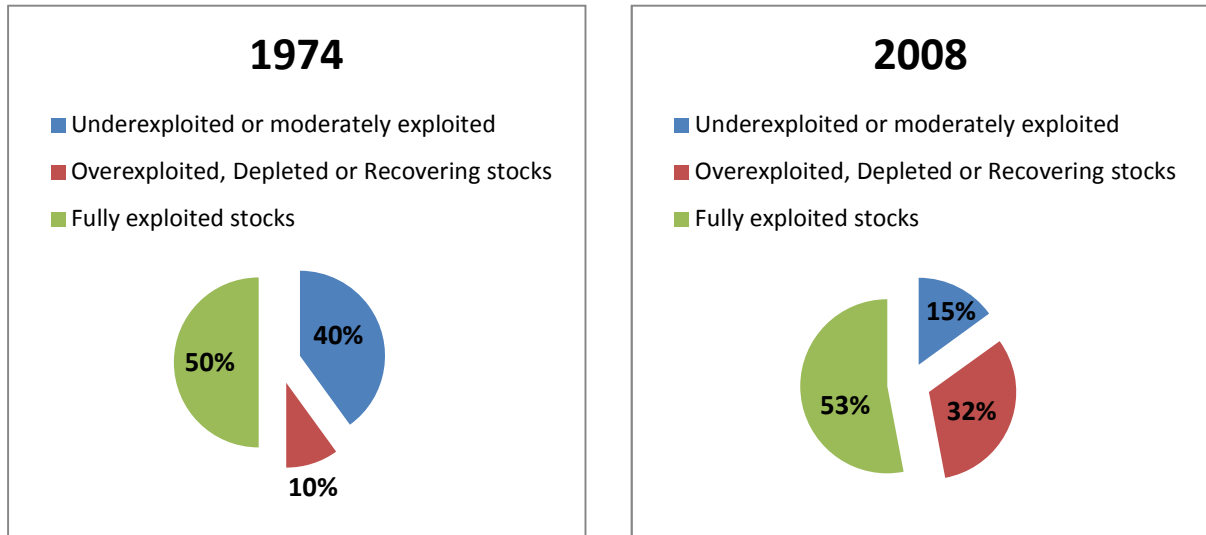


Figure 3: Marine fisheries capture: Exploitation of stocks (FAO, 2010).

It is also very important to understand that of the overexploited, depleted or recovering stocks, only 3% of these are recovering, 9% are depleted and the remaining 88% are overexploited (FAO, 2010) – generally representing a bleak outlook.

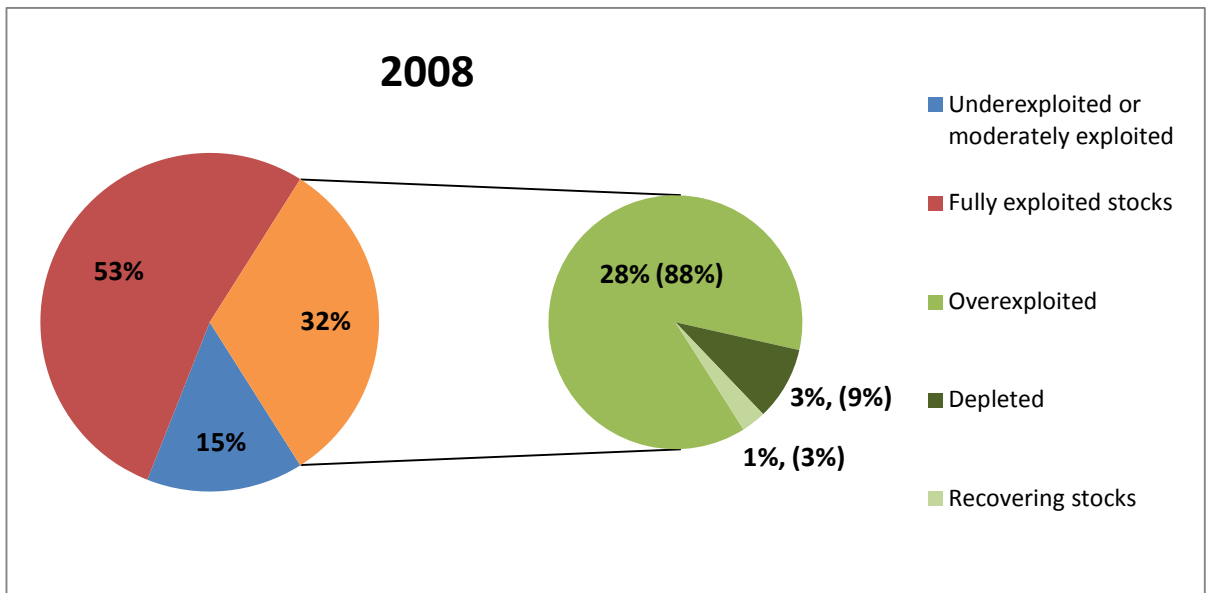


Figure 4: Marine fisheries capture: Breakdown of overexploited, depleted or recovering stocks (FAO, 2010).

Access to information on stock-exploitation levels gives an indication of the health of the stock. Tuna is one example of the stock represented in the above graphs. There are 23 tuna stocks as divided into the following categories:

Tuna Stocks	Percentage
Underexploited exploited (mainly skipjack)	+/- 5%
Fully exploited stocks	+/- 60%
Overexploited or Depleted	+/- 35%

Figure 5: Tuna stocks, 2008, (FAO, 2010).

The 90 million tonnes of capture fisheries (80 million tonnes from marine waters) in 2008 was estimated to have a first-sale value of US\$93.9 billion. Aquaculture was responsible for 52.2 million tonnes, which was valued at US\$98.4 billion and is predicted to overtake capture fisheries (FAO, 2010). Apart from the high level financial figures, the fishing industry is estimated to support 540 million livelihoods in both the primary and secondary sectors of the industry. That represents about 8% of the global population. Jobs in the capture fisheries are static (or decreasing) and increasing significantly in aquaculture. From the figure below, it is also clear that China forms a huge proportion of global production, which is also steadily growing in proportion over time. Once again, this graph shows an upward trend and adds increasingly to the pressure currently being experienced by fish stocks around the world.

World capture fisheries and aquaculture production

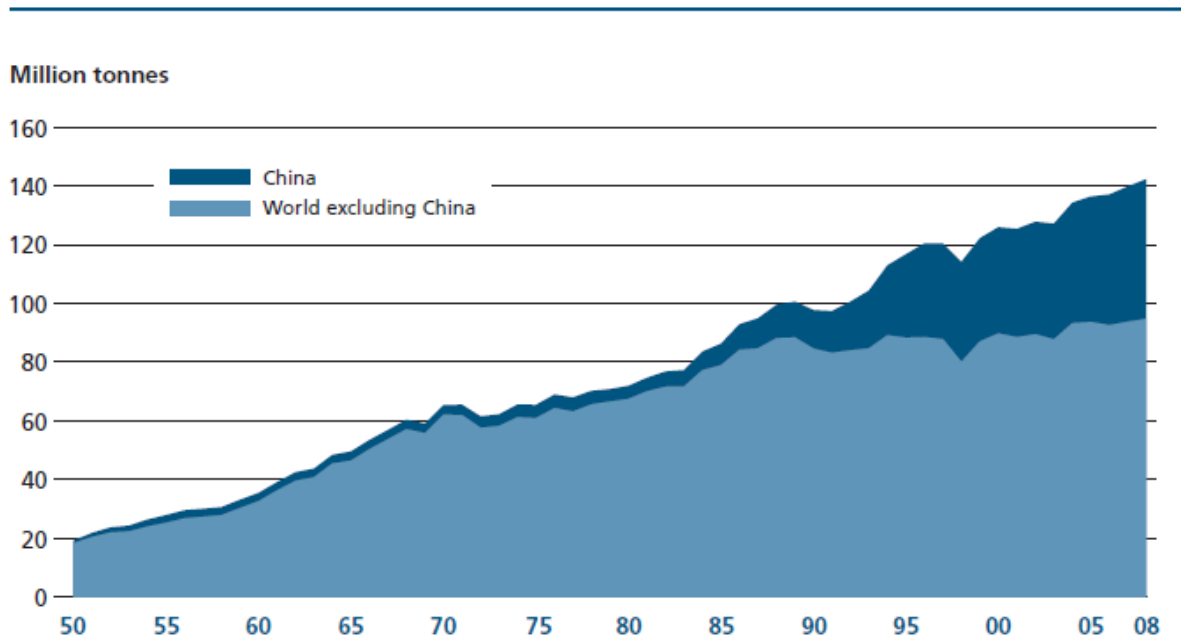
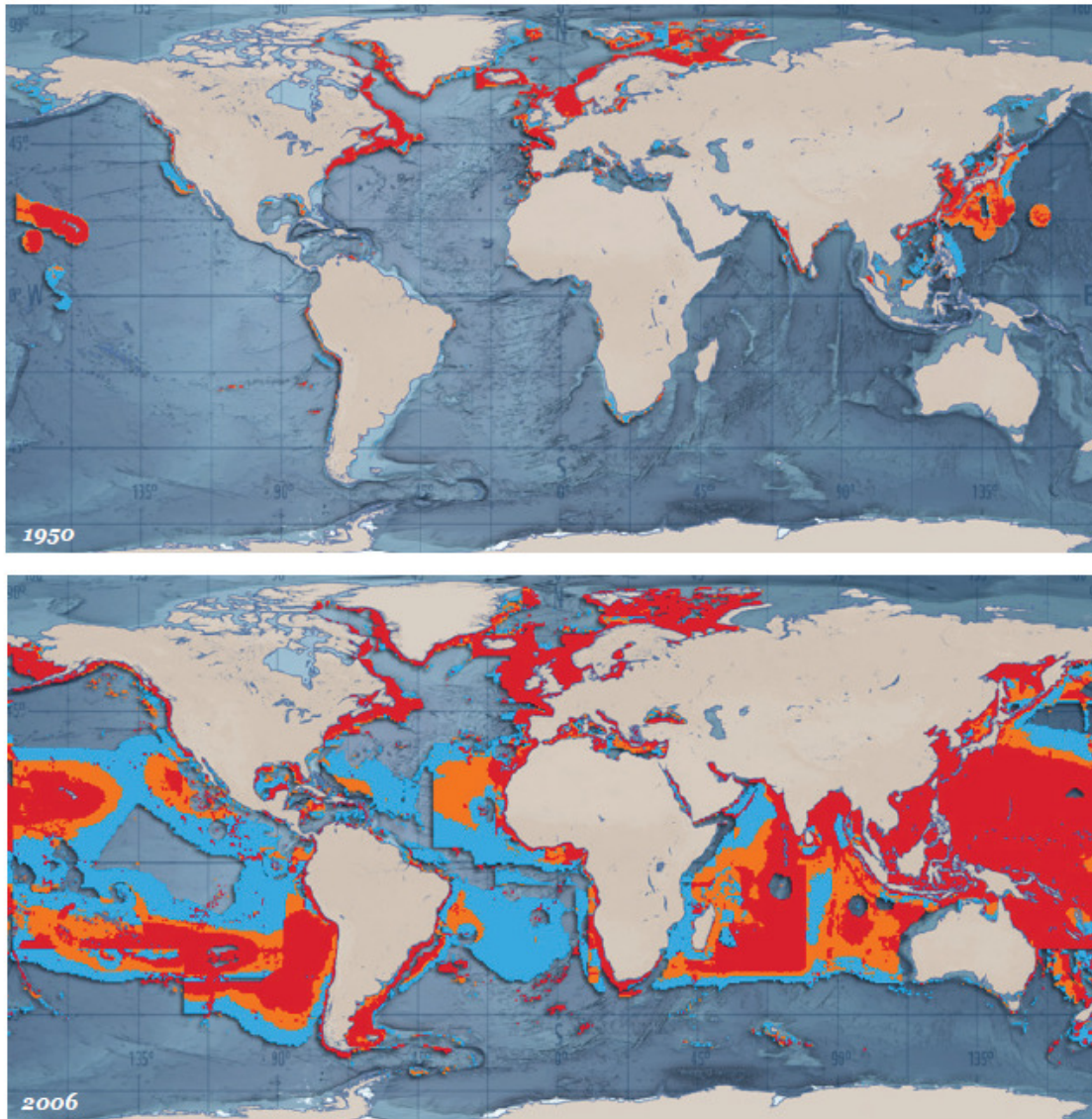


Figure 6: World production 2008 (FAO, 2010).

The figure over the page shows that of the 142 million tonnes of fish in 2008, 115 million tonnes (81%), was for human food and represented the highest ever kilogram per capita amount of 17kgs/capita. This graph also appears to show that the food supply-and-demand have reached equilibrium. Based on current trends, it seems highly likely that demand is about to begin to exceed supply in the very near future. Furthermore, the massive expansion (as shown over page) in the world's fishing fleets is adding to the ability to harvest fish stocks at unsustainable rates.

Below is a direct extract from WWF, Living Planet Report, 2012 showing the geographical expansion of worlds fishing fleets.



The maps show the geographical expansion of the world fishing fleets from 1950 to 2006 (the latest available data). Since 1950, the area fished by global fishing fleets has increased ten-fold. By 2006 100 million km², around 1/3 of the ocean surface, was already heavily impacted by fishing. To measure how intensively these areas are fished, Swartz et al., (2010) used the fish landed in each country to calculate the primary production rate (PPR) of each region of the ocean. PPR is a value that describes the total amount of food a fish needs to grow within a certain region. In the areas in blue, the fleet extracted at least 10% of this energy. Orange indicates a minimum of 20% extraction and red shows [at] least 30%, highlighting the most intensively and potentially overfished, areas. WWF and the "Sea Around Us" project collaborated to produce an animated map showing these changes over time and also the expansion of the EU fishing fleet, see http://www.wwf.eu/fisheries/cfp_reform/external_dimension/

Key

- At least 10% PPR extraction
- At least 20% PPR extraction
- At least 30% PPR extraction

PPR is a value that describes the total amount of food a fish needs to grow within a certain region.

Figure 7: The expansion and impact of world fishing fleets in (a) 1950 and (b) 2006 (WWF, Living Planet Report, Summary, 2012.) The full and summary reports can be found at: http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/

World fish utilization and supply

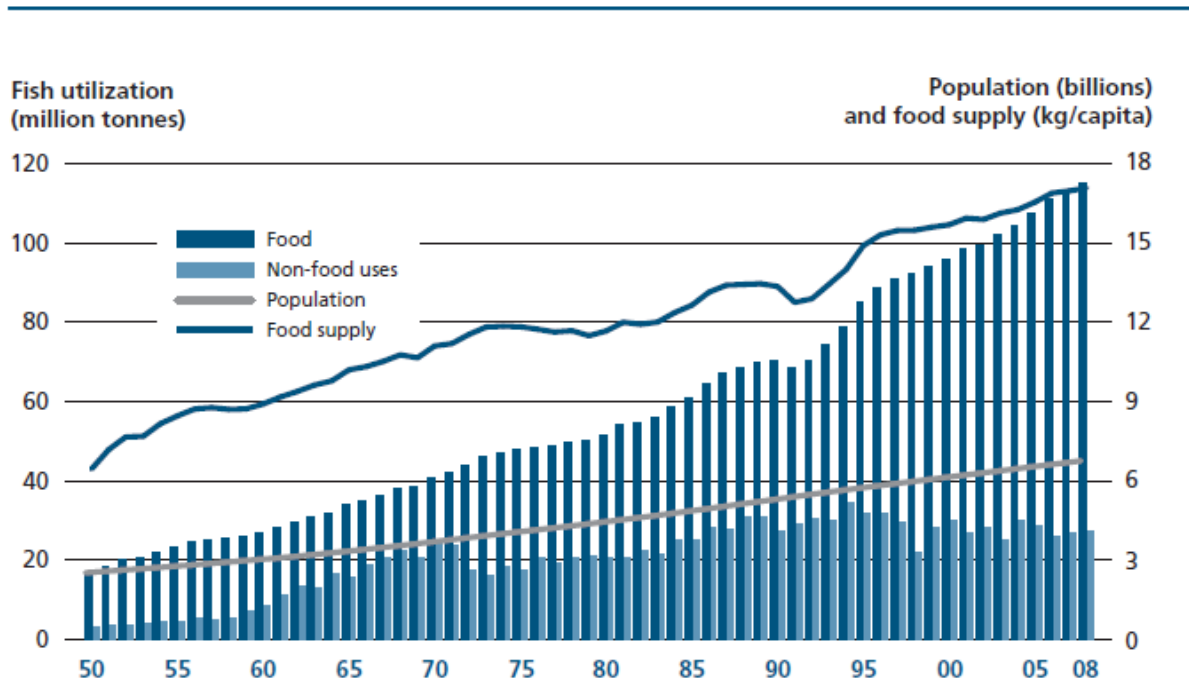


Figure 8: World utilization and supply, 2008 (FAO, 2010).

There is, however, some good news as some fish stocks and marine ecosystems are being improved through good management. Some areas include: Australia, on the Newfoundland-Labrador Shelf, the Northeast United States Shelf, the Southern Australian Shelf, and in the California Current ecosystems.

In conclusion, the main findings are very similar to those represented in the White Paper of 2009. The update can be broadly classified into the following points:

- The increasing demand for fish is apparent and continuing.
- Aquaculture is playing an increasingly large role in fisheries globally.
- China is still the largest producer of fish in the world.
- Supply and demand are basically at equilibrium.
- Per capita usage is at an all-time high.
- Africa (by value) is a net exporter but a net importer by quantity.
- Communities are playing an increasingly important role in the fishing industry, due to the linkages between socio-economic situations and fisheries.
- Levels of by-catch remain high and ecologically damaging.
- Consumers in wealthier countries are increasingly demanding sustainably-sourced fish, with traceability being a key determining factor.

Some management systems are seeing positive results.

2.3 Summary

The opportunities from climate change, particularly for the fishing industry, are explored throughout this paper as are the various actions the industry is beginning to take in tackling this global threat. The aim is to give Oceana a good understanding of international trends associated with global warming, including some examples of where and how this affects fisheries in southern Africa. In addition, the approach fishing companies in South Africa should follow when addressing the risks and opportunities presented by global climate change is proposed.

The paper firstly considers what adaptation is and what the latest scientific findings tell us, before considering the international context of fishing and the relevance of climate change to the South African fishing industry (which is mostly marine capture rather than inland capture or aquaculture). The business case for managing climate risk is discussed, whilst a potential approach for putting processes in place which result in actions is promoted by way of a conclusion.

Addressing climate change is not a process to be achieved overnight, nor is there a simple solution to a complex issue which impacts across sectors and countries to varying degrees and at multiple levels. Addressing the challenges presented by global climate change requires planning, innovation, desire, courage and, most of all, collective action.

*Fishing and aquaculture have the distinct
advantage of being from renewable sources,
if managed responsibly.*

Stanford Limited, New Zealand

3. The Concept of Adaptation

“Adaptation has the potential to reduce adverse impacts of climate change and to enhance beneficial impacts, but will incur costs and will not prevent all damages.”

IPCC, Third Assessment Report (2001)

The IPCC has also stated that, due to past and current emissions of greenhouse gases, the earth will inevitably see some degree of climate change, regardless of the success of mitigation measures. Thus, even if the world were to stop all greenhouse gas (GHG) emissions with immediate effect, climate changes due to GHG emissions already present in the atmosphere, would continue for another 50 to 100 years at the very least. This means that addressing the predicted impacts of climate change is a critical requirement for any comprehensive climate change programme.

- The impacts of climate change, such as an increase in the frequency and intensity of extreme weather events across the planet (including: storms, floods, droughts, storm surges, heat waves, and cold snaps), are already taking place.
- Action to mitigate these climate impacts and to increase the resilience of businesses to them is now firmly on the agenda of many global companies.

Therefore adaptation could be summarised as follows:

Adaptation is a way of reducing vulnerability, increasing resilience, moderating the risk of climate impacts on lives and livelihoods, and taking advantage of opportunities posed by actual or expected climate change.

Pertinent to southern Africa is the fact that, initially, developing countries (those least responsible for climate change) will be the most affected by its impacts. This highlights the need for businesses operating in countries like South Africa (and in its coastal waters) to address adaptation within their core business strategies.

3.1 Adapting to change

Human and natural systems do, to some extent, adapt autonomously to changes in climate. Adaptation that is planned can also supplement some of the autonomous adaptation. However, it is argued that the “options and incentives are greater for adapting the way we as humans sustain ourselves as a species, than for trying to implement adaptation which tries to protect natural systems” (IPCC 2001: 6-8).

The ability of systems (e.g. socio-economic systems) to adapt is influenced by certain system characteristics called “determinants of adaptation”. These determinants include terms such as:

- Sensitivity
- Vulnerability
- Resilience
- Susceptibility
- Adaptive capacity

The occurrence and the nature of adaptations are influenced by these, and other, determinants.

Adaptations vary not only with respect to their climatic stimuli but also with respect to other, non-climate conditions, also referred to as 'intervening conditions', which serve to influence the sensitivity of systems and the nature of their adjustments.

For example, in the agricultural sector, a series of droughts may have similar impacts on crop yields in two regions, but differing economic and institutional arrangements in the two regions may well result in quite different impacts on farmers and hence in quite different adaptive responses, both in the short and long terms (Smit et al. 2000: 235).

Adaptation can be reactive (after the impact has taken place) or anticipatory (in preparation for the expected impact) (IPCC, 1995). Adaptation can be localised or widespread, and can serve numerous functions and take on numerous forms.

Finally, adaptation is about being able to adjust to changing conditions. An example from the UK shows that there is evidence that changes can be quite substantial as what was historically a one in 10-year event now occurs every 2.7 years, the 20-year event occurs every 4.3 years, and the return period for a 100-year event is just 12.5 years (Dlugolecki, A. et al. (2009).

3.2 Some useful definitions

Adaptation: Actions by individuals or systems to avoid, withstand, or take advantage of current and projected climate changes and impacts. Adaptation decreases a system's vulnerability, or increases its resilience to impacts.

Adaptive Capacity: The ability of a system to cope with and/or adjust to either actual or expected stresses caused by climate change or increased climate variability.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2007). Furthermore, vulnerability could also be defined as: an indication of a sector's exposure to external risks, shocks and stresses and its ability to cope with, adapt to and recover from the resulting impacts placed on the wellbeing and livelihoods of the individuals in that sector (Chambers, 1989).

Resilience: The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change (IPCC, 2007). It often requires a capacity to anticipate climate change and plan the necessary adaptations.

Variability: Climate variability refers to variations in the mean state and other statistics (such as standard deviations, statistics of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events (IPCC, 2007).

Limits to adaptation: Adaptation can reduce the adverse impacts of climate change considerably but it cannot eliminate them. This largely depends on the resources available and capacity of the individual, economy, business etc. Thus, adaptation does have its limits.

“Current and past emissions have committed the earth to some degree of change in the climate. Even if dramatic and effective mitigation measures are undertaken to reduce greenhouse gas emissions, the climate will continue to warm.”

IPCC, 2007.

