

Influence of climate change, the activity of fishermen and the qualitative yield of their fishing: Case of the port of Kenitra (Morocco)

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Abstract

The port of Mahdia and its fishing region is of local and national importance for fishing and the marketing of seafood. However, for more than a decade fishermen have felt that the quantity and quality of the seafood. Sin product has degraded. This degradation affected fish, molluscs and crustaceans. Likewise, the biodiversity of their fishing areas has been disturbed by the disappearance, appearance or modification of the appearance of the frequency of certain areas. Thus, the structure of the fishing stand seems to be disturbed. The size of some species caught has reduced, and for other species, the geographic range or depth of fishing is no longer 100/100% the same. For the causes of these disturbances, they could be one of the consequences of the excessive exploitation of fishing, which is known for its destructive effect on the population of fish, crustaceans or molluscs, and of degradation of the world stock of fishery products. . However, the cause which better explains this phenomenon of change of the environment, described by the answers to the questions asked to the fishermen, is the phenomenon of "climate change". Indeed, many of these changes in the biotic and abiotic environment of the marine area studied are internationally known to be the direct or indirect result of global warming of the environment.

I. INTRODUCTION

For the past fifty years, the climate has warmed at a very unusual rate. The increased concentrations of greenhouse gases in the atmosphere and solar emissions are blamed[1]. Note that at present, the consequences of climate change are not fully known even if we know that they are numerous and diverse and have influences on various vital activities, in particular the inertia of the ecological systems of the earth, weather, glacier cracks, stability of the ozone layer, biodiversity, economy, conflicts, population migration, health, etc. [2, 3]. However, the rise in temperatures, the main sign of global warming, is often taken as linked to the increase in the concentration of greenhouse gases [4]. This virtual

certainty, assessed by the IPCC on the The basis of the scientific literature is not deduced from a temporal correlation between these two observations but from a scientific understanding of the mechanisms of the greenhouse effect. In Morocco, studies carried out by researchers from the ETH report various projections relating to the impact of climate change on the Haouz, Moulouya, and Ziz Hriiss basins. Respecting the universal MAGICC and SCENGEN methodologies, these studies predict, over time, an average temperature increase of 2.2 ° C and a decrease in precipitation of 16% [5]. However, neither the conception of the phenomenon known as "climate change" nor the consequences of this change have been sufficiently estimated.

In addition, the results of many researchers indicate that the rise in sea level could be faster than what is announced by some authors (Robert et al., 2016) and that its rise will continue well after the 21st century, even if we manage to limit the rise in temperatures to 2 ° C, the objective announced in the COP21 agreement[6]. Thus, a long-term rise of several meters in sea level is practically already "written" with consequences that our descendants will have to manage. The assessment of the consequences of climate change on the marine environment and related activities can be studied.

Thus, through this work, we are helping to determine the influence of climate change on

one of the main human activities, the quantitative and qualitative performance of which depends on the characteristics of the environment: sea fishing.

II. MATERIAL AND METHODS Study site

It is located in the Rabat Salé Kenitra region and has a vocation for fishing and commerce. It takes place on the south bank of the mouth of Oued Sebou at position (34 ° 16 ' , 04 '' N; 006 ° 39', 46 '' W).



Figure 1: Location of the Mehdia port

Study methodology

These are the results of a survey of people working as fishermen. The survey method is based on filling in a questionnaire which took into account certain numbers of parameters, in particular certain characteristics relating to the fisherman (age, place of birth, school level, the function performed in the fishing

operation,...), the nature of the fishing carried out by the boat, the quantity and quality of their fishing collections, etc.

The sample questioned is made up of 80 people met at random after the return of the fishing boats and who agreed to answer the questionnaire;

Constraints: Moderately only 35% of the people who offered the questionnaire agreed to answer the questionnaire. The most common reason for this refusal is the state of fatigue of the people after returning from their fishing activity.