4. Climate Change: General Trends and Future Projections

“Global warming will confound the impact of natural variation on fishing activity and complicate management.”
Fourth Assessment Report, IPCC, 2007.

4.1 International context

In 2007, the IPCC affirmed that warming of the climate system is unequivocal, with effects such as increasing land and ocean temperatures. From 1961 to 2003 global ocean temperature has risen by 0.10°C from the surface to a depth of 700 metres. This is causing a number of changes in the oceans including: changes in ocean water masses, increased levels of inorganic carbon, increased acidity from dissolved carbon dioxide, rising global average sea level, and increased severity of storms (IPCC, 4AR, WG I, Ch 5). The outlook is as follows:

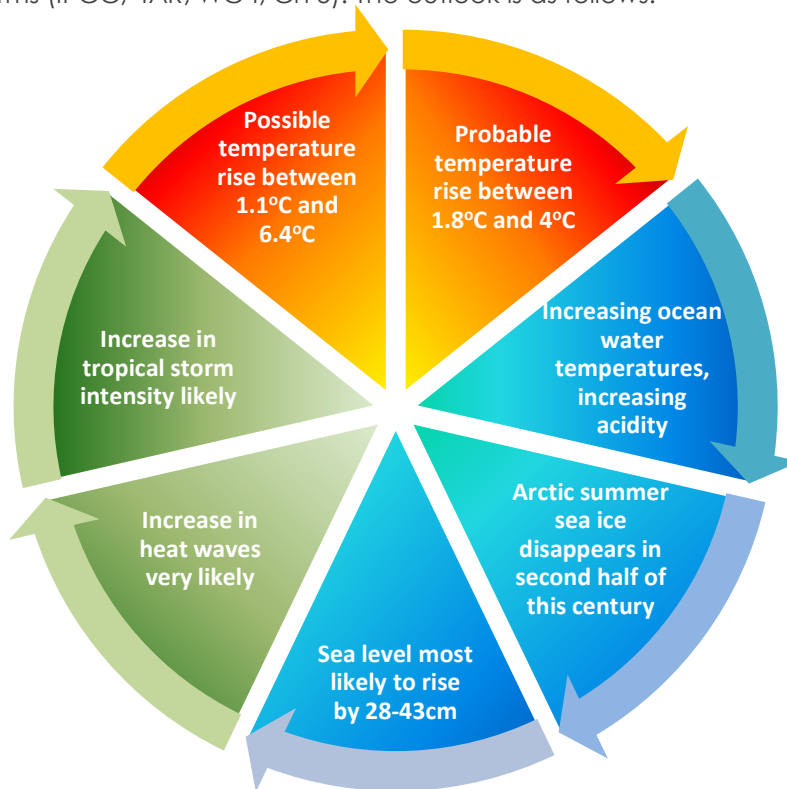


Figure 9: Predicted global impacts (IPCC, 2007).
 © GCX, 2009

These changes – which are linked directly (90% certainty level) to human activities producing greenhouse gases – are already causing changes in terrestrial and marine ecosystems, water supply and availability, and patterns of extreme events, with (in many but not all cases) consequent damages to human health, livelihoods, infrastructure and equipment. Thus, the question is no longer, “Is there human-caused climate change?” but “What can be done to adapt to it?” Adaptation does not preclude steps to reduce greenhouse gas emissions, but recognizes that we are unavoidably committed to some amount of climate change, and that changes are already occurring.

While climate change will affect everyone, it is expected to have, at least initially, a disproportionate effect on those living in poverty in developing countries. Financial safety nets may be required for the poorest in society, who are also the most vulnerable to climate impacts and least able to afford protection (Stern Review, 2006).

The financial costs are likely to be extremely high. In a report from the UNEP's Finance Initiative (UNEP FI) a doubling of financial losses every 12 years from weather events is estimated (UNEP FI, 2006). Furthermore, Yvo de Boer (head of the UN Climate Change Secretariat) reported to Reuters in August 2009 that, tackling climate change is going to cost about US\$ 300 billion each year from 2020. He added that about one-third of that money will go into adaptation, but that developing nations are already asking for cash to implement adaptation measures – cash which, to date, is not forth-coming. To put the US\$ 300 billion into context, the US economic stimulus package agreed upon for 2009 was worth a total of US\$787bn (Reuters, 2009).

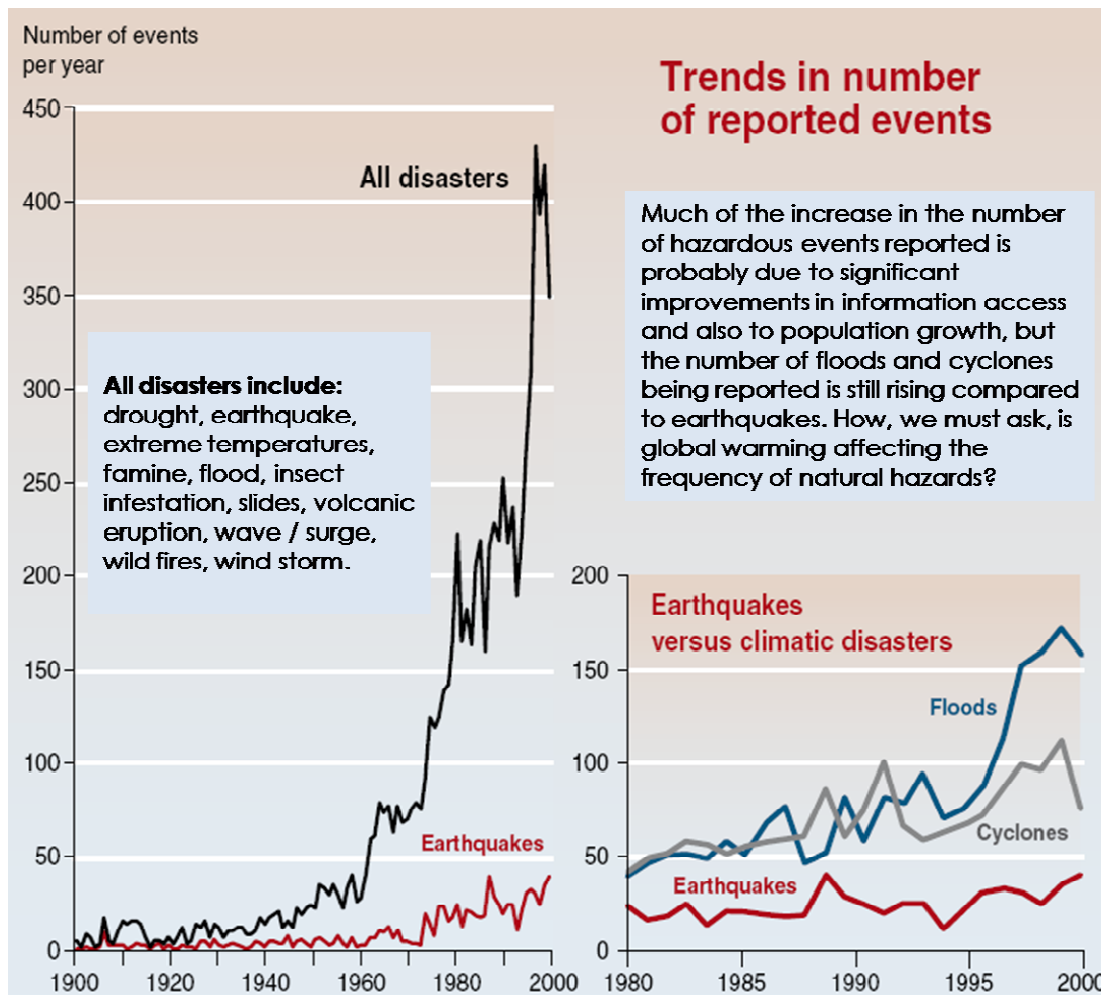


Figure 10: The number of reported extreme climatic based disasters is increasing dramatically worldwide (IPCC, 2006).

Note: It is claimed by some part of this increase in the number of weather-related disasters, may be due to better reporting mechanisms and communication. However, similar increases in reports have not taken place in relation to other types of disasters like the number of reported earthquakes (Source: In Dead Water, 2008. Reprinted with permission.)

4.2 The South African context

The predictions for Africa as a continent are clear and they are not good. Africa is considered one of the most vulnerable continents to climate impacts. The figure below summarises the main impacts which Africa is likely to encounter, and southern Africa is a region which is likely to be particularly hard hit by the impacts associated with these predictions:

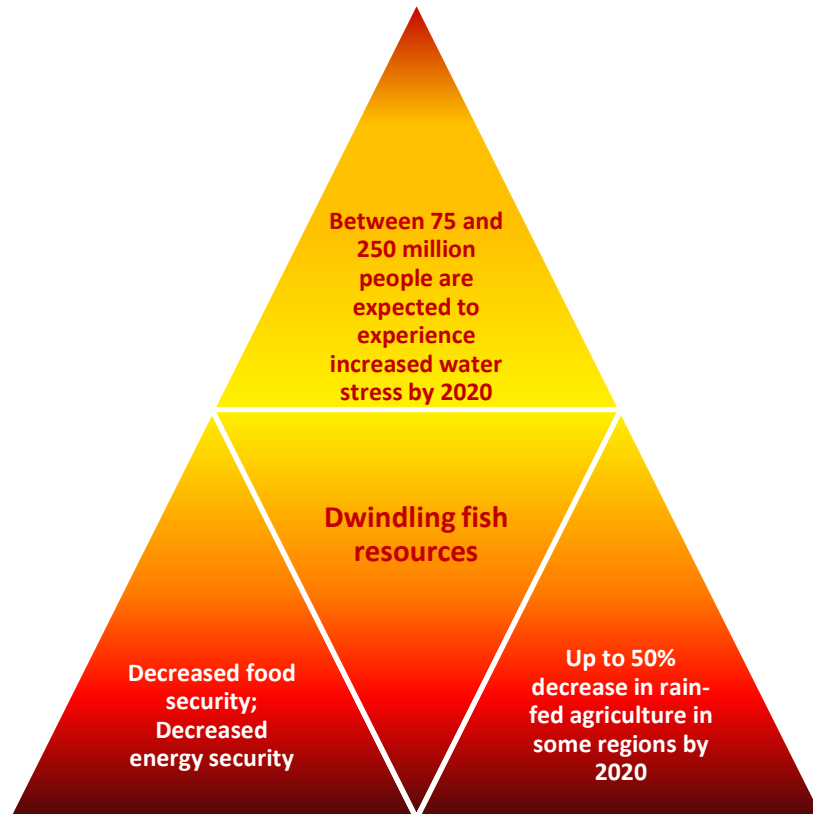


Figure 11: Headline expected impacts for Africa (IPCC, 2007).
© GCX, 2009

Climate change is projected to bring with it a number of impacts including changes in rainfall and temperature regime changes (as shown above), possible increases in the number of droughts, floods and other extreme events. These changes may, in turn, add additional stresses to the following:

- Water resources
- Land use
- Agriculture
- Transport networks;
- Fisheries
- Tourism
- Mining
- Infrastructure

South Africa is shown to be highly vulnerable to climate change as it is already a water-stressed region. Whilst some areas, generally the eastern parts, are predicted to see increases in rainfall, it is the type of rainfall which causes damage, rather than being beneficial. The western half of the country is likely to see a general drying and reduction in rainfall, further reducing the availability of water in an already highly water-stressed region of South Africa.

There is a projected increase in precipitation, as well as an increase in rain-days and an increase rainfall intensity. For coastal regions (subject to orographic precipitation) the seasonal totals may be expected to either remain relatively stable or increase. Over the Western Cape, winter rainfall shows indications of drying (Hewitson, et al., 2005).

The changes in climate, along with an increase in the frequency and intensity of severe weather events, have impacts on livelihoods, local economies and life itself. The Western Cape has been severely hit by a number of weather-related events in the past five years and has already spent over R100million in aid/assistance for droughts and floods (2008).

In addition to land-based expenses, the increasing costs of these events are being witnessed in the marine and coastal environments. There are a number of indicators of these impacts, among them: numbers of lives lost, ships running aground/wrecks, oils spills and reduced operational days.

Due to seafood being an important part of our diets (with many fish products being used for animal feed), reductions in catch will slowly begin to impact on food security. The Food and Agricultural Organisation (FAO) states that in 2006, fish provided over 2.9 billion people with at least 15% of their average per person animal protein intake (FAO, The State of World Fisheries and Aquaculture Report, 2008, <http://www.fao.org/docrep/011/i0250e/i0250e00.HTM>).

Reductions in catch is not the only food security stressor; there are also others as the prediction by the FAO which says that we can expect that farmers in Africa, where the climate is already hot, will face severe problems growing crops if [and when] the weather becomes even hotter (<http://www.fao.org/kids/en/agriculture-gw.html>).

The costs associated with the impacts of extreme weather are already being felt. An example of this is shown in section 5.6.1 of this report. The study shows that the costs of extreme weather events are not sustainable, and a great deal of effort is directed towards the reactive approach rather than being proactive about the predicted (and witnessed) increasing frequency and intensity of these kinds of climate-related impacts.

4.3 Timelines

According to some scientists, climate change-related impacts are currently almost impossible to identify as it is still considered by them to be "early days". The danger is that if we wait until climate change is scientifically proven to be responsible for extreme weather events before we act, by then it will, probably, be too late.

Therefore, whilst it is very difficult to set timelines for changes, we know one deadline and that is for action... and the deadline is now. The post-Kyoto agreement is in all likelihood going to include some developing nations and South Africa, with its European-style per capita emissions, must be high up on the list for possible inclusion. The result is predicted to be increased carbon measurement and management requirements, carbon taxes for high emitters and regulations around compulsory disclosure of greenhouse gas emissions.

It is not the threat of imminent legislation which should be the driver for change, but the potential impacts of climate variability and change on the fishing industry. It will become clearer further on that this is not an exact science, and that there are many uncertainties surrounding these impacts with the knock-on effect of trying to prepare for and manage them.

As the UK Climate Impacts Programme (UKCIP) points out, “Climate change is having profound effects on marine and freshwater ecosystems, but it is difficult to separate the climate impacts on fisheries from those caused by human fishing pressure” (UKCIP, Online, 2009).

It is easy to do nothing, however, risk management is an essential part of any long term company with a vision of being in business in 10, 20 or even 30 years time. For those businesses, and Oceana is one of them, the time to act is now, and the way to act is boldly.

“At the moment the consumption of fish is growing faster than that of meat, mainly due to health considerations. Because of acidification of the oceans and over-fishing, companies with fishing as their core business could face problems.”

**Gerard Rijk, ING Wholesale Banking,
The Netherlands, 2008.**

5. Adaptation for the Fishing Industry

“Because the ocean has already absorbed 82% of the total additional energy accumulated in the planet due to global warming, it is fair to say that the ocean has already spared us from dangerous climate change. But each day we are essentially dumping 25 million tonnes of carbon into the ocean. As a consequence, the ocean is turning more acidic, posing a huge threat to organisms with calcareous structures.”

**Patricio Bernal, Assistant Director-General of UNESCO,
IOC Executive Secretary.**

5.1 Historical overview

Fishing is truly one of the most ancient of practices. Its earliest records date back about 40,000 years to the start of the Paleolithic period with the evidence of fish in the diet of early humans. Mostly, these people were living as hunter-gatherers although where permanent settlements have been recorded, one of the largest sources of food has often been fish. From there the fishing “industry” grew and was recorded by the Egyptians in tombs and on papyrus scrolls. Stories of great wealth created from pearl fishing are told with the famous Greco-Roman god, Neptune often depicted with his fishing trident. Trade in fish became more common later with one of the world’s longest trading histories being the trade in dry cod. This trade started during the Viking period and still continues today, over 1000 years later.



Figure 12: Stone Age fish hook made from bone (Wikipedia).

5.2 Background

Fishing is not new to society. Humans have been practicing it for millennia. Likewise, climate change is an on-going process which living organisms, including humans, have been adapting to for thousands of years. What is new, however, is the rate of change we are currently experiencing.

The fishing industry, and the practice of fishing itself, is accustomed to operating in uncertain and often extreme weather conditions. Thus, the concept of climate change has taken some time to infiltrate the fishing industry’s agenda. Until recently, those setting the agenda from a policy perspective (such as the UNFCCC) have tended to ignore fisheries. Climate change, as we know it today, has not been high on any fisheries agenda and the linkages with gradual climate change have been tentative at best. This is changing extremely quickly, although there is still a great deal of work to be done on both sides.

The key difference between the fishing industry 20 to 30 years ago and today, as far as climate change is concerned, is that in the past climate change-related events were essentially dealt

with as isolated events and would not have been regarded as climate events, but rather as freak/rare/unusual events. They would not have been associated with something a lot more long term. The events would have been dealt with on a case by case basis and, at best, used in scenario planning for any similar future events.

Therefore, the challenge is going to lie in the Industry's ability to become proactive rather than reactive to the challenges of global warming – and the rate at which this change is delivered.

In 2006, The Stern Review noted that increasing costs from weather-related damage could be as high as 0.5 – 1% of global GDP by 2050. Furthermore, an increase of 5 – 10% in hurricane wind speeds, linked to global warming, are estimated to double annual hurricane damage costs in the USA. Heat waves such as that experienced in Europe in the summer of 2003 (35,000 deaths and losses to agriculture of approximately US\$15 billion) could be a common occurrence by 2050 (Stern Review, 2006).

Interestingly, the largest industry in the world, the Insurance Industry, has already developed considerable data and expertise on natural hazards and is able to assess risk (storms, flooding, sea level rise etc.) at the level of individual addresses. This information is already starting to change the way insurance is calculated. For example, in the UK in 2006, the industry announced that it would "blue line" flood hazard areas for new and existing homes – making approximately 350,000 homes potentially uninsurable. There is an increasing awareness in the Insurance Industry that higher premiums, as well as information about reducing risk, may help to reduce the costs associated with extreme weather events (UKCIP, 2007).

Where does this leave the fishing industry in its attempts to tackle the impacts of global warming and its contribution? The answer is, at this stage, relatively far behind. Some of the main reasons include a slow response from the industry itself as well as historically being marginalised in international policy debates. Fortunately, this is changing and the industry is starting to look at climate change and its impacts more carefully.

Learning the lessons from past and more recent impacts is a good place to start building the Industry's capacity and approach towards combating climate change.

Embedding the following approaches into current practice will go a long way to developing a stance on global climate change, which not only addresses the needs of present generations, but also considers those still to come:

- Increasing awareness (both within and outside of the Industry),
- Promoting risk-averse practices through awareness and well-designed strategies (many of which would be in line with the FAO's Code of Conduct for Responsible Fisheries), and
- Establishing sustainable strategic alliances with partners such as government and marine management bodies to ensure collaborative approaches focussed on future sustainability.

5.3 Predicted Changes

Note: This section builds upon the general trends and the predictions discussed earlier with a specific focus on the fishing industry. It is important to keep in mind the complex interactions between climate impacts and to understand that one impact can be felt in many places directly or indirectly, often geographically very far away from the actual event. Many of the effects in the oceans will also impact the terrestrial areas (e.g. extreme weather events).

5.3.1 Climate Change's Seven Deadly Sins for the Oceans

The temperature differences between land and sea, as well as distance from the equator (or poles), have a great impact on our weather and climate system. Due to increased levels of GHGs, temperatures are rising unevenly across the planet. This is causing changes in differential temperatures, which is impacting on the weather and climate as we know it (FAO, Building Adaptive Capacity to Climate Change, 2007).

There are a number of predicted impacts which will affect fisheries. Whilst the impact and knock-on effects surrounding aquaculture and inland capture are large and cannot be ignored, the impacts listed below focus mostly on marine capture fisheries). These changes are moving from the category of "predictions" towards that of "observations", which is partly why the Industry and the impacts are rising up the agenda so quickly. The Seven Deadly Sins refer to the seven ways in which the oceans are being negatively affected by climate change. These changes are stated in the Blue Carbon report published in 2009 by the UNEP, FAO, IUCN and UNESCO. These seven ways in which the oceans are being negatively affected by climate change are a very good summary of the reality of the situation and seriousness of the potential consequences if no action is taken. They effectively set the scene for beginning to consider how to deal with each risk going forward into an uncertain future.

Below is a graph summarising these seven predicted changes in the oceans due to increasing global temperatures, followed by a full discussion on each.

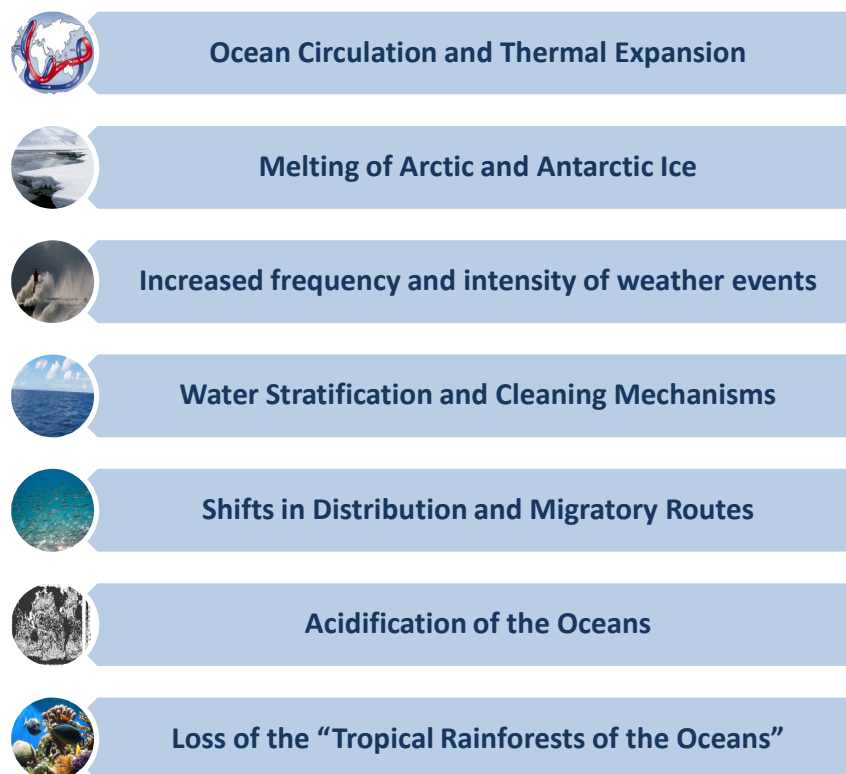


Figure 13: Predicted changes to the oceans (IPCC, 2003).
© GCX, 2009

1. Ocean Circulation and Thermal Expansion

The melting of ice and glaciers, as well as the heating of the oceans caused by the increased greenhouse effect, will affect ocean currents (see graph below). Ocean currents move around the planet in what is known as the thermohaline circulation, which is driven by water densities (salinity and temperature). Changes in circulation, even slight, are expected to affect many eco-systems and functions of life beneath the oceans.

Furthermore, as land-based ice (i.e. glaciers) melts sea levels are expected to rise. The current prediction for sea-level rise is about 43cm by 2100. This may appear to be an insignificant rise, however, for low-lying and coastal areas, which is extremely worrying when coupled with other climate change predictions such as storm surges. (This will be discussed further in the following section.)

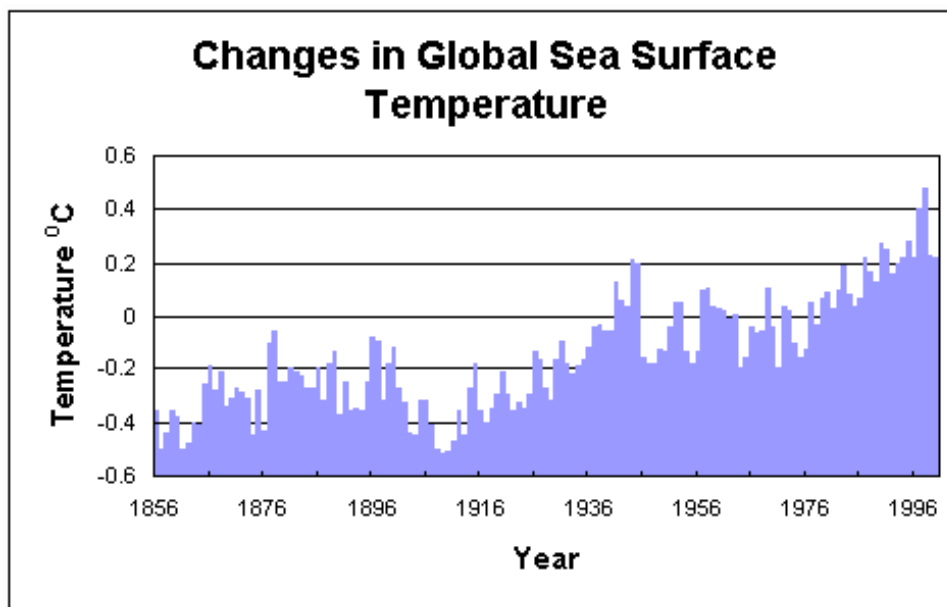


Figure 14: Evidence of surface water temperatures rising (Source: UNEP-WCMC online, 2009).

A rise in emissions of greenhouse gases has increased the earth's temperature by almost 1°C in the last 50 years. Increased air temperatures quickly translate into warmer oceans.

2. Melting of Arctic and Antarctic Ice

The increasing global temperature is causing Arctic and Antarctic ice to melt. This will dramatically affect biodiversity, and their distribution in these areas as well as the seas and oceans surrounding them. The ocean circulation, mentioned above, are currently unknown. One further effect is that the melting of the ice will reduce the amount of incoming solar radiation being reflected back out into space, known as the albedo affect. Albedo is an important climate regulator and with a reduction in reflective ice cover, more solar radiation will be absorbed by the earth increasing further average global temperatures.

3. Increased frequency and intensity of weather events

This is one of the most commonly stated results of an increase in global temperature. The reason for this is that warmer ocean waters increase evaporation, which in turn gives the atmosphere increased energy. This energy is converted into increasing the severity of storms, winds and other extreme weather events. Recent incidents around the Cape (e.g. the running aground of the

Weskus-1 and Seawind Sapphire on the beach at Kreeftebaai near Melkbosstrand or the massive storms experienced along the Natal and southern coasts last year).

4. Water Stratification and Cleaning Mechanisms

An increase in the oceans' temperatures results in a reduction of the mixing of warmer and cooler water. This mixing process, driven by winds and currents, is essential for bringing nutrients to the upper water levels. Moreover, there is also a likely decrease in important flushing and cleaning mechanisms which would result in an increase in the amount of "untreated" pollution in the oceans, increased algae blooms and dead zones. In addition, there would also be a reduction of nutrients being delivered to the deep sea bed.

Reduction in upwelling of the nutrient rich waters as well as flushing systems will impact fisheries in areas where this is important, which according to current estimates is more than 75% of the world's fishing grounds (In Dead Water, GRID-Arendal, 2008).

5. Shifts in Distribution and Migratory Routes

Currently, there are recorded shifts in a number of species, mostly in oceans which would not affect South African fisheries. These shifts have been over 100s of kilometres in some cases and although these are not from South-east Atlantic species, it is an early warning of what may lie in store. Additionally, it has been broadly noted that there have been some noticeable changes to the migratory routes of many fish species (Blue Carbon, UNEP et al, 2009).

Importantly, there are some examples of variations where these shifts have occurred and impacted on local fisheries. Certain species rely on currents and winds to transport eggs from the spawning grounds to the nutrient rich nursery grounds off the west coast. The fish, including the juveniles, then migrate back towards the spawning grounds (Lehodey et al, Climate Variability, Fish, and Fisheries, 2006). Changes in migratory patterns and distribution of fish in the southern Africa context has already resulted in operational adjustments to some fisheries. Further increases in these variations can be expected under climate change scenarios.

6. Acidification of the Oceans

Oceans play a massive role in climate regulation too as they store large amounts of Carbon Dioxide (CO₂), a principle greenhouse gas. With the increases concentration levels of CO₂ in the atmosphere the oceans are absorbing more and more CO₂. In fact oceans absorb more CO₂ than land-based absorption as stated in the Blue Carbon Report: "Of all the biological carbon, or green carbon captured in the world, over half (55%) is captured by marine-living organisms - not on land - hence the new term blue carbon" (Blue Carbon Report, 2009).

Currently, it is estimated that oceans have absorbed about "82% of the total additional energy accumulated in the planet due to global warming" (Bernal, P, 2009). This also suggests that the Oceans are potentially masking the true impacts of global warming or are certainly acting as a buffer.

What is important is that the excess CO₂ being absorbed by the oceans is leading to a change in the biogeochemical carbonate balance of the ocean, causing an increase in the acidification of the oceans. The effects of acidification are widespread, including, importantly the uptake of CO₂ from the atmosphere. This will reduce the pH as well as the calcium carbonate saturation levels and is likely to affect many marine species, especially those who require carbonate for the development of the shells, carapaces and skeletons (Blue Carbon, UNEP et al, 2009). It also states that "thousands of marine species will be affected".

7. Loss of the “Tropical Rainforests of the Oceans”

Coral reefs, both the deep, cold water as well as the shallow, warmer water reefs, are being affected by changes in the oceans temperature. One of the effects, particularly on shallow coral reefs is a phenomenon known as coral bleaching. This occurs when micro-algae called “zooxanthellae”, living in the corals in a symbiotic relationship, become stressed due to prolonged increased water temperatures, and are expelled by the corals. This leaves the corals looking “bleached” (hence the term) and also more vulnerable to disease. Coral bleaching is known to occur during prolonged increases in Surface Sea Temperatures (SST). The best known case occurred in 1998 due to a severe El Niño event when approximately 16% of the world’s corals were lost to bleaching (National Geographic Society Committee for Research and Exploration, 2006). The outlook for coral reefs is bleak, with an estimated 80% - 100% of the world’s coral reefs suffering from annual bleaching by 2080. The loss of these “Tropical Rainforests of the Oceans” would have a huge impact on marine biodiversity as well as the economic benefits they bring to many nations, including South Africa.

5.3.2 Other predicted changes

It is important to remember that the fishing industry, especially in the case of Oceana, is not only about catching fish at sea. The company, like many other large fishing industry companies, is also involved in the allied services sector. Thus, Oceana is actively involved in catching, processing and procurement of marine species as well as providing cold storage and fruit handling facilities (Oceana, Online, 2009).

This means that Oceana is not only susceptible to ocean climate impacts but also some of those associated with on-shore impacts (e.g. floods – even though these are often inextricably linked). Impacts on facilities, transportation, distribution, packaging, influences from the market place (both competition and consumer-related) and other logistics are all susceptible to climate impacts. Influences on all these areas pose a risk to a fisheries company and must be included in a risk assessment under future climate change.

The impacts associated with climate changes affecting the ocean (marine) as well as the terrestrial activities of the fishing industry and Oceana’s business will now be discussed in detail.

5.4 The Vulnerability of the Sector (Risk and exposure)

The impacts of the predicted changes discussed above will be varied and diverse. There are likely to be both positive and negative, depending on numerous factors. The risks are highlighted below, with the opportunities being discussed later in this paper. It is important to remember that the influence of the impacts, whether direct or indirect, not only depends on the severity of the change but also, and importantly, on the vulnerability of the industry and the degree of exposure to the impact.

Thus, industries with high levels of exposure, coupled with low adaptive capacity will be far more sensitive to the impacts. The converse applies too, which makes preparation and building adaptive capacity to impacts all the more important for the fishing industry.

Below are the impacts which are expected to be felt by the fishing industry due to climate change and variability. The sections below have been broadly divided into two; the first noting the impacts across fisheries, and the second noting those more related to allied services as well as broad other business impacts.

5.4.1 Impacts for the Fishing Industry – Fisheries-related risks

There are a number of predicted impacts on the fishing industry from a marine fisheries/capture perspective. The figure below gives a brief overview of some of the most significant impacts which are expected to effect on the industry.

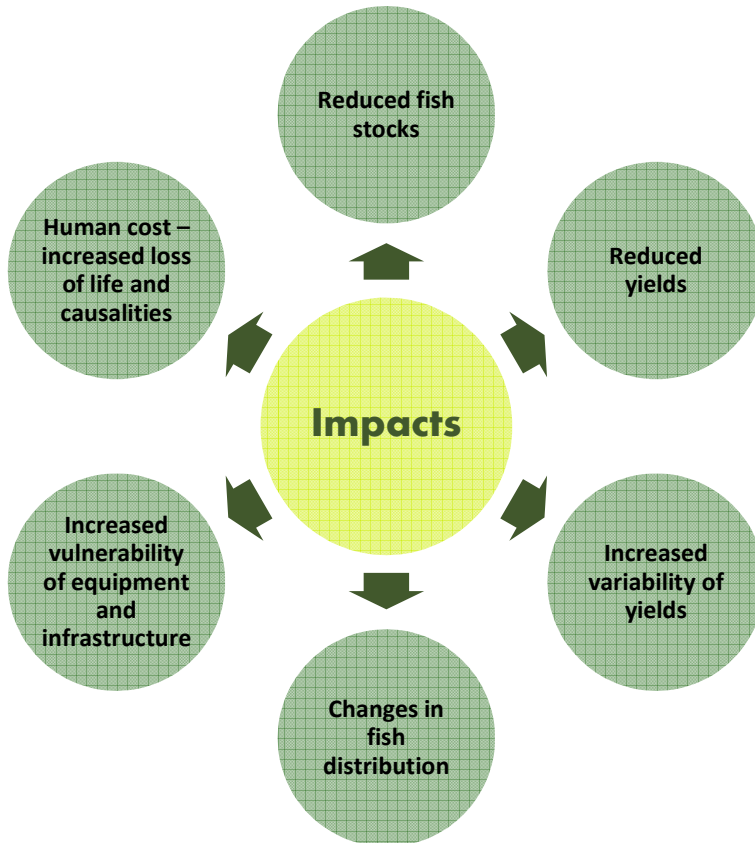


Figure 15: Impacts on marine fisheries/capture (Source: FOA, 2010). © GCX, 2012

1. Reduced fish stocks

There are more pressures on the oceans aside from climate change. In fact, the over-exploitation of marine resources and using the sea as a place for dumping waste (sometimes very toxic waste) is well-documented. Add the impact of climate change to existing pressures on the marine environment, and the picture just gets a great deal worse. A compounding issue is that half the world’s catch is caught in less than 10% of the ocean ((Blue Carbon, UNEP et al, 2009) and that about three-quarters of global fishing areas are currently fully exploited, overexploited or depleted (IPCC, 4AR, WGII, Ch 5). This raises concerns over the sustainability of current practices, even before considering additional stress of climate-related impacts.

Fish spawning in waters with rising water temperatures increases the risk of these eggs not surviving, as they are very sensitive to water temperature. Any reductions in food supplies through other impacts on species or reduced upwelling of nutrients could reduce stock sizes.

If one looks further to the expected climate-related impacts on agriculture and food supply, one sees additional stresses for fish stocks, as more pressure may be exerted on the supply of fish to boost food supply globally. Earth’s population is expected to reach about 9 billion people by 2050 and food demand on the oceans is likely to increase dramatically over that timescale too (FAO, Committee on Fisheries, 2009). Whilst this remains only a possibility, it does highlight the

interconnection between apparently unrelated industries / sectors and the necessity to look at interactions which may not appear connected at first but which pose a real risk.

2. Reduced yields

Leading on from the above point, it is relatively obvious that reduced stocks will impact negatively on yields. In addition, changes in migratory routes or feeding grounds would further reduce yields. Reduced yields will impact on many aspects of the industry, mostly from a financial perspective. Managing this process would need careful planning in order to limit the losses as well as plan for adapting to the changing yields. Clearly, a reduction in yield which was unexpected and unplanned for will have a far greater effect on an industry player than where this potential risk was addressed. The potential fall-out would include others' livelihoods too, which has a reputational aspect attached. The impacts of climate change are said to be greater on the poor in our world, and this is a case for where a reduction in yield could render many of those solely reliant on the fishing industry for their livelihoods with nothing.

3. Increased variability of yields

In addition to reduced yields, existing yields may in fact vary more greatly than in the past (IPCC, 4AR, 2007). Variations are likely to be more extensive and so will also require planning. Variations are something the sector is relative used to but the changes in the intensity of these variations needs to be managed.

This point links very closely with distribution in that species are likely to move due to changes in their habitat, caused mainly by the increase in water temperatures. The predictions for change generally agree that there will be a decrease in primary production, with a resultant change in food webs. As stated above, changes in the distribution of fish have already been observed and changes tend to be a movement of species nearer to the poles (FAO, Expert Workshop, 2008).

The same workshop also concluded that "the most rapid changes occur within pelagic species", leading one to assume that locating the fish might become easier due to technology, but getting to the "new fishing grounds" might be more difficult and costly. There is also the uncertainty surrounding how fast or gradual this change might be.

In some instances, this poleward movement of species might play into some of the fishing company's hands, whilst other may have to travel further to harvest fish. If the latter is the case, then companies will have to spend more resources on equipment, time and energy getting to and from their fish resources. Add to this the expected increase in competition for a dwindling resource and the task gets a little more difficult (and costly).

Finally, the further vessels need to travel (and/or the faster they need to get there and back) the more fuel they will use and the more GHGs the industry will emit into the atmosphere – thereby adding to fuel to the global warming fire. In the coming years, climate sensitive practices are likely to be centre stage and a company's carbon accounts are going to be scrutinised like financial accounts are today. This aspect will be discussed in more detail below.

4. Changes in fish distribution

This is a very difficult impact to predict accurately. What is known is that the body temperature of fish varies with the ambient temperature. Accordingly, any changes in the water temperature (their habitat) will affect a number of key aspects such as metabolism, growth rate, total production, reproduction rates and timings (FAO, Expert Workshop, 2008).

Very importantly, the temperature change from climate change (i.e. rising global temperatures, which in turn heat the oceans), will have a greater effect on the spatial distribution of fish than on their productivity levels (FAO, Expert Workshop, 2008). Add to this the fact that increases in water temperature have been associated with increases in diseases and exotic species, most of whom are often detrimental.

Thus planning effective adaptation for these changes is very difficult. However, it is important to list this as a potential impact because monitoring this change is essential for sustainability of the industry. Moreover, as the science improves and more is known about these impacts the uncertainty levels will drop, making it slightly easier to set in motion actions which will reduce the risks associated with changes in distribution.

Under this impact, there are a number of contributing factors as well as further risks, each in their own right potentially major changes and influences. The influences, according to the FAO and IPCC, include the following:

- Changes in nursery grounds;
- Changes in feeding grounds;
- Spawning grounds shifting;
- Migratory routes affected and changing.

These in turn can result in an:

- Increased risk of species invasions and diseases.
- Increased likelihood of transboundary disputes and/or conflicts.

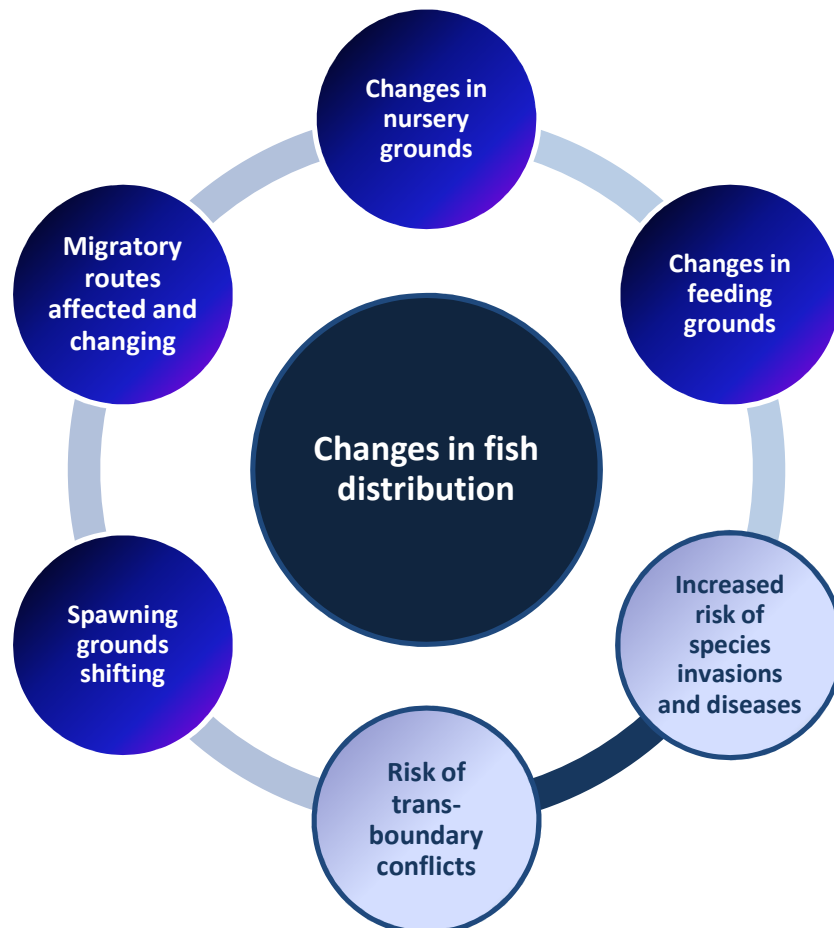


Figure 16: Contributors to changing distribution and increased associated risks
© GCX, 2012.

5. Increased vulnerability of equipment and infrastructure

Possibly the best known of all climate change related impacts is the likelihood of an increase in the intensity and frequency of severe weather events (IPCC, 2007). Images of hurricanes in the Caribbean or flooding in Bangladesh are often associated with these stories. However, the reality is we are beginning to experience these changes in southern Africa ourselves. A good example, from the Western Cape, was the storm systems we had in November 2008. The damages to farmland, property, infrastructure and transport networks were extensive. To illustrate the increased intensity and impact of this storm the total cost of extreme weather events for 2007 was ZAR 827 million, whereas the costs associated with this one 4-day storm in November 2008 amounted to a staggering ZAR 1.1 billion. One can clearly see the enormous cost ... and this happened in the Western Cape 2008. Interestingly enough, one of the areas worst hit (the George area) in Nov-Dec-09 is experiencing one of its worst droughts in decades.

There are a growing number of these examples from around the world and it is in line with the predictions coming from the top climate scientists in the world. The impacts of an increase of severe weather events on an industry based in an already hostile environment (the sea) as well as a tough environment from a business perspective (in normal circumstances) is cause for concern. A further impact on infrastructure is sea-level rise and, potentially, floods.

Sea level rise often appears to be an over-stated impact relating to climate change. This may well turn out to be true; however, what is often under-explained is the connection between sea level rise, increased intensities of storms and flooding. The important aspect to remember when considering an impact is not only the impact in isolation but rather as part or coupled with other impacts, such as storm surges¹. The figure below shows an example of the impact of a severe weather event reaching a harbour and the effect the "one" storm could have on a fisheries business if events are coupled together.

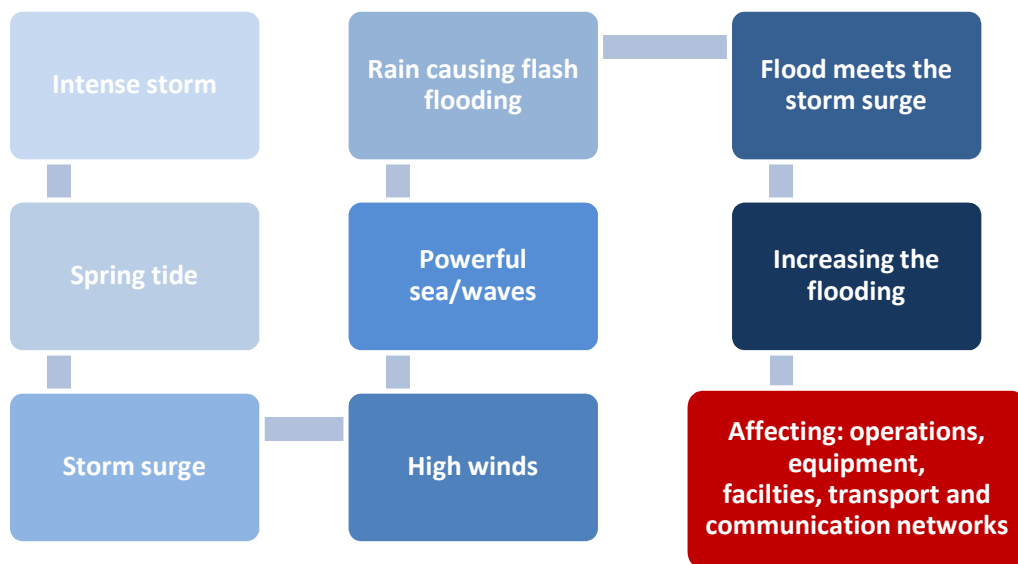


Figure 17: The potential coupling effect of one severe weather event.
© GCX, 2012.

¹ It is also interesting to note that in the World Disaster Report 2008, it notes that of 60% of all losses were from wind storms and floods. Storm surges (a fast rising sea caused mainly by strong winds driving water ashore) account for over 90% of all loss of life and property.

The above example was all related to being in a port or ashore. Obviously, it is important to remember that severe storms (often more intense) occur at sea regularly and increase the already dangerous activity of fishing at sea. An increase in intensity and frequency of these will also have an impact on the fishing industry from an equipment, operational and human casualty perspective. All of these are directly related to costs. Loss of damaged equipment, reduced operational capability (lost fishing days) due to increased number of intense storms, and the loss of life (or increased number of injuries) all incur financial and other costs to the industry.

6. Human cost – increased loss of life and casualties

Last but by no means least, is the potential increase of loss of life. Fishing at sea is purported to be the most dangerous occupation in the world (State of Fisheries and Aquaculture 2008 Report, 2009). Injuries are a cost but the loss of a life cannot be properly valued. This is an occupational hazard of being a fisherperson and one which is ever-present. The idea that this may increase due to increased likelihood of severe weather events means that adapting to climate change impacts carries an even weightier burden than many are willing to accept. Protecting lives is something the industry is fully aware of, however, this need is likely to increase as climate changes influence the weather we are used to and therefore basing future plans on past events is not always going to be sufficient for the changes the scientists are telling us are on their way.