III. ESULTS AND DISCUSSION

1-Results

The results of the responses to the questions attributed to the respondents are grouped in Table 1.

Table 1: questions given to the people surveyed and answers of these people to the questions.

Theme	Fisherman's response	Percentage (%)
Boat type of fishing boat:	Small boat	32.61
	Sardine	34.78
	Fishing rod	32.61
Fisherman age	20 to 30 years	19.57
	31 to 45 years	34.78
	Over 45 years	45.65
Fisherman's birthplace	Chlihat (at 2 km)	13.04
	Kenitra (at 2Km)	6.52
	Larache (at 110 km)	8.70
	Mehdia (at 0 Km)	56.52
	Oueled Berjal (at 10 Km)	8.70
	Sidi Tayebi (at 12 km)	6.52
Function of the sinner	Sailor	71.74
	Fishing boss	28.26
School level of the sinner	Primary	45.65
	Secondary	50.00
	High school	4.35
Feel there is a sea change in your fishing area	Yes	21.74
	No	78.26
Feel that there is a general climate change in the region	Yes	86.96
	No	13.04
Feel that there is a warming of the climate	Yes	80.43
	No	19.57
Is there a change in the list of caught fish species	Yes	89.13
	No	10.87
Since when did you notice that there is a change	For 15 years	45.65
	For 10 years	26.09
	For 5 years	28.26
Do you think there is a change in the specific structure of the seafood caught?	Yes	84.78
	No	15.22
Is there a reduction in the size of the fish caught.	Yes	91.30
	No	8.70
Y'a-t-il réduction de la quantité des poissons pêchés.	Yes	76.09
	No	23.91
Does this change affect the Whiting	Yes	58.70
	Non	41.30
Does this change affect the Whiting the Dorade	Yes	60.87
	No	39.13
Does this change affect the Sole	Yes	80.87
	No	39.13
	Yes	65.22

Does this change affect the specific structure of the cephalopods collected	No	34.78
Does this change affect the quality of the cephalopods collected	Yes	80.43
	No	19.57
Does this change affect the amount of cephalopods	Yes	76.09
	No	23.91
Does this change affect the specific structure of crustaceans	Yes	47.83
	No	13.04
	No remarks	39.13
Does this change affect the size of crustaceans	Yes	86.96
	No	
	No remarks	2.13
Does this change affect the quantity of crustaceans the quantity	Yes	82.61
	No	2.17
	No remarks	15.22
Does this change affect the color of crustaceans	Yes	73.91
	No	8.70
	No remarks	17.39
Are there any species of fish missing from your collection	Ye	60.87
	No	39.13
Are there any new fish species appearing in your collection	Yes	89.13
	No	10.87
Are there any new species of seabirds emerging in your area	Yes	84.78
	No	15.22
Are there other types of algae	Yes	65.22
	No	34.78
Is there a change in frequency in the presence of jellyfish in your fishing grounds	Yes	60.87
	No	39.13
Is there a change in fishing depth for certain species of fish	Same depth	32.61
	Not at the same depth	67.39
Are there changes in the fishing seasons for certain species of fish?	Yes	65.22
	No	34.78
Does this change of fishing seasons concern white fish?	Yes	30.43
	No	69.57
Does this change of fishing seasons concern cephalopods?	Yes	43.48
	No	56.52

Nature of the fishing boat:

For their fishing, 32.61% of fishermen use boats, 32.61% sardine boats and 34.78% fishing channels. Statistically, we can conclude that the fishermen of Mehdia share equally the available means of fishing and that in Mehdia, the structure of the means of fishing is dominated by boats and sardine boats.

Mehdia fishing therefore depends a lot on artisanal fishing.

Age of fishermen:

For the age of the fishermen, roughly half of these fishermen are aged 46 or over, 34.78% are aged between 31 and 45, and this is the youngest fraction of the fishermen (20 and 30 years old).) which is the least

important (19.57%). Given the risks of this profession, it is logical that the share of young people should be greater than the results represent. It therefore seems that fishing as a profession is no longer of interest to young people.