5.4.2 Impacts for the Fishing Industry – Allied services and other business-related risks

As mentioned previously, there are additional impacts on the fishing industry, which are especially relevant in Oceana's case. These include a number of impacts on mostly "land-based" allied operations. Therefore, the following figure shows areas of Ocean's business which will also be affected by climate change. It is very important to consider these impacts as they are equally important as the more "obvious" impacts discussed above. Each is discussed in more detail below.

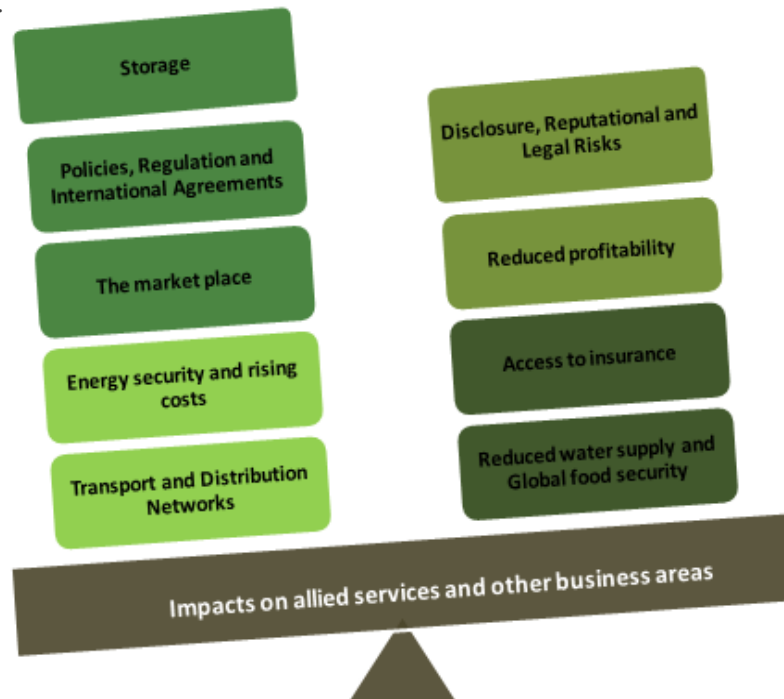


Figure 18: Impacts on allied services and other business areas. © GCX, 2012.

1. Storage

The location of storage facilities will need to be carefully planned. If close to the coast they may be vulnerable to the impacts discussed in the section on equipment and infrastructure above. Severe weather events could have an impact on cold storage in a number of ways. As temperatures increase, as they are predicted to do in southern Africa's case, keeping cold storage products at the right temperature is going to take increased amounts of energy. This makes cooling mechanisms work harder and for longer periods which have cost implications on the equipment as well as on energy usage. With the increases in energy costs as laid out by Eskom this year, it is clear that the raising prices will become a material cost factor, even without the added pressure of rising temperatures and increases in heat waves and number of above average temperature days.

Energy supply also comes into question more as demand increases and the power outages of a few years ago are still fresh in the business communities' memories. Back-up generators at cold storage sites would need to be in place and kept on stand-by and may also have to be run more often if demand exceeds supply.

All of the above add financial and logistical stress to Oceana and need to be factored into their risk assessments for addressing climate change alongside other, more common, business risks – not separately from them.

2. Transport and Distribution Networks

In addition to the knock-on effects on post-harvest activities in allied services such as storage, there are also considerable potential effects on transportation and distribution networks. Some of these would also occur in and near harbours too and the impacts on operations could be severe.

However, that aspect has already been dealt with in detail above. The effects on distribution or transportation of goods and products from ports to processing and then to market are a substantial business risk. Not to mention the risks involved in the increased amount of transportation required due to increased imports and/or catches landing in areas further away from the processing facilities (this aspect is addressed later in the paper).

A good example which severely impacted the agricultural industry last year occurred when millions of Rands worth of fresh goods were left to perish as farmer could not get their products to market due to damaged road and rail infrastructure in the Western Cape.

Some of the impacts on transport networks include:

- Extreme weather-related damage to infrastructure. For example:
 - Flooding of roads, railways, transit systems and runways (increased impact of these in coastal zones);
 - Storm surges and wave action damaging and constraining port activities.
 - Bridge joints, pavements, railway lines suffer from heat extremes;
- Heat waves impacting on schedules;
- Aviation: take-off loads will need to be reduced in extreme heat;
- Delays to all forms of transportation which will have significant cost implications and other negative feedback effects.

It is worth mentioning here that many of these events also disrupt vital communication networks, which can too affect the functioning of a company.

The damage created by severe weather events is becoming well-known globally and this can have a crippling effect on industries that rely on these networks for their business.

3. Energy security and rising costs

Already briefly mentioned above, is the risk of ever-increasing energy costs and the reliability of the energy supply. Known rising costs are more manageable than unknown, but the increases announced by South Africa's main energy supplier, Eskom, will have a relatively large impact on all users and must be factored into risk management plans as these may not be the last increases or the actual increases. Linked closely to this, is the fact that Eskom produces electricity at an extremely high carbon emission rate of about 1.03kgs of CO₂ per kilowatt hour (Eskom, Annual Report, 2009). Any increase in usage (e.g. under increased cold storage requirements under increasing temperature regimes) will also equate to an increasing carbon footprint and adding to further global warming (see disclosure discussion below).

4. Mitigation efforts

It should be noted that Fisheries do not contribute significantly to emissions in global terms but that greenhouse gas (GHG) emissions from operations remain an important consideration when addressing climate change in any industry.

Most GHGs emanate from capture fishery operations, processing, storage and transportation of fish products. Efficiencies in operations usually lead to reduction in fuel use, which in turn has a positive effect on operational costs. With increasing fuel prices, efficiencies are an excellent way to reduce costs as well as benefit mitigation efforts in addressing climate change.

Transportation of fish can have very high emissions per weight of product, especially when fish is air-freighted. In 2007, it was estimated that air freight imports of fish to the USA, Europe and Asia resulted in 435 000 tonnes of CO₂ (Conway, [2007], FAO, Technical Report 530, 2009).

What is even more critical perhaps is that due to the fact that fisheries are largely solely dependent on fossil fuels, access to these fuels is paramount. Vulnerability of fisheries becomes higher in a world with diminishing fuel reserves, increasing fuel prices and, of course, reducing fish stock levels.

Mitigation should remain high on the agenda of fisheries, as there are a number of benefits involved in addressing emission reductions, including reporting and disclosure, awareness of operational efficiencies and the ability to counter some of the market forces at play, such as rising fuel and energy prices.

5. The market place

Already discussed in the section above, is the changing distribution of fish stocks. Whilst this may benefit South African waters, there is also the possibility that it may not and may, in fact, benefit other international waters. New fishing markets, opening up as a result of a change in fish distribution, may impact on a fishing business' markets and competition grow from a place once not strongly associated with the fishing industry as fisheries might be able to access the fishing grounds more easily in the future.

From a climate change perspective, this impact is not yet as apparent in the fishing industry, although the practice is becoming more apparent due to the increasing amount of importation being practiced. Whether or not this is related to climate change and the degree to which climate change might be influencing it, has yet to be determined.

However, there is a more direct causal link already happening in other sectors such as the wine industry. In Spain and other wine-growing countries, some growers are feeling the impact of countries not associated with wine-making (e.g. Belgium and Holland) now making good wines due to a changing climate and entering the market place (BBC, Spanish Vineyards, Climate Change Report, 2008).

Importantly, consumers are becoming more informed and are looking for increased transparency about their products' impact on global warming. Consumers are increasingly

checking packaging for environmental information relating to products (dolphin friendly tuna, fairly traded products, sustainably sources wood products etc). A good example of where this is impacting business is the fruit industry, which is being asked to declare and reduce their GHG emissions by large supermarket chains in Europe, such as Tesco in the UK. This has a direct impact on the South Africa fruit industry and it is likely that an increased demand for transparency and reduced environmental impacts will be sought by consumers of fish in the near future, as seen through the Southern African Sustainable Seafood Initiative (SASSI) in South Africa.

6. Policies, Regulation and International Agreements

The risks lie in a lack of collaboration between stakeholders within the fishing industry (FAO, Expert Workshop, 2008). These include:

- The private sector
- Government Agencies and Departments
- Communities.

A lack of a co-ordinated response between these may result in an unsustainable industry under the current and future climate-related stresses. In addition, the transboundary nature of key stakeholders further complicates critical negotiations and communications between nations. Add to this the increasing likelihood of a change in distribution and a reduction in fish stocks under climate change scenarios and the potential for conflict grows.

Environmental protection could reduce fleet sizes, total allowable catches (TACs) or fishing in certain waters. This may open up the opportunity for an increase in illegal fishing, poaching and the related illegal trade, which may cause a tightening of regulation on exports and imports of fish products. Illegal fishing could become a highly negative aspect, adding further stress to reducing fish stocks globally and which needs to be addressed at the highest level. Tackling illegal fishing requires a collaborative effort from a strong international partnership, using all available resources to decrease the practice and trade in illegal fish/seafood.

Without due consideration, a better understanding of the consequences and full participation from all stakeholders, regulations, agreements and policies may be found to be exacerbating an already fragile system, and potentially placing the fishing industry in a more vulnerable position.

7. Disclosure, Reputational and Legal Risks

There is a growing understanding amongst the business community that disclosing carbon emissions is a strategic business decision. The Carbon Disclosure Project (CDP)² started in 2000. Its aim is to get companies to disclose their carbon emissions in order to understand the contribution, of mainly the corporate sector, to climate change and how individual companies are addressing the issue. The number of disclosures by large companies from around the globe has risen from 235 in 2003 to a staggering 3715 from over 60 countries in 2011 (CDP, Online, <https://www.cdproject.net>, 2012). This shows the importance large companies are putting on the disclosure of their carbon footprints to reduce risk.

² The Carbon Disclosure Project (CDP) is an independent not-for-profit organization working to drive greenhouse gas emissions reduction and sustainable water use by business and cities. We provide a transformative global system for thousands of companies and cities to measure, disclose, manage and share environmental information. When provided with the necessary information, market forces can be a major cause of change. Working with the world's largest investors, businesses and governments, CDP is uniquely positioned to catalyze action towards a more sustainable economy. (Taken directly from the CDP website: <https://www.cdproject.net/en-US/Pages/HomePage.aspx>, May 2012.)

Disclosure is particularly important from investors point of view, as understanding the threats and opportunities from a climate change perspective is fast becoming one of the critical benchmarks used by the investment community. This is aptly illustrated by the quotation below.

"Climate Change is one of the greatest challenges of the 21st century... It is extremely important for investors to take account of climate change in their decision making. I wish the Carbon Disclosure Project success with its further efforts both in Germany and worldwide." Dr Angela Merkel, German Chancellor.

Reputation risks are closely linked to environmental issues. From a climate change perspective, companies who are seen to be addressing the issue are held in better regards than those who appear to be doing nothing, or conducting business as usual. This is clear from the CDP, as it is currently more interesting to consider who is not disclosing than who is. This will change over time and the important question will move towards "who is reducing / acting on climate change the most actively and effectively.

Finally, under this heading, legal risks are worth mentioning. There is a growing concern that high emitting entities may be held liable for the damage they cause the environment. Although not an immediate risk to the fishing industry, it is worthwhile noting that this apparent extreme is a reality and is being considered carefully by leading insurance companies around the world.

A country-scale example of this is that the small island state of Tuvalu is considering legal action against Australia, a large GHG emitter.

(<http://www.tuvalu.islands.com/news/archived/2002/2002-03-04.htm>)

The following quotation is an example of how seriously climate impacts are being taken by the business world and is something worth including in a climate change response strategy when addressing safety, for example, of vessels and crew alike.

"(There is a) very real risk that (the advisor) will be sued for negligence on the grounds that they failed to discharge their professional duty of care to the client by failing to raise and take into account Environmental, social and governance considerations," Paul Watchman, (UNEP FI Article, July 2009).

8. Reduced water supply

Southern Africa is already a water stressed region and this is likely to become worse if climate predictions for this sub-region are accurate. Therefore, access to the dwindling and limited resource of water is going to become more difficult and costly. This is an issue which will affect nearly every one of us, both at home and in business. It will especially affect industries who use large amounts of water (e.g. for cleaning and processing). Water is a critical life resource and conservation of water should be practiced almost regardless of climate impacts but even more so due to the predictions for this region.

9. Global food security

Food security is also generally low in southern Africa. Climate change is set to have a devastating impact on the agricultural sector and the World Food Programme believes that "Changing climate patterns are already having an effect on world food production" (WFP, online, 2009) and this reduction could have knock-on effects for the fishing industry. Whilst this may initially be a positive influence, the associated impacts on the fishing stocks could result in a crash in stock numbers to unsustainable levels, leaving the fishing industry without a long-term future.

A reduction in food security is an important issue relating to climate change. It is also included in the objectives of the international Code of Conduct for Responsible Fisheries where the objective states: "promote the contribution of fisheries to food security and food quality, giving

priority to the nutritional needs of local communities" (Code of Conduct for Responsible Fisheries, 2011). Climate change is likely to impact the four dimensions of food security (see below), including aquatic food. Oceana has a strong Corporate Social Responsibility (CSR) element to its business and provides a lot of protein to lower-income groups within the country.

Should the four dimensions of food security be impacted in the fishing industry, the implications for health and livelihoods, especially in the lower-income brackets of South Africa, could be serious. Food security is a huge global issue, and fish plays a very important role in the issue. Changes in climate are likely to negatively impact food security globally and fisheries are no exception.

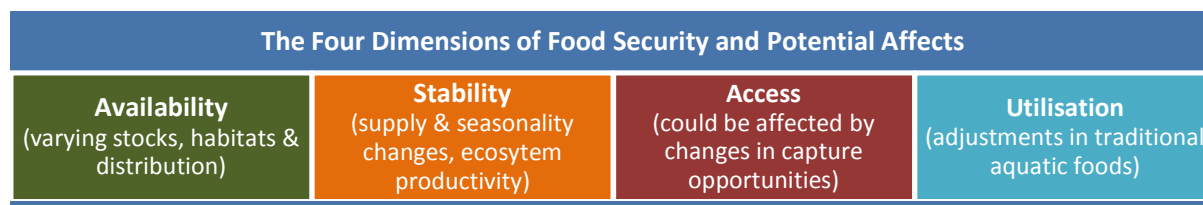


Figure 19: Dimensions of food security (FAO Technical paper 530, 2009). Adapted by GCX, 2012.

10. Access to insurance

Global warming's potential to increase vulnerability to weather extremes is especially relevant for the insurance sector (Vellinga et al. 2001). The insurance industry is the world's largest in terms of revenues and insurers bear a large portion of weather-related risks, such as damage caused by floods and storms (Mills, 2007).

Recent history has shown that weather-related losses can stress insurance firms to the point of elevated prices, withdrawal of coverage, and insolvency (bankruptcy). Insurers are sensitive to a diversity of potential climate changes (Ross, 2000). Understanding and adapting to weather-related losses are high priorities in the insurance industry. Increased losses have also resulted in the withdrawal of commercial insurance for the most vulnerable risks areas, such as flood or crop damage in many countries.

The insurance sector has already been forced to evolve in order to cope with new varieties of environmental risk. As climate changes and historical weather records become less useful, the insurance sector will have to develop new ways of assessing risk and spreading it away from those affected, while encouraging those at risk to adapt to the new environment.

Already a difficult issue in the fishing industry is made potentially more difficult through climate impacts. Insurers are starting to act strongly on climate change and are encouraging their clients to implement adaptation measures (Mills et al, 2009).

11. Reduced profitability (all above could lead to this)

It is clear that all of the abovementioned impacts could lead to a reduction in profitability. In the current global economic climate, any impact on margins is concerning. There is still uncertainty around the nature of these impacts on the fishing industry in South Africa. What is certain however, is that being as well prepared as possible for these impacts is an important risk management strategy which should be developed and implemented within any fishing industry company in the near future.

In summary, there are a number of climate change-related risks facing the fishing industry and its allied services at present. Some of these risks are direct, such as the reduction in fish stocks or the changes in fish distribution, while others maybe more indirect such as a change in demand for fish products. Indirect impacts can sometimes be more damaging than direct impacts and therefore need to be as carefully considered.

It is also important to bear in mind that none of these impacts should be seen in isolation. They tend to compound one another and this is where the bigger impacts often lie. What is clear is that there are a number of potential impacts which may be more significant for the industry than others. Careful consideration of these should take place and an adaptation strategy created for addressing, where possible, the high impact/high probability areas first.

The section below scrutinises current global considerations in the fishing world at an international level by a variety of stakeholders.

The State of World Fisheries and Aquaculture Report 2010 summarised the main expected impacts into the following categories with examples in each. For the purposes of this report, the original table has been adapted to include more Oceania-specific impact examples.

IMPACTS		
Indirect Ecological	Direct Physical	Indirect Socio-economic
Change in yields	Damaged infrastructure	Increasing fuel costs
Change in species distribution	Damaged gear	Reduced health for lower income groups
Increased variability of catches	Increased danger at sea	Relative profitability of other sectors
Changes in seasonality of production	Flooding of allied services and operations	Resources available to management
Species invasion	Changes in location of operations	Reduced food security
Predator-prey interactions		Risk and Vulnerability
Food web disruption		Funds for adaptation measures
		Landing locations

Figure 20: Climate change impacts (FAO, 2010). FAO Technical paper 530. Adapted by GCX, 2012.

The figure below is an adapted summary taken from the FAO Technical Report 530, 2009, which summarizes the changes, processes and impacts linked to ocean fisheries.

Type of changes	Physical changes	Processes	Potential impacts on fisheries
Physical environment (indirect ecological)	Increased CO ₂ and ocean acidification	Effects on calciferous animals e.g. molluscs, crustaceans, corals, echinoderms and some phytoplankton	Potentially reduced production for calciferous marine resources and ecologically related species and declines in yields
	Warming upper layers of the ocean	Warm-water species replacing cold-water species	Shifts in distribution of plankton, invertebrates, fishes and birds towards the North or South poles, reduced species diversity in tropical waters
		Plankton species moving to higher latitudes	Potential mismatch between prey (plankton) and predator (fish populations) and reduced production and biodiversity and increased variability in yield
	Sea level rise	Timing of phytoplankton blooms Changing zooplankton composition	Loss of coastal fish breeding and nursery habitats e.g. mangroves, coral reefs
Fish stocks (indirect ecological)	Higher water temperatures	Changes in sex ratios Altered time of spawning Altered time of migrations Altered time of peak abundance	Altered timing and reduced productivity across marine and fresh water systems
	Changes in ocean currents	Increased invasive species, diseases and algal blooms	Reduced productivity of target species in marine and fresh water systems
Ecosystems (indirect ecological)		Increased frequency of ENSO events	Changes in timing and latitude of upwelling
	Coral bleaching and die-off		Reduced productivity coral-reef fisheries
Disturbance of coastal infrastructure and fishing operations (direct)	Sea level rise	Coastal profile changes, loss of harbours, homes.	Increased vulnerability of coastal communities and infrastructure to storm surges and sea level
		Increased exposure of coastal areas to storm damage	Costs of adaptation lead to reduced profitability, risk of storm damage increases costs of insurance and/or rebuilding
	Increased frequency of storms	More days at sea lost to bad weather, risks of accidents increased	Increased risks associated with fishing, making it less viable livelihood options for the poor

Figure 21: Climate change impacts (Source: adapted from Allison *et al.*, 2005, FAO, 2009.) Adapted by GCX, 2012.

The above-mentioned impacts have associated risks, as covered in detail in the White Paper 2009. Below is a representation of the main risks to Oceania in the medium to long term. It is important to remember that impacts are difficult to access precisely. The level of uncertainty as to the magnitude, timing and location of these impacts remains high.

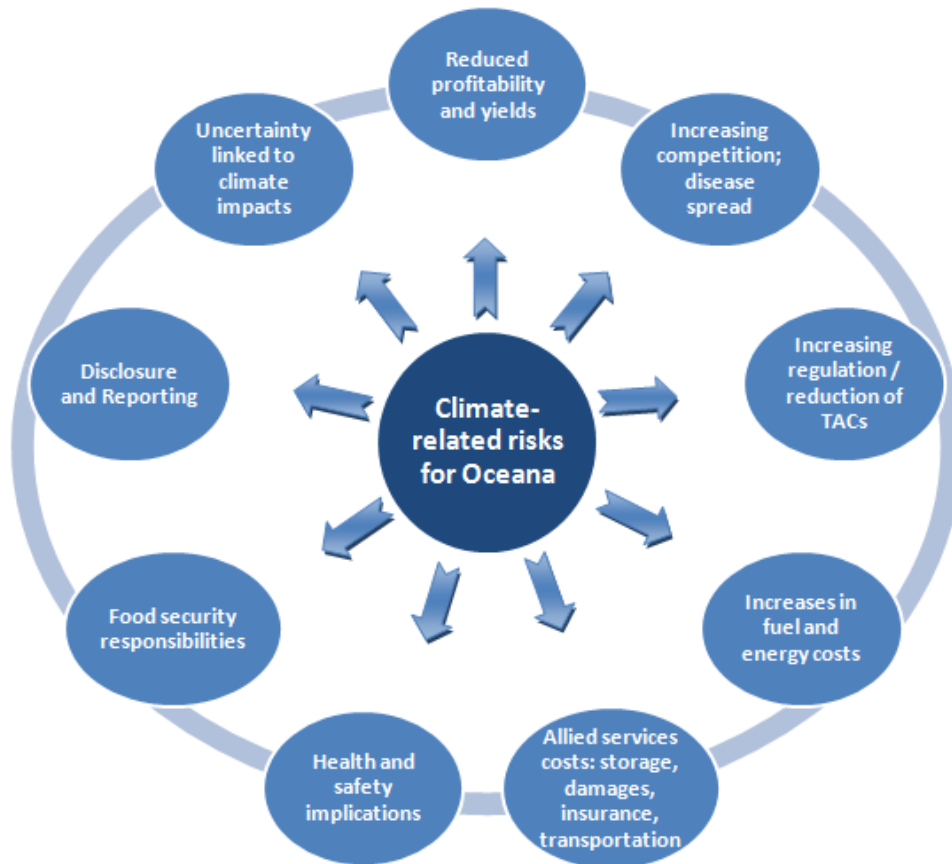


Figure 22: Climate related impacts (GCX, 2012).

Whilst the impacts appear many and potentially damaging to Oceana and the fishing industry in general, it should be remembered that other impacts such as depletion of fish stocks and other factors such as changes in markets, governance, over-capacity issues etc, pose much higher levels of risk than those related to changes in climate and its effects on oceans, fish and the industry in general.

Finally, the impacts are not always negative. There are some examples of where a positive impact due to climate change may occur. In the far north, it is likely that some sea routes may open or remain open for longer time periods due to the melting of arctic ice sheets. Closer to home, companies who are able to “weather” the climate impacts better might conceivably benefit from the decline of competitors in the same markets in the future.

5.5 Current Considerations in the International Context

5.5.1 Overview

The implications of climate change and increasing climate variability have very slowly started to emerge from a fisheries point of view. Most of the current debate concerns the impact of climate change on fisheries from a poverty perspective, rather than a business and industry perspective. Nevertheless, this situation is changing and some industry players are starting to address the issue more formally (The State of World Fisheries and Aquaculture Report, FAO, 2009). The implications for capture fisheries in the oceans are becoming clearer and there are attempts to start addressing the many impacts given the still high levels of uncertainty which

surround the predictions. This section considers some of the most recent discussions and information available on what fisheries (including the private sector) could do to address the plethora of potential impacts and how the industry could reduce its vulnerability to and increase its capacity to deal with future climate change.

5.5.2 Understanding the risks

It is important to note that , adaptation strategies will vary, based on location and context and therefore are very difficult to model or predict. The graphs below have been adapted from a table generated during the FAO Expert Workshop held in 2008 and have been linked to be in line with this paper, showing impacts and possible strategies for dealing with each, as well as who would be responsible for the implementation of the strategy. In addition, the graphs indicate whether these are likely to be more proactive or reactive initiatives. Often the anticipatory actions help to reduce vulnerability and should form part of long term management plans. However, they do need to be carefully considered as to not result in mal-adaptation³ practices. It is clear from these graphs that the industry or private sector has a large role to play.

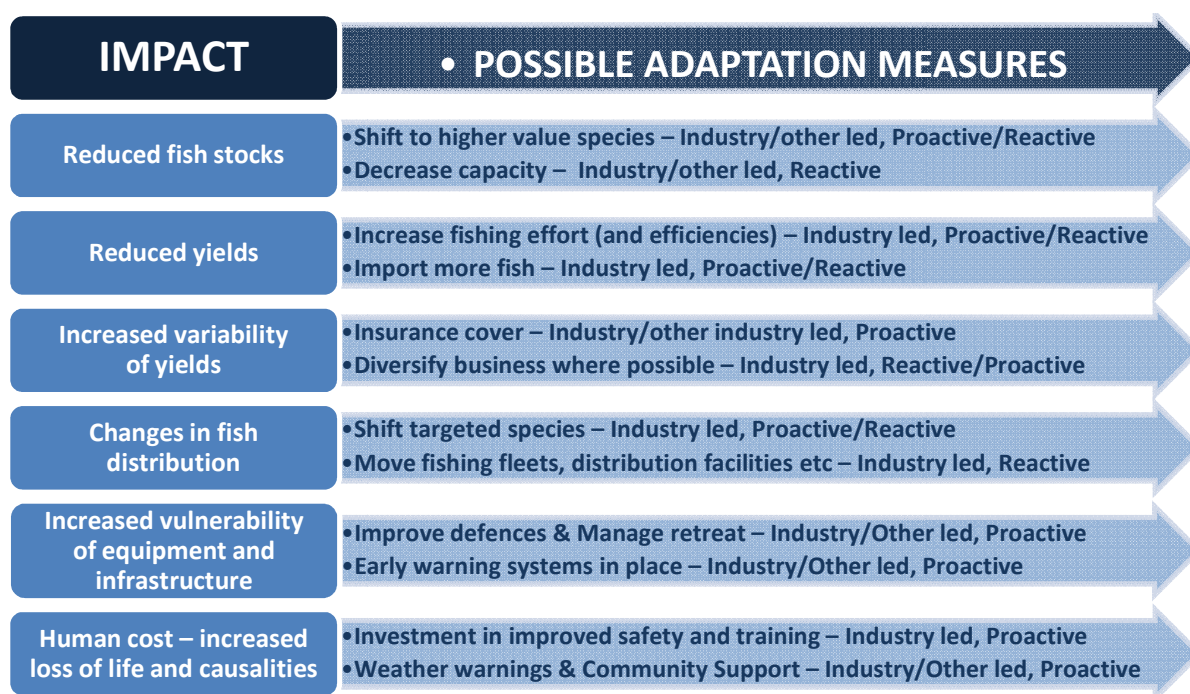


Figure 23: Adaptation options for anticipated impacts
(Source: Adapted with permission from the Food and Agricultural Organisation (FAO) of the United Nations, Fisheries Report 870, p26).

Two issues from the figure above which are worth discussing in slightly more detail are the importing more fish and relocating (or sometimes redesigning) facilities. These are both practices which have and will continue to be employed by the industry. Once again, the reasons for these measures have mostly been unrelated to climate change or, at least, climate change has not been the main driver for them. What is important to understand when looking at potential adaptation measures, is that climate change is likely to exacerbate already difficult situations within the fishing industry.

Firstly, if we take the current increase in importing greater quantities of fish from other parts of the world as an example, we see that competition for these fish markets is growing making

³ Mal-adaptation will be discussed towards the end of this section.

accessing fish stocks caught elsewhere more difficult. In addition, importing fish carries a cost and other risks such as disruption to transportation or in the processing of the fish. This is where global markets as well as international trade and environmental policy could potentially impact on these decisions, as well as the availability of the markets in the future. Importing fish remains a solution only as long as fish stocks remain sustainably harvested in the areas from which the imports originate. Reducing stocks is already a global issue and, although not the main cause, climate change is going to make this situation even worse.

Secondly, moving or relocating processing facilities, even if temporarily, carries with it logistical constraints as well as costs. The alternative of increasing transport distances to access the catch also carries similar logistical and cost issues. They also both have inherent risks associated with them. For example, a move to follow a change in the distribution of a species may be premature or even too late. Increasing distances travelled by vehicles or other transportation of fish has a related cost, as well as increased carbon dioxide emissions. From a transportation perspective, the risks may include that fish catches are not as high as expected, and so the transportation is not required to the extent to which was planned. If the distances travelled are not great the impact is lower, however, if the distances and costs are significant then the result is very different for the company involved.

Neither of the above two options are new to the industry. What is new is the prediction that, due to the impact of climate change is likely to increase the frequency with which these measures will need to be deployed in the future, further increasing the pressure on global fish stocks. With over 75% of fisheries already fully exploited or overfished (WWF, Online, 2009), this is a situation which requires urgent action from all stakeholders. It is also a situation which the fishing industry needs to play a leading role in addressing. Furthermore, there are also the impacts associated more with the allied services and other business considerations. The figure below shows some of the options available for adaptation with regard to these impacts.

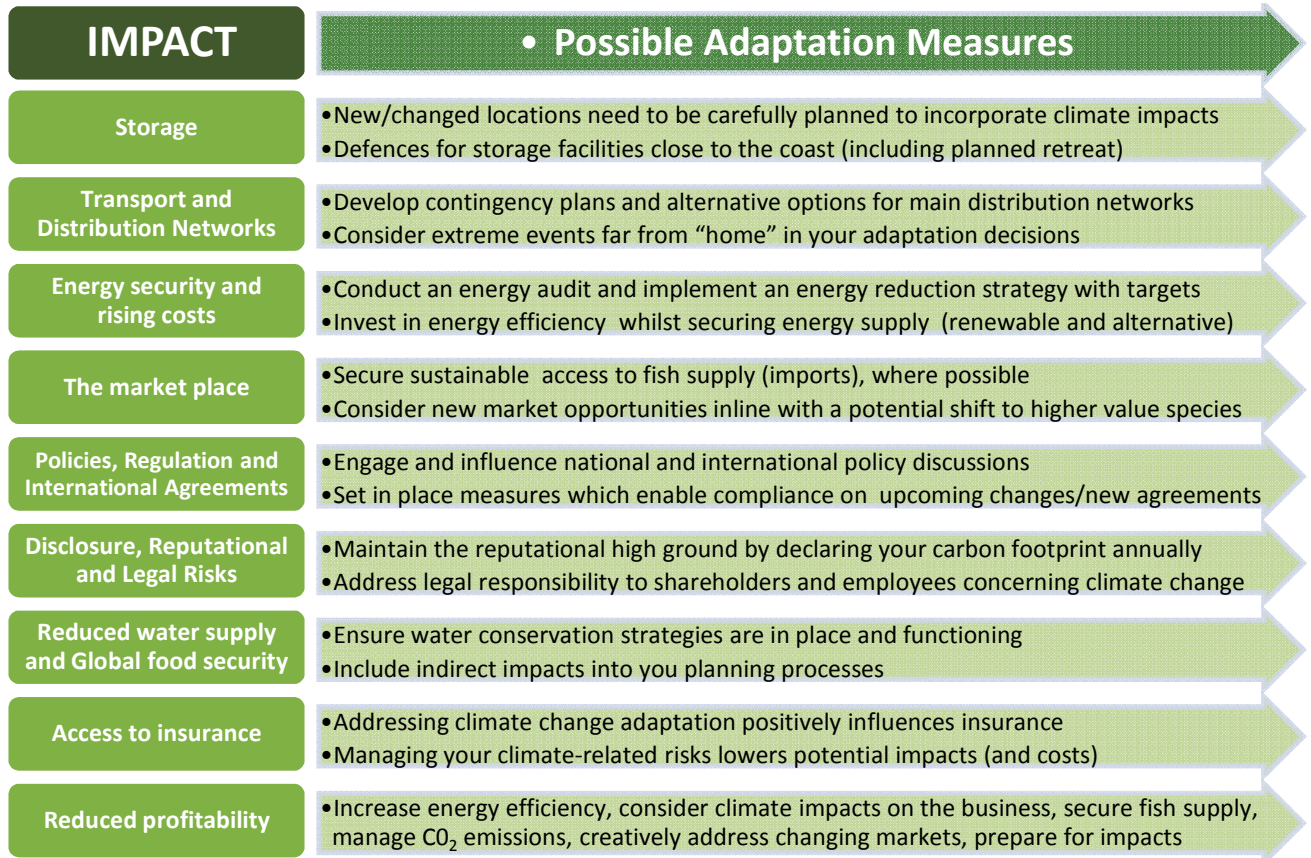


Figure 24: Adaptation options for other business-related impacts

5.5.3 Initiatives and Actions for the Fishing Industry

The consideration of climate change impacts on the oceans and its ecosystems and the implications of these for the fishing industry is relatively far behind the development of climate policies and strategies for addressing issues on land. This is not surprising for two reasons. Firstly, the seas have in the past been associated with endlessness (both in supply of materials and food as well as in distances and depths) as well as the unseen of what takes place below the waves. Secondly and possibly more importantly, is the fact that humans live on land and so the impacts on land are more visible, appear to impact humans more directly and conceptually seems to be more manageable in addressing.

What this has led to is a situation where addressing the impacts, from an industry point of view, is only in its infancy stages. Whilst this situation is not ideal, there are some interesting and transferable lessons from other industries. One of the leading industries globally on the issues surrounding adaptation to climate change is the insurance industry and there are some best practice examples and lessons from which the fishing industry can learn.

Thus, by learning from these and other lessons from around the world, the following initiatives forms almost a check-list for what players in the fishing industry should be including in their climate response strategies and management plans. Whilst this list is neither prescriptive nor comprehensive, it does form a basis from which to build an approach to adapting business to the multiple challenges presented by climate change from a holistic point of view.

This will take planning and commitment although this is a process and the most important aspect of addressing climate change is to start the process.

These are some of initiatives in which the industry should be involved and/or play an active role. Many have strong linkages, and are most effective when combined in a holistic approach to tackling the issue. Each one is described in more detail below.

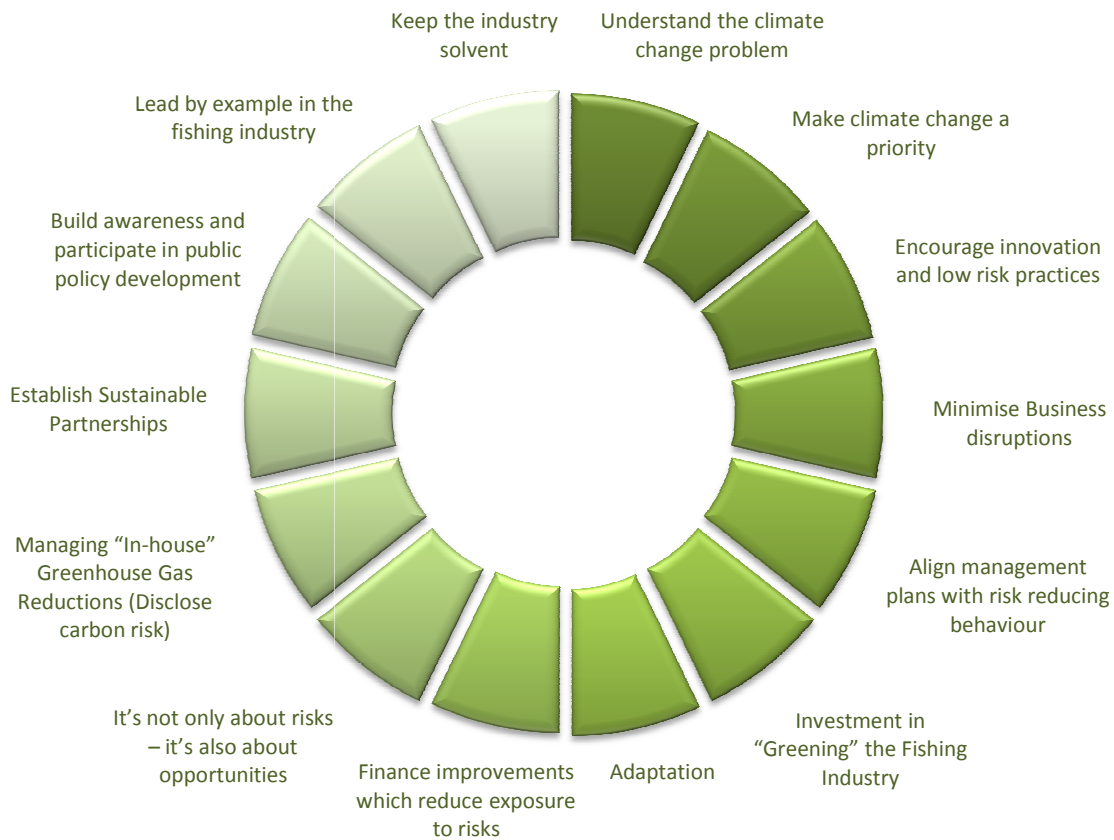


Figure 25: Initiatives and Actions for the Fishing Industry.
© GCX, 2012

1. Understand the climate change problem

This is a critical part of being able to make informed decisions relating to action. The problem is relatively simple to understand, but what is difficult is acting upon that knowledge. The Fishing Industry needs to maintain and increase its awareness of where the main threats lie and identify opportunities within future climate constrained oceans. Understanding the problem is also important for all those involved in the industry, as everyone will have a role to play in adapting to and being part of the solution to climate change and increased variability.

2. Establish Risk and Vulnerability

Some critical elements of adaptation include understanding one's risk to the predicted changes for your business, community, operation etc. Once the risk has been established, it is then important to understand one's vulnerability within the context of the predicted impacts and their potential effects on one's operations. Vulnerability depends on exposure to risk and sensitivity to that risk. Vulnerability is also influenced by other factors such as markets, disease, poverty, socio-political situations etc.

Importantly, the sensitivity element is also determined by the ability to adapt (also known as adaptive capacity) and levels of resilience to the predicted impact. Below is a diagram which represents the concept of vulnerability.

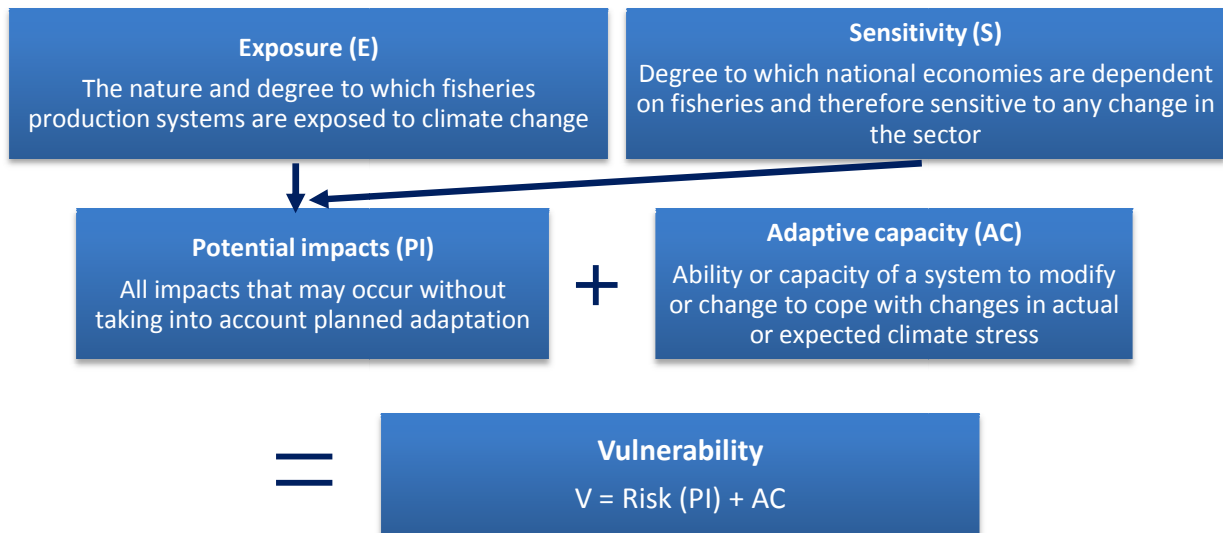


Figure 26: Conceptual model of vulnerability (adapted from Allison *et al*, 2005)

Once you have established your risk exposure, which includes risk liability and sensitivity, it will set a vulnerability context from which to make informed decisions.

Risk exposure reductions can then be made and actions taken to plan for adaptation, in order to reduce the impact, should a climate-related risk occur.

Assessing vulnerability to climate change is an important component of risk management. Climate impacts are likely to be familiar events, but their frequency and intensity are predicted to increase significantly under climate change scenarios. Therefore, adaptation planning can be done based on current events happening more frequently, with greater intensity, not upon unknown strange phenomena. Unusual climate impacts could only be expected to occur once "tipping points" have been surpassed. At this stage, there is still a great level of uncertainty about where these tipping points may lie. There are, however, some examples of tipping points which have been reached with results such as the collapse of the Atlantic cod stocks.

Oceana are currently considering a risk and vulnerability analysis, which would enable the company to get a clearer view of their vulnerability in terms of climate change.

3. Make climate change a priority

In a recent study carried out by Ernst & Young to establish the ten greatest risks that the insurance industry faces using their Strategic Business Risk Radar device, climate change came out as the top insurance risk in 2008.

The result may not be identical for the fishing industry, were it to conduct a similar study, but there is certainly a clear message from insurance whose business is about risk and the future. The fishing industry needs to place climate change firmly on their agenda and prepare for increasing levels of climate-related risk and build their resilience to these anticipated changes.

4. Encourage innovation and low risk practices

Innovation should be encouraged at all levels from capture to distribution; product processing to marketing; as well as securing imported fish or relocating facilities. Innovation is not necessarily only linked to climate change in this instance. It is important for climate change to form part of the decision-making/innovation processes.

Companies within the industry could also incentivise risk reduction strategies throughout its supply, production and distribution chains, thereby lowering their risk and vulnerability to climate impacts and, to a certain extent possibly even other financial/fish stock shocks.

5. Minimise Business disruptions

This demonstrates the links between different business sectors as well as the global economy. For example, an extreme climate event in one part of the world, causing loss of fish stocks / crop failure could impact on the other side of the world where the food was destined. Equally, disruption due to extreme weather events such as windstorms can affect fisheries, agriculture, tourism, transport and economies on both sides of the planet almost simultaneously.

There is an urgent need for the fishing sector to address the interconnectedness of the global village – some of which may be done via insurance cover, market share and/or spread of risks through diversifying their income streams through the opening up of new markets where possible.

6. Research is critical - Oceana's Scientific Reports

Oceana have a number of scientific reports on the status and management of their main fish stocks. Below is a very brief summary of some of the main findings and key issues. For detailed information, these informative reports can be accessed via the website: http://www.oceana.co.za/sustain/scientific_report.php

The research being conducted by the hydro-acoustic surveys show a large reduction in recruitment for anchovy and sardine in 2011. By-catch does remain problematic and in some instances the precautionary upper catch limits (PUCL) have had to be increased (e.g. juvenile horse mackerel when recruiting anchovy off Namibia) in order to ensure against the premature closure of the anchovy fishery (Status of the South African and Namibian fisheries for horse mackerel, Dave Japp: CapFish and Fisheries and Oceanographic Support Services (FOSS), July 2011).

Hake stocks appear to fall into two categories: Firstly, shallow water, where stocks appear to be sustainable levels and secondly, deep water, where the stocks appear to be over-fished. Careful management of this situation, through keeping sustainability of shallow water stocks in order to re-build deep water stocks, is currently underway. (Status of the South African hake fishery 2010 to 2011, Dave Japp: CapFish and Fisheries and Oceanographic Support Services (FOSS) cc: July 2011.)

These reports are used for a number of purposes, including the setting and adjustment of Total Allowable Catches (TACs), estimating stock levels and even considering other environmental impacts such as the building of nuclear power stations near some coastal fisheries.

Oceana's investment in such research and development could certainly be considered an excellent risk management programme as part of reducing vulnerability to changes in stocks. Not only from a capture/stock perspective but will also assist in highlighting any early changes which might occur in distribution due to possible climatic changes off the South African and Namibian coastlines in the future.

Finally, as noted in the UN Country Profile of South Africa, the largest sector (by volume) is the anchovy and sardine fishery, which is linked to the Benguela Current ecosystem and the productive upwelling along the west coast. The Agulhas Bank also plays an important role in spawning and recruitment of important fishery species such as anchovy and sardine. These are critical natural systems and cycles which are sensitive to changes in their environment (FAO, Country Profile, South Africa, 2010.)

7. Align management plans with risk reducing behaviour

This is a key area where success could lead to the fishing industry playing a leading role globally as an industry which will manage the adverse impacts of climate change through building resilience and reducing risks.

Many companies are familiar with the term "scenario testing" which involves the establishment of plausible events and their outcomes. This is sometimes referred to as the "what if" scenarios. Fishing companies do this but need to start incorporating climate scenarios into these planning sessions. In the UK, "what if" scenarios have been played out using extreme weather event examples from each season by planners in conjunction with the emergency services. This serves as an excellent way of preparing for extreme weather events in partnership with other stakeholders.

Risk management is often based on past events. Whilst this is a good start companies must integrate the future risk of climate change into their plans and strategies and not simply base these on the past.

There is a question of slightly raised liability within the fishing industry from the increasing level of risk if companies ignore climate change risks. This risk remains low at present however, it could possibly change and therefore become more important over time. In future for directors of fishing industry companies to acknowledge and be seen to act appropriately on the threats posed by climate change (The Geneva Reports, No.2, July 2009).