Place of birth of fishermen:

Regarding, the place of birth, it is Mehdiya and Chlihat (geographical areas neighboring the fishing area) which, with 56.52% and 13.4% respectively, which represents 70% of the place of birth of seafarers working in the port of Mehdiya. The other places of birth are not very far from the port and present only low frequencies despite the national importance in the fish trade of the Mehdiya market hall, this site therefore

Nature of function:

Concerning the function of these fishermen, about three quarters (71.74%) of fishermen are sailors, the bosses only constitute 28.26%; however, this number of bosses remains high compared to the number of people in activity. This reflects that in Mehdiya small-team fishing is frequent and requires it to be more organized into larger fishing units.

School level :

As the results show, 50% of fishermen have a "secondary" level and 45.56 a "primary" level, ie 95.65% of the workforce of those active in fishing. The educational level of these people does not favor the acquisition of more sophisticated fishing means and techniques.

Observation on changes in the state of the sea:

Regarding the change in the state of the sea (increase in pollution visible to the naked eye, increase in water turbidity, etc.), more than three quarters of sailors (78.26%) noted a change.

Observed Climate Change:

Regarding the prevailing climate change, almost 90% of seafarers noticed a change in the general climate of the sea area of their fishing and 80.43% felt an increase in water temperature.

Degradation of the quality and quantity of seafood caught:

Concerning the seafood since 89.13% of the people surveyed noted a qualitative and quantitative change 28.26% of the people surveyed felt this change for 15 years; 45.65% for 10 years, and 26.09% for 5 years.

Pelagic species change: (specific structure, size, and quantity of these species):

Regarding pelagic fish, 84.78% of sailors believe that this change affects sardines and mackerel. In addition, 91.30% believe that this change affects the size of pelagic fish caught, 76.09% of sailors believe that this change is manifested by a reduction in the amount caught.

Change in white fish: Whiting, Dorade, Sole (the structure, quality and quantity of these species)

For "white fish" (whiting, sea bream, sole), 58.70% of respondents suggested the existence of a change in the quality and quantity caught. In fact, 60.87% of these people believe that there is a reduction in the size and quantity of the fish caught.

Change in Crustaceans (specific structure, size, quantity and color).

For Crustaceans, about half of Mehdiya sailors (47.83%) noted that there is a change in the quality and quantity caught compared to 39.13% of sailors who did not. However, 86.96% of people who believe in a change believe that there is a reduction in the size of the shellfish caught, 73.91% believe that there is a reduction in the amount caught and 73.91% think that there is color change of the caught fruit.

Observation on the disappearance or appearance of some species of fish:

For the change in the specific structure of the fish caught in Mehdiya, 60.87% of the sailors believe that there is disappearance of some species and 10.87% noted that there is the appearance of new species.

Appearance of other species of seabirds, algae and jellyfish:

Regarding other changes in the Mehdiya area, 15.22% of sailors noted the presence of new species of birds, 65.22% noted an increase in the amount of algae caught by their net, 60, 87% noted the increased frequency of appearance of jellyfish.

Observation on the depth and the change of fishing seasons for pelagics (white fish and cephalopods):

The results show that 67.39% believe that the depth suitable for fishing for certain species of fish is no longer the same, and 65.22% believe that there is a change in the fishing season of certain species, of which 30.43% estimate that there is a change of season for white fish and 43.48% believe that there is a change of fishing seasons for cephalopods.

2. Discussion

According to the observations of those surveyed on changes in the state of the sea, more than three quarters of sailors (78.26%) reported that there are changes in the state of the sea (increase in visible pollution with the naked eye, increased water turbidity, etc.), 90% of sailors noticed a change. 80.43% noticed a change in the frequency, speed and direction of the wind, and in the increase in water temperature. It should also be noted that 89.13% of those questioned felt an increase in the salinity of the water. Such changes in marine conditions under the effects of climate change have

been noted in several hydroecosystems around the world[7].