8. Investment in "Greening" the Fishing Industry

The "Green Industry" is an extremely fast-growing industry across the world. The Climate Group predicts that the global carbon market will be worth approximately US\$ 3 trillion by 2020 (The Climate Group, 2008).

There are many ways for the fishing industry to benefit from this growing industry through accessing some of its products and potentially investing in some of these markets.

Integrating investment and carbon reduction strategies through, for example, the installation of renewable energy can result in increased energy security. This will have the dual advantage of reducing downtime during power outages as well as reducing the carbon footprint of the company in question.

Even the implementing of offset or carbon reduction projects, such as in the Clean Development Mechanism (CDM)⁴, would (potentially) assist in lowering energy costs as well as helping to reduce global emissions as well as support sustainable development in the developing world.

9. Adaptation

Currently, the global debate is focusing very strongly on climate adaptation measures. Conference of the Parties (COP 17) in Durban, South Africa in December 2011 had adaptation high up on the agenda, although the post-Kyoto negotiations are likely to take centre stage for a while yet.

Adaptation takes on many forms and is essential to reduce vulnerability and increase resilience as mentioned above. Insurance is one form of adaptation measure which will continually be weighed up against the costs of other forms of adaptation. It is likely that insurance against the risk of climate impacts might be the preferred option when weighed against other (costly)

⁴ The Clean Development Mechanism (CDM) refers to an arrangement under the Kyoto Protocol whereby industrialised countries (with emission targets) can invest in emission reduction projects in developing countries and use the emissions saved by the project to reduce their carbon tallies.

adaptation alternatives (European Central Bank, The Impact of extreme weather events on Budget Balances and implications for fiscal policy, 2009).

Coupled with this, fishing companies are experiencing mounting pressure as building regulations and emissions standards become increasingly demanding (Stern, 2006) and will likely permeate the southern African region sooner rather than later.

Importantly, adaptation cannot prevent all losses or damages. Nor does all adaptation equal good adaptation practice. Mal-adaptation exists and when planning measures, it is critical to evaluate the potential negative impacts of an adaptation practice or action. There are cases where excessive adaptation practice has led to negative social and economic impacts (FAO, Expert Workshop, 2008). Hence, when deciding on an approach, it needs to be supported by robust data as well as best practice wherever possible to reduce the inherent risk of mal-adaptation.

10. Finance improvements which reduce exposure to risks

Whether it is investment in safety equipment or procedures, building defences for low-lying infrastructure, insuring imports, renewable energy, investing in fuel efficient transportation or upgrading inefficient lighting and/or cooling systems, finance is a requirement to do any of these. Addressing climate change is not free and budgets do need to be set aside to incorporate these costs.

Having said that, investments can (and often do) have a financial benefit and therefore should be treated more as opportunities rather than “losses”. In addition, they have the added benefits of lower the impact of the fishing industries contribution to global warming as well as being a “good news” story for those companies who take the initiative. Thus investment into improvements can offer a number of benefits for the company such these listed below:

- Reduced costs
- Lowering risk (financial, reputational and legal)
- Prepared for policy and legislation changes, incentives
- Innovation
- Marketing opportunities
- Increased customer and employee loyalty.

11. It's not only about risks – it's also about opportunities

Reading about climate change impacts is often like reading the doomsday scenarios. This need not be the case as, firstly, there is a great deal of information out there upon which to act and secondly, there are also a number of business opportunities which have arisen out of this “planetary emergency” (Al Gore, 2007).

Also not all climate change impacts will be negative. A good example of this could be that the changes in distribution of fish could in fact be a huge positive for some industry players, depending on location. Moreover, fishing fleets are becoming more mobile and management systems (e.g. access agreements and internationally traded quotas) are beginning to assist adaptation measures. This means that countries (and companies) with higher adaptive capacity will be able to take advantage of this and benefit from these positive changes (FAO, Building Adaptive Capacity to climate change, 2007).

There is also the distinct possibility that fishing will emerge as a vital part of addressing climate change due to its importance mainly as a food source globally and has such a direct impact on poverty and the livelihoods of the poor. Therefore, international co-operation and support may be more directed towards the fishing sector as a whole, with international co-operation and win-win negotiations between countries and the international community alike. Were this to happen,

backing from the international community for adaptation would almost certainly form the majority of support. By not considering climate change in business decisions, the fishing industry would also be missing another potential opportunity in negotiating reduced insurance on their imports⁵.

Over all, opportunities for addressing climate change for the fishing industry do exist and would broadly include the following:

- Reduce climate risks to the company (industry)
- Incentivise risk reduction through careful management planning;
- Manage these risks (litigation, reputation, regulation);
- Reduce operational costs through cutting carbon emissions in-house. This also is an opportunity to lead by example;
- Raise awareness and educate others in the sector and further afield;
- Market differentiation as an environmentally sensitive and active industry;
- Counter the global financial crisis through leadership and innovation;
- Engage with new markets and potentially new fish species;
- Create positive preferences for society, which lead towards a low carbon future;
- Forge partnerships to share/pool risks with government and other relevant stakeholders;
- Establish the industry as a climate change leader in international climate discourse and negotiations;
- Be seen as an industry which works for the good of society, and add to Corporate Social Responsibility (CSR) contributions;
- Market oneself as a low carbon or carbon neutral company. This is seen very positively by employees, clients and suppliers alike;
- Contribute towards combating global climate change;
- Become the stewards of the oceans for future generations.

Over and above these opportunities are other "indirect" benefits, for example, where the rebuilding of damaged homes happens faster when insurance is known to be in place (The Geneva Reports, No.2, July 2009), which benefits clients, local economy and the perception of insurance as an important player for good in civil society.

12. Managing "In-house" Greenhouse Gas Reductions (Disclose carbon risk)

Interestingly enough, the oceans perform a massive role in capturing and storing carbon. As this quotation from the Blue Carbon Report 2009 aptly shows: "Out of all the biological carbon (or green carbon) captured in the world, over half (55%) is captured by marine living organisms – not on land – hence it is called blue carbon."

Fisheries and aquaculture activities have a relatively small but significant contribution to global greenhouse gas (GHG) emissions during production operations and the transport, processing and storage of fish, with the average ratio of fuel to carbon dioxide (CO₂) emissions for capture fisheries estimated to be about 3 million tonnes of CO₂ per million tonnes of fuel used (State of Fisheries and Aquaculture 2008 Report, 2009). Even though the fishing trade has low emissions for an industry, human-induced carbon dioxide emissions are causing accelerated climate change and addressing these within the fishing industry remains important.

⁵ Usually reporting in c.i.f. (cost, insurance and freight), whereas exports are reported at f.o.b. (free on board) values (State of Fisheries and Aquaculture 2008 Report, 2009).

One area where the fishing industry is starting to play a role is in their own “back yard”. In-house emissions-reduction strategies, carbon measuring and monitoring, carbon foot-printing and carbon neutral aims are slowly beginning to play an increasingly greater role in the industry. This initiative is seen as important to credibility across many industries as it shows leadership in addressing global warming as well as out of a “requirement” to address what is possibly the most talked about global phenomena today.

- **Measuring and Management**

Many companies are reducing their own greenhouse gas emissions through analysing their carbon footprints and then implementing carbon reduction strategies. These include energy consumption reductions through low-energy lighting, energy management devices (such as timers) and staff awareness programmes which alter behaviour and the culture within an organisation leading to reduced energy consumption.

It is understood within the industry that good fisheries management can also substantially improve fuel efficiencies (State of Fisheries and Aquaculture 2008 Report, 2009).

- **Low carbon/Carbon Neutral**

The ability to measure ones emissions often leads to greatly increased emissions management. Reducing carbon emissions has a number of positive impacts as mentioned above, and will also reduce the amount of offset tonnes required should a company wish to “go carbon neutral”.

- **Disclosure**

Carbon Disclosure Project reporting has increased in recent years with a significant increase in the USA as of 2008. This voluntary carbon emissions disclosure project is becoming a powerful weapon for companies in addressing their current situation, setting targets, engaging with carbon and using the results and process of reporting as a strategic management tool for addressing their company's responses to climate change. The information from submitting to the CDP is also very useful for awareness-raising within the companies concerned as well as for client/shareholder/investor information too. Oceana has submitted a publically available response to CDP in South Africa every year since 2010. Their responses can be found at: www.cdproject.net.

13. Establish Sustainable Partnerships

Forming strong alliances and sustainable partnerships is seen as another critically important aspect for companies. Industry in general, for all its power and influence, cannot stem the tide of increasing global temperatures on its own. Therefore, creating effective and collaborative links with others is imperative. Key strategic partnerships should include, amongst others, the following:

- Government agencies;
- Other industry sectors (transportation, agriculture, finance);
- Customers/clients;
- International maritime and marine agencies
- Other international bodies such as the UN and the FAO.
- Port and Harbour planners;
- Supply chains.

14. Build awareness and participate in public policy development

It is important for the fishing industry to not only stay informed about climate policy but also to be a part of developing the policy. Currently, this is an area which needs more input from the industry.

15. Lead by example in the Fishing Industry

There is a wonderful opportunity for the fishing industry in South Africa to lead by example. Oceana is already undertaking its carbon footprint, addressing energy and considering adaptation in its overall business strategies. This is a great start and one which should be encouraged and supported. The fishing industry needs some leading lights to forge the way ahead into the on-coming waves of climate change and increased variability.

16. Keep the industry solvent

It is estimated by WWF, that if current fishing practices continue the commercial fisheries will be close to fully depleted by 2048 (WWF, Why It Matters article, [accessed online: December 2009]). Clearly, this is not a sustainable future for the industry and changes are required. Add to this, the prediction that climate change is going to make this situation worse and the solvency of the industry is really brought into sharp focus.

It is the role of the fishing industry to engage with climate change policy, manage their risks, contribute to the reduction of emissions and practice sustainable fishing, following the Code of Conduct for Sustainable Fisheries.

5.5.4 Summary

The world's oceans store vast quantities of carbon dioxide; they produce about 70% of our oxygen; they influence and help to regulate our climate and weather patterns; they store resources which help run economies across the planet as well as feed millions.

These are the same Ocean's which give life to the marine fishing industry and are also under stress from past and present fishing practices in some regions as well as the added impacts of global climate change.

The State of Fisheries and Aquaculture 2010 Report estimates that 32% of stocks are over-exploited (28%), depleted (3%) or recovering (1%). Approximately 53% are fully exploited. That equates to about 85% of all marine stocks being over-exploited, depleted or fully exploited. This leaves 15% that are either underexploited (3%) or moderately exploited (12%). (State of Fisheries and Aquaculture 2008 Report, 2010).

Furthermore, a WWF article states that "scientists predict that at the current rates of fishing, all the world's commercial fisheries will be exhausted by 2048" (WWF, Why It Matters article, [accessed online: December 2009]).

Thus, the fishing industry has a growing awareness of the potential threats and risks which exist as well as the predicted impacts presented by the climate change and increased climate variability. Often the solutions lie in some of the simpler strategies which address the larger areas of impact. As discussed earlier in this paper, not all risks and impacts can be addressed by adaptation but the old saying of "fore warned is fore armed" is applicable and could be applied to the realm of climate change adaptation measures.

In summary, the above gives a number of illustrations where extensive work has been done on addressing the "new" risks associated with climate change. However, nothing has yet been comprehensively established as "best practice" but the journey has at least begun. There are still plenty of gaps in all of the above initiatives to which solutions need to be found. Uncertainty is part of the package received and whilst it is an important factor in decision-making it should not be used as an excuse for inaction.

5.6 Current Practice in Southern African Waters

5.6.1 Africa – The (in the) Dark Continental Shelf?

Africa has a level of climate change that is inevitable. It is likely to be one of the regions hardest hit (initially) and is one of the least resilient and so is, therefore, highly vulnerable. It has been suggested by the IPCC that some crop yields in southern Africa will be substantially lower as early as 2020, and that net crop revenues could fall by as much as 90% by 2100, with small-scale farming being worst affected (IPCC, 2007). Water supply is at the core of many climate issues in southern Africa and is linked strongly with increased levels of disease, decreased access to water and negative impacts on the livelihoods of those least able to adapt.

The predicted climate-related impact on health is significant. Increases in vector-borne diseases, heat-stress, decreased nutrition, increased food poisoning, increasing respiratory cases and deaths are some of the key expected impacts. The World Health Organisation (WHO) estimated that 150,000 deaths in 2002 were as a result of climate change (The Geneva Reports, No.2 July 2009). In 2009, the number is predicted to double to 300,000. By 2030 it'll be closer to 500,000 (Financial Times, online, May 2009).

Once again, these are mainly land-based predictions and statistics but they should not be ignored as some will impact on the fishing industry – some positively perhaps but mostly negatively. The fishing industry, as described earlier, is facing its “own” set of commercial and climate threats to its fisheries with the added pressure coming from impacts to its allied and land-based activities too. Current and anticipated threats and likely impacts for southern Africa include some issues shown in the figure below.



Figure 27: Impacts and threats in the southern African context.
Photo: Tom Curtis, www.FreeDigitalPhotos.net

Anticipated losses range from fish stocks, property, agriculture, forests, business hours, liability to deaths from increasing frequency and intensity of extreme weather events. Not all sectors are currently on the front line. However, some are more vulnerable than others, but none can afford to be complacent, as the front line is advancing faster than expected.

The diagram below, developed by KPMG International, and adapted by GCX estimating where the fisheries sector might be placed, gives a good idea of where various sectors sit with regard to the preparedness of the sector versus the perceived level of risk that climate change poses to that sector.

Interestingly, the insurance sector sits in the region of being reasonably prepared but tends towards a higher level of risk, whilst the fisheries industry is in an area of some preparedness but also quite a high level of risk. Whilst this is a global study and is not Africa-specific, the results are likely to be similar within the South African context.

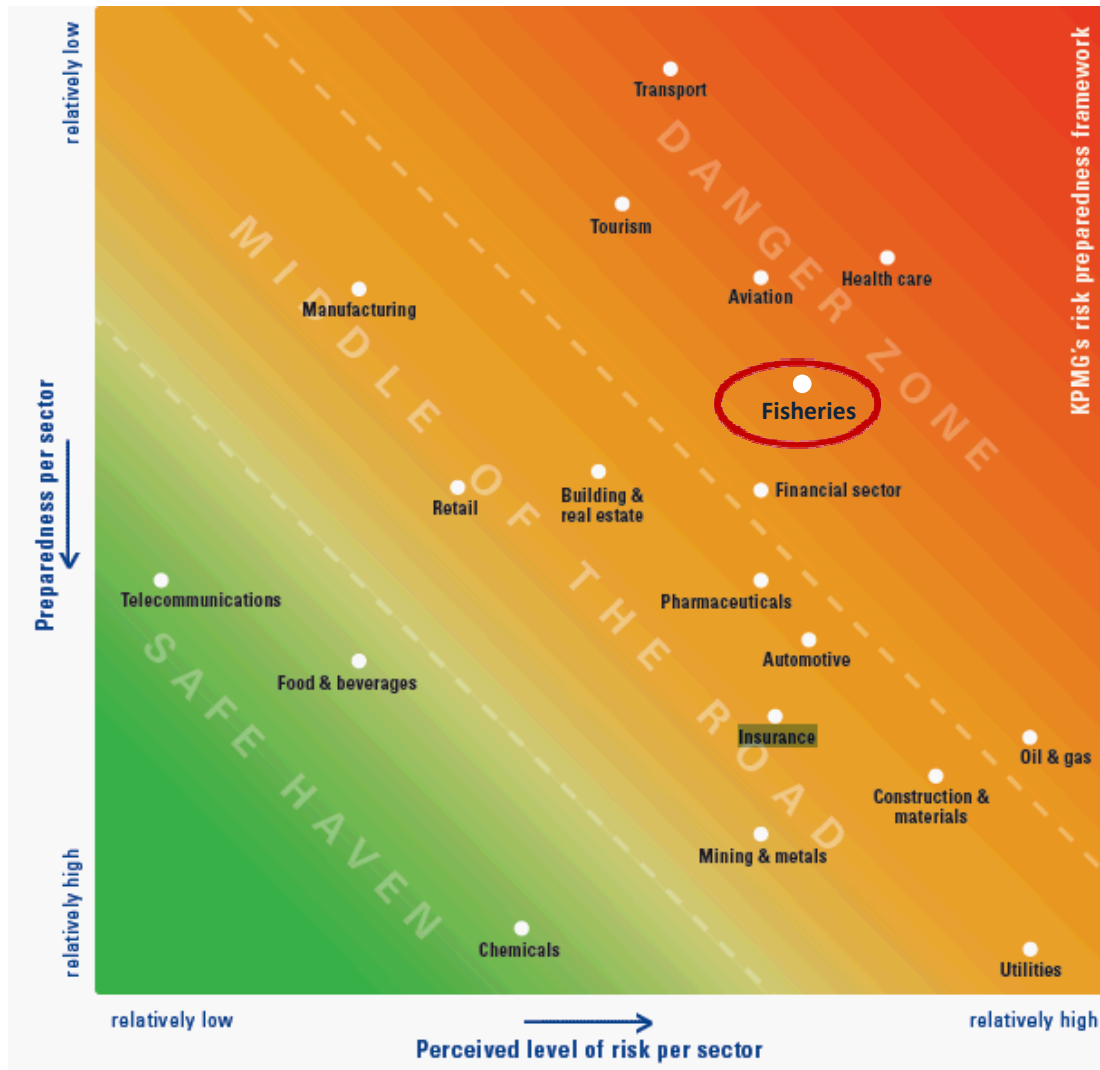


Figure 28: Sector preparedness – GCX estimated Fisheries sectors position
 Source: KPMG International, 2008. KPMG LLP, London. (With Permission.)

Until recently, adaptation had been largely ignored (or placed in the “too hard” box). However, this is fast changing as a result of increased evidence of climate change impacts and hence the uncertainty around the reality of climate change is diminishing. Within the South African context businesses, including insurance, retail, manufacturing and now fisheries are slowly waking up to the realities of climate change. Mitigation is still the better known and understood of the two approaches to tackling climate change, although even carbon foot-printing remains an anathema for some.

There is reason why this should be the case though. The global financial meltdown has certainly impacted on businesses' ability to deal with issues which are not mandatory. Currently in South Africa there are no specific climate change regulations aside the pending carbon tax, although this may change in the post-Kyoto agreements. However, the recent increases in energy prices will certainly prompt many to adopt energy reduction strategies. Furthermore, there is gathering evidence to suggest that South Africa is going to be hard hit by climate change.

Whilst we are fortunate to have a number of Nobel Peace Prize winning climate scientists in our midst working on southern African scenarios and predictions, we also have evidence of an increasing number of extreme events as illustrated by the increasing costs we are experiencing in disaster management. The figure below illustrates the cost of extreme events in the Western Cape and, as can be seen, there are substantial amounts being spent annually on extreme weather events. Focussing on just one single extreme weather event in November 2008 (discussed earlier), one can see it is clear that the climate science is concurringly accurate.

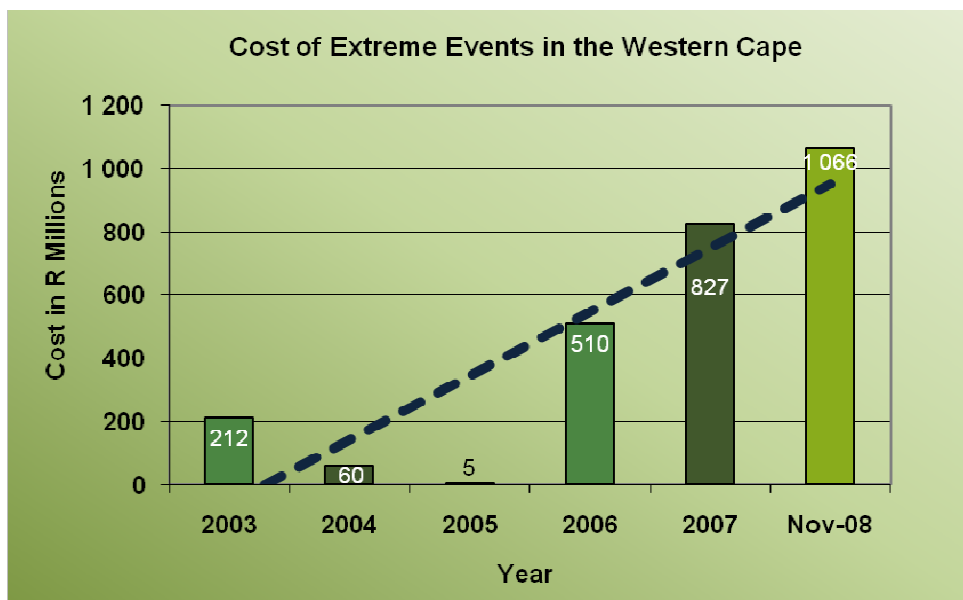


Figure 29: The cost of extreme weather events in the Western Cape compared to November 2008's extreme weather event (Source: Disaster Risk Management & Sustainable Resource Management).

Once again, data exists for land-based activities and impacts and the ocean information is limited. Below is a case study of the variation and impacts that this has on the fisheries off the western coast of southern Africa.

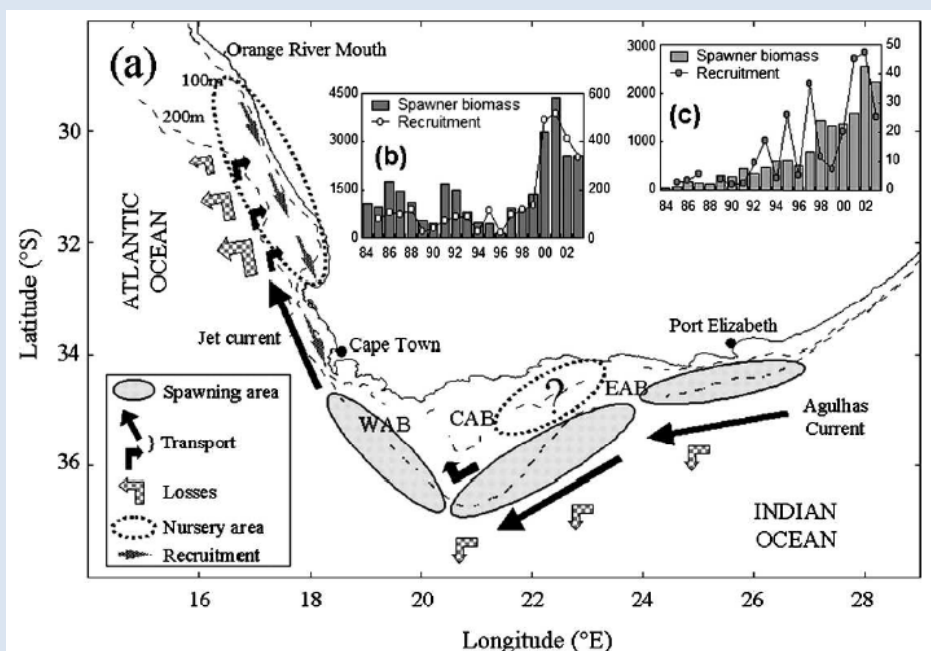
5.6.2 Seasonal Variation Studies

5.6.2.1 Benguela Current Variations

Increased variability due to climate change is one of the key predictions from the IPCC. Variability exists, as is explained in the study below, however what is important is the scientific evidence pointing towards this variability increasing. The example given below (over page) is based on the an article in the American Meteorological Society's Journal of Climate (Special Edition), 2006 and shows the complex web of interactions already existing within "normal" variability. Often the limited ranges within which marine (and other) species live, is particularly vulnerable to changes in climate and climate variability.

The southern Benguela current runs northward along the south west coast of Africa. The Benguela upwelling brings to the surface nutrient rich waters upon which a variety of pelagic fish species, such as anchovy *Engraulis encrasicolus* and sardine *Sardinops sagax* rely. The upwelling is driven by strong south-easterly winds in summer and it reaches its maximum in about January each year. In winter, the predominant westerly winds reduce the upwelling substantially.

The species that rely on this upwelling for survival and are well adapted to these seasonal changes. Even though the upwelling is important for nutrients, the area of the southern Benguela is not ideal for successful fish reproduction due to wind mixing and strong winds driving surface waters off-shore. This means that both the species mentioned above have adapted to this and, in the case of Anchovy, they mature and spawn over the Agulhas Bank between October and March. The Sardine mature later in the year and spawn over both the Agulhas Bank and sometimes also on the west coast of South Africa and they spawn throughout the year. Both fish generally reproduce in a way which separates the spawning and nursery grounds.



Map of the Southern Benguela off South Africa showing the locations of small pelagic fish spawning grounds (anchovy and sardine both spawn over the Agulhas Banks, but the sardine spawning habitat off the west coast is not shown for clarity) and nursery grounds (although the west coast is considered to be the major nursery ground, the south coast may in some years act as a significant nursery ground), and transport and loss processes that impact on eggs and larvae; and time series of spawner biomass (bars) and recruitment strength (circles and lines) of (b) anchovy and (c) sardine from hydroacoustic surveys of 1984–2003. The 100- and 200-m depth contours are shown, and WAB, CAB, and EAB are defined in the text.

The eggs spawned over the western Agulhas Bank are moved towards the west coast nursery grounds where the young are able to feed in the nutrient rich waters. Not all survive but juvenile anchovy of about four months old end up in catches off the west coast from about March onwards. These fish then migrate back towards the Agulhas Bank in spring. Both Anchovy and Sardine eggs spawned on the central and eastern Agulhas Bank end up in three main places, namely, the western Agulhas Bank, the southern Indian or Atlantic Oceans.

Recruitment success is closely linked with the transport of eggs between spawning and nursery grounds. Slight changes in climatic conditions can adversely affect recruitment and therefore catches. Research, over a 10-year period, has shown that an increase in average south-easterly winds during the spawning season, resulted in poor anchovy recruitment.

Source: P. LEHODEY *et al*, American Meteorological Society's Journal of Climate (Special Edition), Climate Variability, Fish, and Fisheries, Volume 19, p. 5011, 2006 (with permission).

5.6.2.2 The South Africa Risk and Vulnerability Atlas (SARVA)

In 2010 the South African Department of Science and Technology produced the first Risk and Vulnerability Atlas for South Africa, known as SARVA. The main purpose of SARVA was for “providing up to date information for key sectors to support strategy development in the areas of risk and vulnerability”. The initiative is now a firm part of the Climate Change Response White Paper strategy, as released in October 2011.

The SARVA covers a number of key sectors including a section on Coastal Areas. One interesting finding noted in this section is explained in the box below.

The western coastal zone, which consists mainly of the Benguela Upwelling System, will exhibit more intense upwelling due to a predicted increase in wind stress over the southern Atlantic on account of global climate change (Lutjeharms *et al.*, 2001). This will induce much cooler sea surface temperatures (SST) along the west coast of South Africa than at present. However, an intensification of the South Atlantic Sub-tropical gyre may also lead to increased atmospheric subsidence, fewer clouds, increased insolation* and higher air temperature. The latter will result in warming of the surface water, which may negate the increased upwelling and offshore transport of cooler waters (SARVA, 2010).

* Insolation: the measure of solar radiation energy received on a given surface area and recorded during a given time (Wikipedia, 2012).

One can see from the above that changes in climate can have multiple impacts, some of which could impact the fishing industry a great deal in the future. However, the exact timing and magnitude of the effects remains relatively uncertain.

Furthermore, the SARVA also explains that under global warming conditions, the Agulhas Current has been predicted to increase in strength, although the exact impact of this is still unclear. Changes in the strength/direction of the current may impact on the distribution of eggs and larvae (of species such as the horse mackerel, anchovies and sardines), leaving them increasingly vulnerable to being lost to the ocean away from the relative “protection” of the nursery grounds.

One other example of an impact in the increased strength of the Agulhas Current is that it could affect the counter flow which is responsible for retaining some fish species’ eggs and larvae on the bank. If these “eddies” were reduced there is a chance more eggs and larvae would be lost to the open ocean with low rates of survival.

The SARVA is an excellent overview of risk and vulnerability for South Africa. Although there is not a great deal of information directly relating to the fishing industry it should be noted that the industry operates within the context of the South African (and global) situation. Being aware of overall risk and vulnerability does increase the fishing industries understanding of possible indirect impacts.

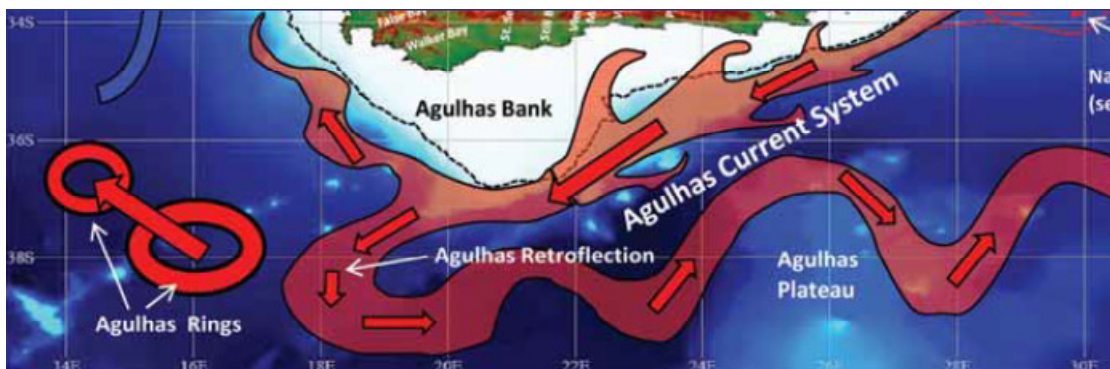


Figure 30: Agulhas Current (SARVA, 2010, adapted Lutjeharms (2006)).

5.6.3 Oceana leading the way

From a fishing industry perspective, Oceana is making great strides. Oceana has embarked on the following initiatives below which all show leadership for the industry in South Africa and send a clear message that Oceana is taking climate change very seriously:

- ✓ Oceana have started measuring in-house GHG emissions through a Carbon Foot-printing exercise;
- ✓ Considering energy efficiency improvements, through energy audits and reduction strategies;
- ✓ Development of South Africa's first white paper on adaptation in the fishing industry
- ✓ Addressing adaptation to climate change for their business, which in turn could lead addressing some of the following:
 - ✓ Risk and vulnerability assessments
 - ✓ Risk reduction strategies
 - ✓ Development and implementation of adaptation strategies to deal with the expected impacts of climate change
 - ✓ Strengthening adaptive capacity

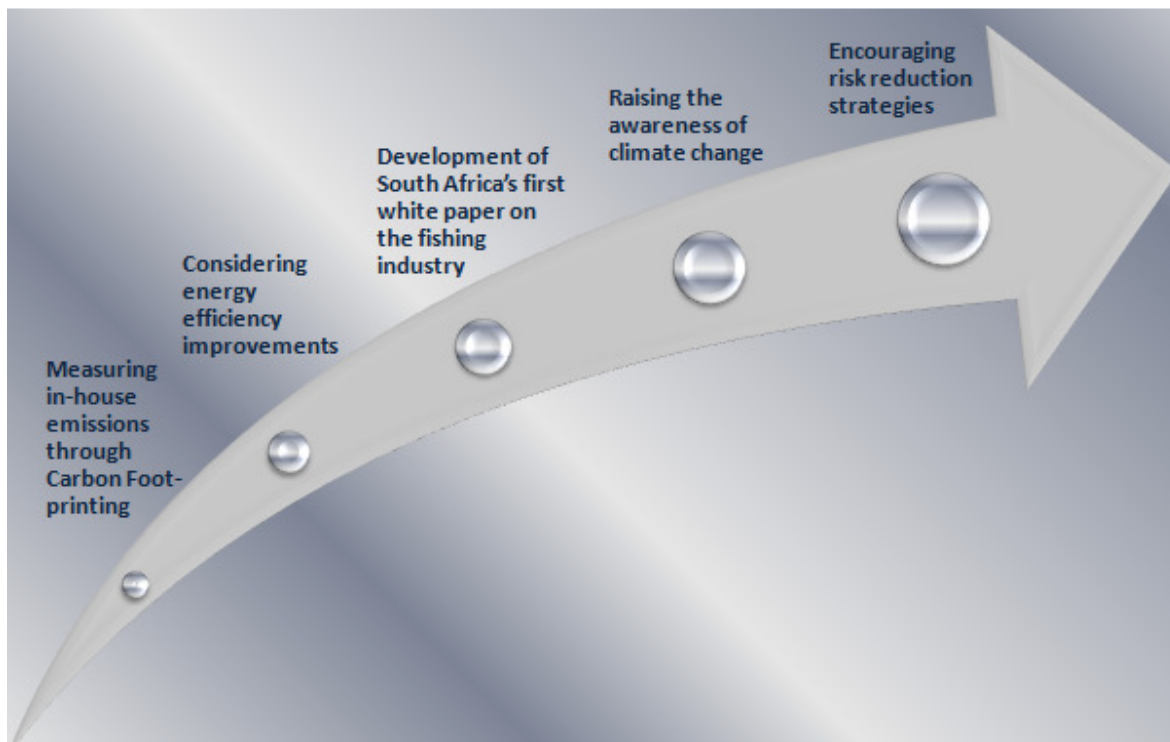


Figure 31: Oceana's leading approach
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5.7 Action and Risk Management

5.7.1 Carbon Disclosure Project

The Carbon Disclosure Project (CDP) has, as one of its main focus areas, risks and opportunities to a business under climate change. Below are some excerpts taken directly from publically available CDP submissions. These have been taken from a diverse number of organisations from across the global corporate world. Reading them shows that the fishing industry plays a hugely important role in other companies businesses. Just like impacts in other sectors may increase affects for the fishing industry and possibly present opportunities, so the impacts on the fishing industry will have multiple affects on other businesses and industries. The excerpts below represent but a small minority of the possible impacts that changes in the fishing industry would have on other sectors from various CDP responding years.

Pronova BioPharma: For Pronova BioPharma the only physical opportunity will be linked to the availability of raw materials (fish) and the supply chain linked to these commodities. Better breeding grounds for the fish types used, and migration of these fish species to areas closer to Pronova BioPharma production facilities. The chance of this is low, and Pronova BioPharma see few, if any physical opportunities linked to climate change. (CDP, 2009).

Pick 'n Pay: We realise that availability of fish is a crucial component in our supply chain and that climate change will also impact on changes in sea water temperatures, leading to changes in currents as well as the ability of the sea to support the current number and size of species. We have therefore partnered with the WWF in a three-year partnership agreement which aims to restore over-exploited fish stocks to sustainably managed levels, whilst maintaining or improving the state of other stocks, through the application of an Ecosystem Approach to Fisheries (EAF) and reducing the impacts of destructive fishing practices to acceptable levels. The partnership also assists us in finding new sources of supply of fish that are green listed and assist us with employee education. (CDP, 2011).

Unilever: The availability of raw materials is essential for our business which has led to the company undertaking several significant sustainability initiatives in partnership with other stakeholders. These have included sustainably certified tea and fish (CDP, 2009).

Woolworths Holdings Ltd: Changing ocean conditions can be expected to impact sourcing of fish and fishing activities through changing patterns of fish migration and impacts on the food chain, as well as tighter limits being placed on catches as a consequence of stock depletion. We are working with the South African Sustainable Seafood Initiative to understand these impacts and minimize the impacts of our fish sourcing (CDP, 2011).

POSCO: Steel making slag will be utilised to develop artificial fishing reef and marine forests by installing on sea beds. The slag promotes growth and photosynthesis of seaweed while fixating CO₂ by using carbonation of by-products (2009). In February 2010, POSCO signed a memorandum of understanding with the Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF) to create ocean forests and fishery resources in the Korean sea. POSCO and MIFAFF are going to restore a damaged ocean ecosystem caused by whitening using the Triton TM product. Throughout the MOU exchange between POSCO and MIFAFF for ocean forests and fishery resources, a new pathway has been found to utilize the steel slag leftover from the company. This activity can lead to an increase in market share of Triton TM and to improve its overall added-value. From 2010 to 2014, POSCO and MIFAFF will provide a 780 hectare area which is used for easily attaching marine algae. Ocean forests will be installed at 19 different areas and it is expected to increase overall productivity of fishery resources by about 73.5 billion

KRW. Using the marine forest technology, POSCO and RIST are also involved in coastal ecology restoration and marine forest restoration projects based out of the POSCO steel mill in Indonesia (CDP 2011).

Dana Petroleum: *Shifts in species distribution: shifts in fish stocks may result in conflicts of interest between the fishing industry and oil and gas industry, as both try to obtain marine resource. (CDP, 2009).*

SPAR Group Ltd: *SPAR recognises the impact of both over-fishing and climate change on our fish resources. The company also recognises the importance of maintaining rich biodiversity within our seas. As a result, the company has initiated a project to ensure that SPAR's seafood range incorporates only sustainable fish sources. A policy is in the process of being developed. Once this is complete, SASSI together with SPAR will assess the sustainability of SPAR's current seafood range and will thereafter look to remove or improve all products that do not comply with this policy (CDP, 2011).*

DnB NOR: *DnB NOR is one of the world's largest shipping banks, and also has large interests in the global energy/offshore and seafood industries. Our locations internationally are thus to a large degree directly exposed to the dangers of rising sea levels, one of the expected consequences of climate change. Local economies suffering from the physical effects of climate change also pose a threat to the profitability of these locations specifically and the Group's operations generally. As one of the world's largest shipping banks, it would be a considerable opportunity should the shipping industry come to be considered the most environmentally friendly way of transportation. Rising sea-levels and changes in habitats for fish can ultimately be both a threat and an opportunity for the seafood industries, industries where DnB NOR has a global engagement (CDP, 2009).*

Darden Restaurants, Inc *The financial and business continuity risks of future climate impacts on fisheries and oceans are also not known with precision; however, research is currently being conducted by industry and academic scientists. To promote more scientific understanding of this topic, Darden is funding key research initiatives on climate change and its impact on marine ecosystems.*

Even with regulatory uncertainty, and possibly small direct impacts, Darden remains committed to lowering energy use, finding transportation efficiencies, improving packaging, and finding lower-carbon agriculture and fishery practices will reduce cost and create higher quality products over the long-term. To this end, Darden is committed to continuing to find innovations both within its operations and supply chain for reducing carbon emissions. Moreover, evolving to a lower-carbon supply chain could prove to be a decisive cost-advantage to Darden's restaurants when carbon is internalized into the cost of goods and services (CDP, 2011).

As is clear from the above, there are many other industries and sectors keeping a close eye on their risks associated with their interactions with the fishing industry.

In a recent announcement Wal-Mart, the world's largest retailer selling huge volumes of seafood and aquaculture products, committed to buying 100% of all its wild-caught seafood to be sold in the USA from Marine Stewardship Council (MSC) certified sources by 2011. (WWF, online, <http://www.worldwildlife.org/what/globalmarkets/fishing/engagingbusiness.html>).

This is a huge step by a massive stakeholder in the fishing industry towards more sustainable fishing practices, to which climate change represents one of the real threats.



5.7.2 Managing Risk and Disasters

Managing risk is something all companies should do as part of their daily lives. Managing climate change, from an adaptation perspective is intimately linked with risk management. Some global companies are using the Enterprise Risk Management (ERM), which is essentially a framework that looks at managing risks as well as positioning an organisation to take advantage of any opportunities which arise. One of the advantages of ERM lies in the proactive approach it offers, with the added benefit that it takes into account the needs and requirement of its clients, thereby creating value not only for its shareholders but for society too. This is not uniquely for a specific industry (although the insurance industry is using it more and more) as it is a risk management strategy that fits well within the context of the uncertainties, risks and opportunities posed by climate change. There is also another aspect which may be more pertinent to some industries, such as the fishing industry, and that is disaster management. A technical paper produced by the FAO (Westlund et al, Disaster Response and Risk Management (DRM) in the Fisheries sector, 2007), in response to the increasing number of natural disasters the fishing sector is experiencing, it notes that: "Over the last few decades, natural disasters have become more frequent and increasingly destructive".

Companies may have excellent disaster management strategies in place. However, if these are not in place, they should form part of a holistic approach to addressing climate change in the future. The FOA technical paper described a disaster a sequence of events, for which each would require a response. The diagram below represents the actions required to mitigate and deal with disasters, especially applicable those which affect coastal fishing communities.

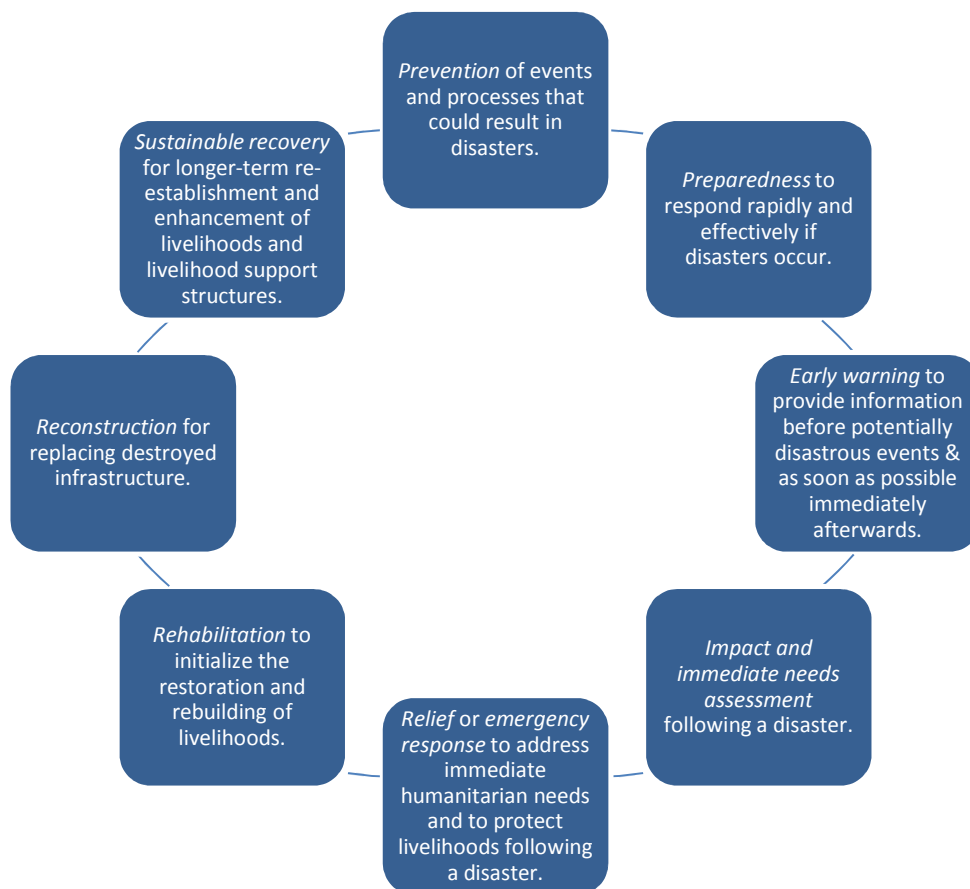


Figure 32: FAO's disaster cycle or emergency sequence.
Adapted from: FAO, Westlund et al, Disaster Response & Risk Management in the Fisheries sector, 2007.

Once again, being prepared for such events does not negate the event but often reduces the impact and the negative outcome. The risk of increased disasters, especially near coastal areas, is increasing with the warming climate and strategies for dealing with these should include DRM.

5.8 Recommendations – what more is needed?

As mentioned above, this is a process with which the industry is still getting to grips. Gaps in knowledge and understanding, coupled with uncertainty and the “natural” volatility of the industry, makes it a challenging task to address climate change. However, some strides have been taken in the fishing industry as well as other industries from which lessons can be learned.

Adaptation encompasses a number of aspects. Adaptation measures can be reactive or anticipatory and are not limited in scope to protecting material assets but also include elements such as building adaptive capacity within an organisation. A climate change adaptive measure or action is that which will reduce the impact of a climate-related event should it occur.

Some examples of specific adaptation measures are shown the figure below. This table was taken and adapted slightly from the FAO's Technical Report 530, 2009. It gives an idea of some of adaptation measures which can be employed by fisheries as well as whether they are reactive or anticipatory actions. (Note that some involve the combination of both public and private sector responsibility.)

Impact on fisheries	Potential adaptation measures	Responsibility	Timescale
Reduced fisheries productivity and yields (indirect ecological)	Access higher value markets	Public/private	Either
	Increase effort or fishing power*	Private	Either
Increased variability of yield (indirect ecological)	Diversify livelihood portfolio	Private	Either
	Precautionary management for resilient ecosystems	Public	Anticipatory
	Implementation of integrated and adaptive management	Public	Anticipatory
Change in distribution of fisheries (indirect ecological)	Private research and development and investments in technologies to predict migration routes and availability of commercial fish stocks*	Private	Anticipatory
	Migration*	Private	Either
Reduced profitability (indirect ecological and socio-economic)	Reduce costs to increase efficiency	Private	Either
	Diversify livelihoods	Private	Either
	Exit the fishery for other livelihoods/investments	Private	Either
Increased vulnerability of coastal, riparian and floodplain communities and infrastructure to flooding, sea level and surges (direct)	Integrated coastal management	Public	Anticipatory
	Early warning systems and education	Public	Anticipatory
Increased risks associated with fishing (direct)	Private insurance of capital equipment	Private	Anticipatory
	Adjustments in insurance markets	Private	Reactive
	Insurance underwriting	Public	Reactive
	Weather warning system	Public	Anticipatory
	Investment in improved vessel stability/safety	Private	Anticipatory
	Compensation for impacts	Public	Reactive

Trade and market shocks (indirect socio-economic)	Diversification of markets and products	Private/public	Either
	Information services for anticipation of price and market shocks	Public	Anticipatory

Figure 33: Specific adaptations to climate change for fisheries, FAO Technical Paper, 2009

Sources: Categories adapted from Tompkins and Adger (2004) and Smit et al. (2000).