For the quantitative and qualitative change on the species caught, 89.13% of the respondents noted a change and 28.26% among them have felt this change for 15 years; 45.65% for 10 years, and 26.09% for 5 years. For pelagic fish, 84.78% of sailors believe that this change affects sardines and mackerel. This finding is in agreement with that of Pecl et al (2017), who indicated that climate change causes a geographic redistribution of plant and animal species on a global scale[2]. In addition, 93.30% believe that this change affects the size of pelagic fish caught, 76.09% of sailors believe that this change is manifested by a reduction in the quantity caught, 91.30% noted the reduction of the quantity pelagic products caught and 58.70% of respondents a reduction in the quantity of white fish. In agreement with this finding [8]. reported that several causal factors in determining the size of pelagic fauna species are climatic.

For Cephalopods, the results show that 65.22% of Mehdiya sailors believe that there is a qualitative and quantitative change in the size of the fruit and 76.09% of these people suggest that smaller cephalopods have smaller sizes. This result confirms the effect of environmental conditions under the effect of climate change on fish size. Thus, Last et al. (2011) reported that observational and experimental data highlighted deep-rooted links between fish size and environmental conditions that may result in additional interannual changes in these indicators[8]. This conclusion is confirmed by the fact that 80.03% of people who believe that there is a change, propose that there is a reduction in the amount of cephalopods caught.

For Crustaceans, 47.83% of sailors note that there is a change in the quality and quantity caught against 39.13% do not think so. In addition, 86.96% of people

who believe in a change believe that there is a reduction in the size of the shellfish caught, 73.91% believe that there is a reduction in the amount caught, and 73.91% think that there is a reduction in the size of the shellfish caught. there is a change in color of the sinful fruit. Note that climate change will reshape marine ecosystems during the 21st century through diverse and complex mechanisms that are difficult to quantitatively assess [9].

For the disappearance or rarefaction of some species, 60.87% of seafarers believe that there is the disappearance of certain species and 10.87% note that there is the appearance of new species. Likewise, sailors have noted the appearance or disappearance of certain species of algae and birds. Or Cnidarians (Jellyfish). The same result has been noted in other regions of the world [2].

Other aspects of changes were reported by sailors such as change in fishing depth (67.39%), fishing season (65.22%). Note that the distributions of exploited and unexploited North Sea fish have responded markedly to recent increases in sea temperature, with nearly two-thirds of species changing in latitude or average depth or both in 25 years [10].

For the change in the geographic distribution of poisons under the effect of climate change as a potential change in the distribution of subsistence fish species due to climate change[11]. In addition, as for many marine areas in the world, it should be noted that excessive fishing (legal or illegal) or destructive fishing, practiced by humans on certain fish, crustaceans or molluscs actively participates in the degradation of the global stock of products. some fishing. Overfishing is therefore another factor other than climate change which has negative consequences on the marine environment.

IV. CONCLUSION

The port of Mahdia and its fishing region is of local and national importance for fishing and the marketing of seafood. However, for more than a decade fishermen have felt that the quantity and quality of the seafood. sin product has degraded. This degradation affected fish, molluscs and crustaceans. Likewise, the biodiversity of their fishing areas has been disturbed by the disappearance, appearance or modification of the appearance of the frequency of certain areas. Thus, the structure of the fishing stand seems to be disturbed. The size of some species caught has reduced, and for other species, the geographic range or depth of fishing is no longer 100/100% the same. For the causes of these disturbances, they could be one of the consequences of the excessive exploitation of fishing, which is known for its destructive effect on the population of fish, crustaceans or molluscs, and of degradation of the world stock of fishery products. . However, the cause which better explains this phenomenon of change of the environment, described by the answers to the questions asked to the fishermen, is the phenomenon of "climate change". Indeed, many of these changes in the biotic and abiotic environment of the marine area studied are internationally known to be the direct or indirect result of global warming of the environment.

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