Note: *Adaptations to declining/variable yields that directly risk exacerbating overexploitation of fisheries by increasing fishing pressure or impacting habitats.

Furthermore, below is a “top 10” list of what industry players operating within the South African context could use as a baseline of aims from which to begin their journeys towards a low carbon, resource constrained and uncertain climate future in South Africa:

1. Fisheries need to play an important role in ensuring the industry's sustainability and solvency is not compromised by mal-practice or lack of climate-risk/opportunity awareness and action.
2. Fisheries should strive to be seen as stewards of the Oceans and could develop this reputation through sustainable harvests, good practice and addressing climate change through their practices at sea and on land.
3. The fishing industry must develop capacity and knowledge about climate change and the related risks.
4. The fishing industry should ensure in-house carbon management and carbon reduction initiatives are at the cutting edge of best practice.
5. The fishing industry should develop climate change adaptation management plans and ensure disaster risk management plans are in line with current climate projections.
6. The fishing industry must implement risk-reduction strategies for their operations as well as encourage innovation to reduce vulnerability, increase safety, improve efficiencies etc.
7. Partnerships are critical – with government, NGO's and the business sector – to reduce and spread the risks (including the irradiation of illegal fishing practice and trade in illegal catch). The fishing industry could play a leadership role but it cannot do it alone.
8. The fishing industry must raise awareness and educate stakeholders on the risks and opportunities presented by a changing climate and increased variability.
9. A framework of mitigation and adaptation plans and strategies at international and national levels is critical if the fishing industry is going to be able to play an influential and positive role in addressing the plethora of challenges climate change presents.
10. Understand any results from Copenhagen and agreements on mechanisms for post-Kyoto to help inform the future role of, as well as the risk and opportunities, to the fishing industry.

The sustainability of the fishing industries of many countries will depend on increasing flexibility in bilateral and multilateral fishing agreements, coupled with international stock assessments and management plans.
Fourth Assessment Report, Working Group II, IPCC, 2007.

6. The Business Case for Climate Change Adaptation

Many challenges lie ahead in terms of: continuing trade globalization; intensification and diversification of farming practices; further advancement in technological innovations in food production; changing human behaviour and ecological systems; heightened awareness for biodiversity protection; greater demand for public health and environmental protection; and increasing concerns on animal welfare and impacts of climate change."

State of World Fisheries and Aquaculture Report 2010.

6.1 The Benefits of Early Action

There are many benefits for the fishing industry to take action, and to take it early. The scientific predictions make it clear that changes are to be expected. The precise impact of these changes is uncertain in many instances. What makes the predictions more difficult to act upon is that each region will experience different impacts at differing levels of intensity.

Climate change is not the only issue around which fisheries should be acting upon to gain benefit from but the incentives it provides to the industry make it an attractive option and one which should not be ignored much longer.

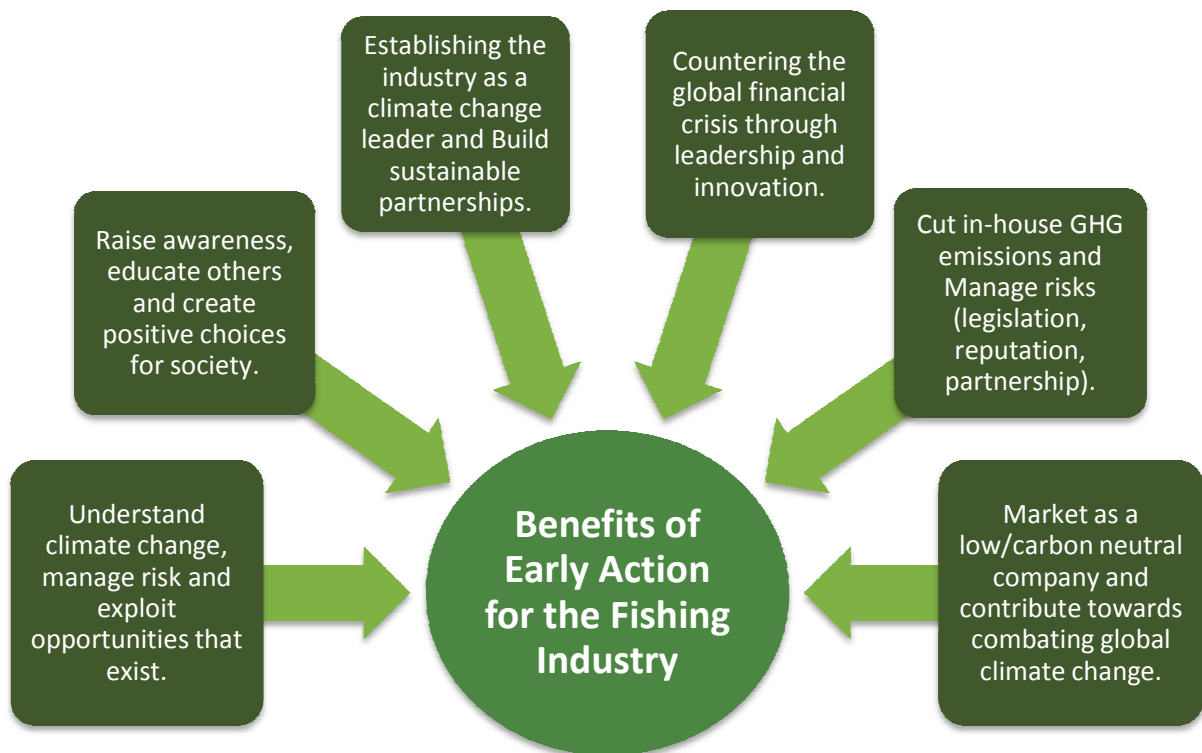


Figure 34: Benefits of early action
© GCX, 2009

6.2 The costs

Taking action early is not without its costs. The Stern Review states that the estimated cost of addressing climate change today is about 1% of global GDP. Interestingly, Stern increased this prediction to 2% in June 2008, as a result of climate changes occurring faster than initially thought (Jowit et al, The Guardian, 2008). If no action is taken, costs were estimated in the same report to be approximately 5 – 20% of global GDP by 2050 (Stern Review, 2006).

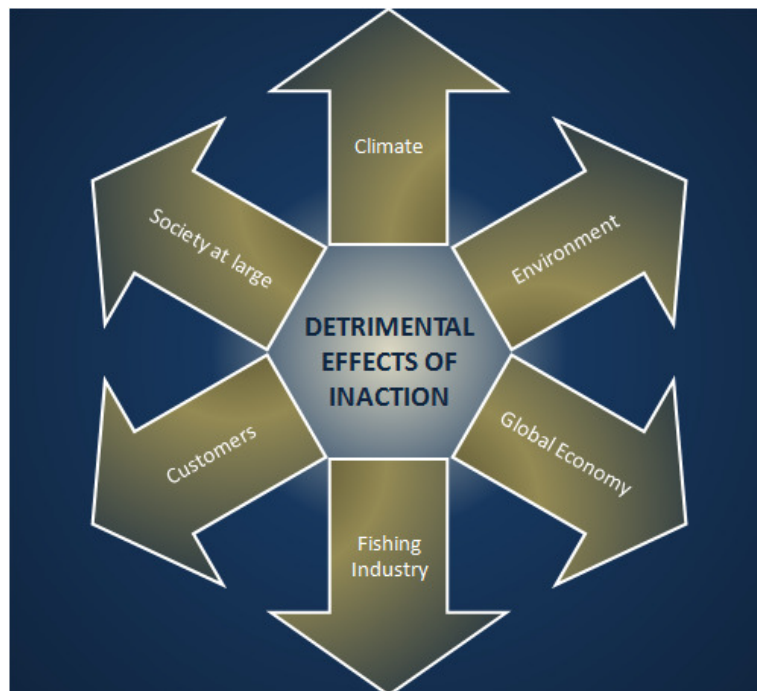


Figure 35: The detrimental effects of inaction.
© GCX, 2009

Although mentioned earlier, it is important to remember the more direct costs incurred by the fishing industry could include some of the following:

- Damages/replacement of vessels;
- Increased insurance;
- Lost/damaged fishing equipment;
- Loss of fishing days;
- Relocation of facilities and defences;
- Increased operating costs;
- Implementation of adaptation/mitigation measures.

Global economies and the markets in which the fishing industry operates are interconnected, and the impacts of inaction will have a detrimental effect on the climate, the environment, the global economy and the fishing industry, its stakeholders, livelihoods and society at large. It is generally agreed that the costs of early action far outweigh the consequences of inaction.

6.3 Current & Future Adaption Strategies

Below is an outline of the various adaptation strategies used. Once again, an appropriate combination of these would create a sound basis from which to operationalise an adaptation management action plan.

i. Hard and soft:

Soft Strategies, such as a simple change made in fishing scheduling; or Hard Strategies such as the installation of new or innovative technology and infrastructure.

ii. Direct and indirect:

A direct strategy would be, for example, the implementation of a flood defence or early warning system, whilst an indirect strategy could refer to a change in business policy.

iii. Development of innovative business operations:

These should incorporate the predicted changes in weather extremes when assessing exposure to risk, as well as when developing risk management strategies.

iv. Communicate risk and raise awareness:

Identify and communicate dangers and risks, i.e. ensure transparency of probabilities, damage potential and uncertainties;

Create awareness and raise the sensitivity of all stakeholders in the industry;

Provide a basis for decision making that enables the various actors to take precautions and to gradually incorporate the impacts of climate change into their business planning and activities.

v. Indicate action options, co-ordinate and define responsibilities, draw up and implement measures:

Such measures may include altering fishing practices, building new facilities, enhancing water use efficiency, changing building codes, investing in new cooling systems, and/or constructing sea walls.

vi. Engage in Policy:

A range of policy instruments are relevant to adaptation in many sectors, including price signals/markets, financing schemes via Public Private Partnerships (PPPs), insurance schemes, regulatory incentives, and research and development incentives.

Adaptation should be evaluated in terms of whether the benefits of such actions and strategies exceed the costs incurred, and by how much, and which are the most effective for the organisation based on the expected impacts, threats and opportunities for the organisation and its operations.

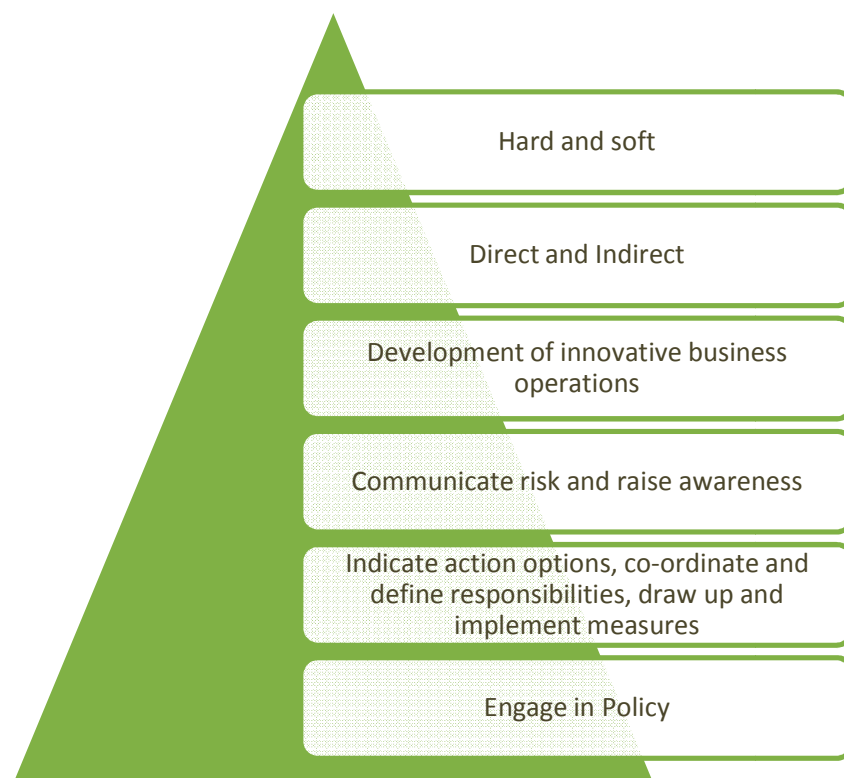


Figure 36: Adaptation strategies.
© GCX, 2009

Sectoral studies have shown that in some sectors certain adaptation actions can lead to high benefit-cost ratios and/or can be implemented at low cost. For example, farm level adjustments, which are assumed to cost very little, can lead to significant benefits in terms of offsetting damages.

The greatest step which now needs to be taken is to put together the information that is available, learn lessons from the past, manage the uncertainties and start the process of incorporating climate change into business decisions at every level.

“Climate change is not an environmental issue, but much more to do with security and economics.”

Jonathon Porritt, Programme, Former Chairman of the UK Sustainable Development Commission

7. Meeting the Challenge in South Africa

“If you want to go fast, go alone; but if you want to go far, then go together.”

African proverb

“We need to go far – quickly.”

Al Gore, with reference to the above proverb, 2007:

7.1 Moving forward in a climate-constrained world

There is an enormous responsibility on the fishing industry to play a role in moving towards more sustainable approaches to fisheries. The oceans are suffering under current over-exploitation as well as pressures from a growing global population. There is now the added stress of climate change and the predicted impacts it will bring.

The vulnerability of fisheries is determined by the degree of climate impact experienced, the sensitivity of that fishery to the impact and its adaptive capacity to the changes. Understanding one's risk is critical in order to adopt risk management strategies. There are many options for addressing the increased risks posed by climate change and include some of the following:

- Increase fishing effort in a sustainable way
- Adopt an ecosystems approach within commercial fisheries to increase resilience of the industry and fishing communities
- Increase energy efficiencies across the board
- Increase imported fish to meet demand through contracts
- Insure against losses (e.g. equipment, infrastructure and supply)
- Diversify business where possible
- Align capacity with changes – building adaptive capacity
- Shift targeted species (if/where appropriate)
- Move fishing fleets, relocation of facilities
- Address over-capacity issues where present
- Improve coastal defences
- Investment in improved early warning systems, other safety and training
- Consider indirect impacts on the business and include in planning processes
- Develop contingency plans and alternative options for main distribution networks
- Manage and reduce greenhouse gas emissions, report and disclose emissions and climate risk.
- Engage and influence national and international policy discussions
- Address legal responsibilities to shareholders and employees

- Understand the social impacts of a diminishing resource of protein and food for poorer communities (especially in South Africa with brands like Lucky Star)
- Understand the context within which Oceana operates and its risks and vulnerability to the impacts of climate change.

Oceana represents a responsible fishing industry company with an understanding of sustainability. Nowadays, sustainability has a far broader application and covers issues relating to the social, financial and environmental arenas. Climate change, therefore, should not be seen as a separate issue but one which impacts all aspects of a business such as Oceana.

Oceana is a company which is potentially more vulnerable to predicted climate change as it operates in the open oceans and is reliant on natural systems. It is these very systems which are at risk of change in a warmer world, which has a direct impact on Oceana's operations.

Furthermore, impacts are also likely to occur as fish stock resources globally are over-exploited and diminished, placing increased pressure on the existing stocks. Markets are likely to alter and sustainable approaches, including but not exclusively addressing climate change, need to be adopted as a matter of urgency before fish stock crashes become frequent events.

Understanding the risks and opportunities that climate change may present to Oceana is one important aspect of addressing the multiple stresses faced by businesses (and individuals) in a climate-constrained world.

Impacts are widespread and almost no entity or person will remain unaffected for long. Thus the impact of the fishing industry on climate change is also dependent on external factors over which it has very little control. If governments and polices help to promote sustainable fisheries, and if the industry takes the issue seriously and acts upon climate change then there is every possibility that the fishing industry will make a significant global contribution to one of the most important challenges facing the world and humanity today.

7.2 The GCX Approach to Adaptation

The complexities of the climate change challenge could be debated for years to come, until long after catastrophic events have occurred and tipping points have been reached and exceeded. Solutions exist, we just need to identify what course of action will put us on a path to a low carbon future, where social injustices, water conflicts, fish stocks exploitation and environmental inequalities are not the order of the day.

Quite simply put; we need to act now. Being part of the solution means that we must act immediately, urgently, sustainably and collaboratively. The scenarios for a failed outcome are extremely bleak, whilst the path to success is paved with benefits (and some hard work!).

A paper such as this has no value, unless it encourages and results in activities which reduce greenhouse gas emissions and influence the decisions which encourage climate-friendly practices. An added benefit would be the adoption of strategies to address the impacts of climate change with businesses across South Africa, so that when the predicted changes and impacts occur, we will be well prepared and losses, damages and financial and human costs will be greatly reduced.

7.2.1 GCX Five Stage Approach to Adaptation

To encourage movement towards action, the diagram and explanation below, provides some guidance as to where to begin the journey towards a future where climate change impacts are managed, damages are reduced and greenhouse gas emissions are curbed.



Figure 37: GCX Five Stage Approach to Climate Adaptation.
© GCX, 2009

- 1. Ensure Climate Change is given priority at a Board level (without high-level buy-in all actions will be mostly unsustainable and ineffective):**
 - a. Appoint a person responsible for climate change issues to the Board. This should not be seen as an additional role but a role in its own right.
 - b. Establish a climate change team below this person to act on climate change.
 - c. Ensure this team is properly resourced.

- 2. Carbon Accounting**
 - a. Measure your own impact through a Carbon Footprint analysis of your company.
 - b. This is the first step towards understanding your impact on global warming as a company.

- c. This enables four important functions:
 - i. Understanding the major sources of GHG emissions associated with your business.
 - ii. The ability to work towards reducing these emissions through the development and implementation of a carbon management action plan.
 - iii. Using the whole process to raise awareness of staff and customers alike.
 - iv. Disclosure of GHG emissions is made possible.
- d. Develop and build capacity within your organisation:
 - i. Train staff in carbon-related issues.
 - ii. Increase awareness and understanding of the reasons for curbing carbon and addressing the potential impacts.
 - iii. Optimise your carbon accounting systems.

3. Conduct a Risk and Vulnerability Assessment

- a. Undertake a risk and vulnerability (R&V) assessment of your company.
- b. Based on the outcomes from the R&V assessments develop a risk profile for the company.
- c. Conduct scenario planning related to climate / weather events.

4. Implement risk reduction strategies across all aspects of the company

- a. Encourage innovation to reduce vulnerability.
- b. Increase levels of safety wherever possible.
- c. Encourage risk reduction strategies in your business, supply chain and with customers alike.
- d. Manage your risk through your own initiatives as well as by creating a network of suppliers and customers with low-risk profiles.

5. Incorporate climate change into all business decisions and strategies

- a. Ensure levels of awareness are sufficient at the decision-making level.
- b. Information about climate change should permeate the organisation to encourage any measures put in place to be applied and adhered to.
- c. All strategies should be "climate-proofed" where appropriate.
- d. Address and engage with local and international policies and regulations concerning climate change.
- e. Aim for leadership in the sector through all of the above.

"Non-climate issues and trends, for example changes in markets, demographics, overexploitation and governance regimes, are likely to have a greater effect on fisheries in the short term than climate change."

Technical Paper, FAO, 2009.

8. GCX Resources Available

The very notion of risk is problematic. In scientific terms risk is an objective, mathematically calculated probability “that is defined and rendered meaningful . . . at the level of a population.” In contrast, in non-scientific parlance risk is a highly emotional notion linked to “anxiety about the future, fear or danger” and “is threatening on a personal level”.

Linell, P et al, 2002.

Below is a range of products and services offered by Global Carbon Exchange (GCX). For more information on our services and company please visit us online at:

www.globalcarbonexchange.com

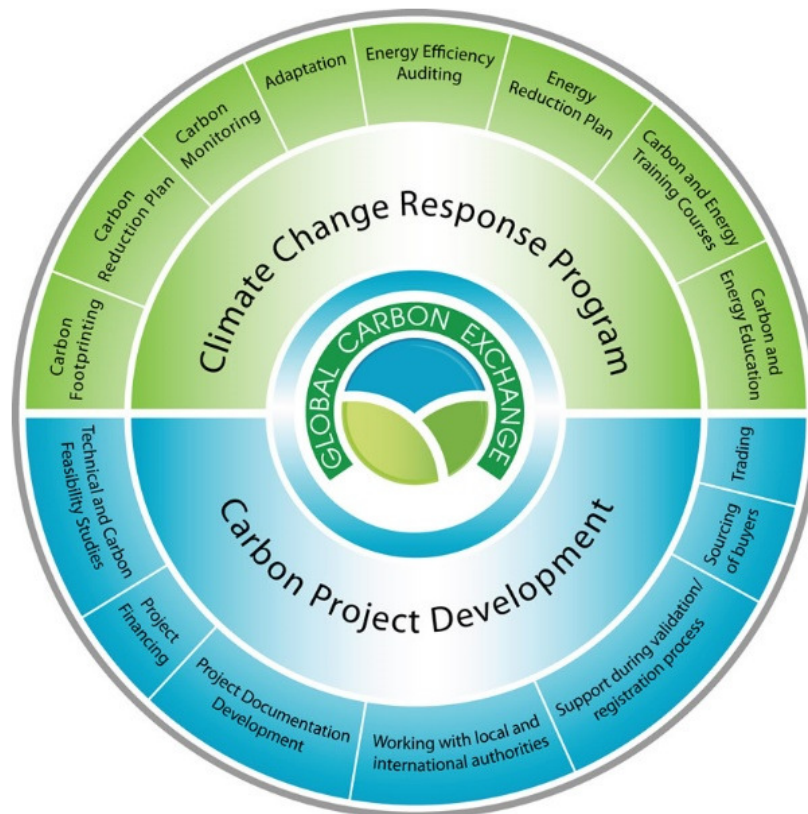


Figure 38: GCX Products and Services.
© GCX, 2009

“Failure to take climate change into account will put companies at risk from future legal actions from their own shareholders, their investors and clients.”

Lloyd’s, Climate Change: Adapt or Bust

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“Climate change is a fact. Countering it is a must. We are convinced that climate protection makes economic sense, as it would be more expensive in the long term to pay for the damage it causes. It offers companies and national economies that react quickly great opportunities ...” (MEAG 2008)

Peter Hoeppe, Munich Re

Glossary

CDM:	Clean Development Mechanism
CER:	Certified Emissions Reduction
CO ₂ :	Carbon dioxide
ESG:	Environmental, social and governance
FAO:	Food and Agriculture Organisation (FAO) of the United Nations
GCX:	Global Carbon Exchange
GHG:	Greenhouse gases
IPCC:	Intergovernmental Panel on Climate Change
IUCN:	International Union for Conservation of Nature
RSA:	Republic of South Africa
UK:	United Kingdom
UNEP:	United Nations Environment Programme
UNESCO:	United Nations Educational Scientific and Cultural Organisation
UNFCCC:	United Nations Framework Convention on Climate Change
VER:	Voluntary Emissions Reduction
WCMC:	World Conservation Monitoring Centre

“Markets that respond to climate information will stimulate adaptation among individuals and firms.”

Stern Review, 2006.

Disclaimer

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