



## International Council for the Exploration of the Sea

## Conseil International pour l'Exploration de la Mer

You are receiving this survey as part of the ICES workshop on pathways to climate-aware advice (WKCLIMAD). This workshop is exploring how the short-, medium-, and long-term impacts of climate change on aquaculture, fisheries, and ecosystems can be accounted for in ICES advice.

ICES has identified you or your organization, or you have nominated yourself as a stakeholder or knowledge holder in the fields of climate, fisheries, or aquaculture.

Information gathered via this questionnaire is subject to the ICES data privacy statement.

The information provided by you will be used to assist ICES to outline actionable strategies and approaches that can be taken to promote resiliency in fisheries, aquaculture, and ecosystems. This information will be published online and made available to the public. Data will be aggregated so you will not be identifiable; in the event direct quotes are used, these will be identified by an alias/pseudonym.

You may withdraw from the research at any time, without the need to explain, without penalty, and your personal data will be immediately deleted. Anonymized research data will be archived by ICES. All personal data will be deleted 5 years after the WKCLIMAD report is published.

By responding to this survey you acknowledge and consent to your personal data being used as described above.

We expect this survey to take 3 hours to complete. You may save the form and come back to it later using the SAVE button at the bottom. An email will be sent to you with a link that you can use to work on it later.

Email	
example@example.com	
Name	
First Name	Last Name

## Fisheries impacts due to Climate Change

Aquaculture and fisheries are captured on separate forms. These impacts on aquatic organisms and the aquaculture or fisheries system are based on the examples provided from the previous round of homework for WKCLIMAD. Using your expert judgement, please rate for each impact the likelihood (1 -none to 10 extremely likely) and magnitude (from 1 -zero to 10 -extreme). Also indicate in the confidence column your confidence in your rating. Further information on each impact can be found in the spreadsheet that contains all the submissions, some with examples. Note many of the impacts are overlapping, causally related, or a subset of others. However, each contains a specific context and link to potential advice and most have some published evidence on their impact. Also some will be direct impacts and others indirect impacts. Please consider both direct and indirect impacts in your ratings. We will discuss the distinction and consequences of direct and indirect impacts at the workshop proper. Impacts may have negative and/or positive magnitudes (beneficial or harmful). These will vary depending on the specific circumstances of those being impacted (e.g. range shifts, changes in market access). So please rate magnitude by the strength of the impact, not by positive or negative. E.g. for a very beneficial impact, requiring a rating of highest positive magnitude, please rate 10. Likewise for a very harmful impact, requiring a rating of highest negative magnitude, please also rate 10. However please do provide some separation in levels so not everything is rated 10. The positive and negative aspects of impacts will be further explored during the upcoming

workshop. The issue of who benefits. who is harmed, monitoring and management

measures will also be explored at the workshop. The mechanisms for the impacts include and are combinations of temperature, salinity, O2, acidification, ice cover,

floods, storms, other extreme events and ocean circulation patterns. These can impact in any part of the fisheries and aquaculture socio-ecological system (ecology, fisheries, agronomy, markets, consumption, governance). There are three sheets for likelihood and three for magnitude. These are for 3 timeframes: short (2021-2040), medium (2041-2060) and long term (2061-2100). NOTE: you must rate all impacts. If the impact is out of your area of expertise or you do not know then indicate low confidence in your answer for those impacts. There is space for further comment at the end of the survey and at the end of each row. You may save the form and come back to it later using the SAVE button at the bottom. An email will be sent to you with a link that you can use to work on the rest later.

Please rate on a scale from 1 (unlikely) to 10 (highly likely), the LIKELIHOOD that each of the impacts listed in the first column will occur over the time period from 2021 until 2040, and indicate your confidence in the estimate. \*

	1	2	3	4	5	6	7	8	9	10	Confidence	Other Thoughts
Change in markets and market access											~	
Changes in mortality of fish											~	
Change in food web dynamics											~	
Changes to connectivity of early life stages											~	
Changes to spawning habitats											~	
Change in interaction with other marine sectors											~	
Changes in distribution of protected species	0	0	0	0	0	0	0	0	0		~	
Ohannaa in												

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fecundity of fish										~	
Changes in behaviour of fish	0									~	
Change in disease and parasites										~	
Changes in distribution of invasive species										~	
Changes in recruitment of fish			0							~	
Changes in growth of fish										~	
Change in susceptibility to disease and pathogens										\ \ 	
Changes in phenology of fish life stages										~	
Change in ecosystem 1° and 2° productivity										~	
Change in damage to fishing gear rate										~	
Changes in processing opportunities										<b>~</b>	
Changes to nursery habitats										~	
Change in pollutants										~	
Changes in distribution jellyfish and salps										~	
Changes in overall stock productivity										~	
Changes in migration routes										~	
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Change in seafood quality for human consumption						~
Change in harmful algal blooms (HABs)						~
Change in fishing opportunities						~
Change in fisheries management measures						~
Changes in range and distribution						~

Please rate on a scale from 1 (unlikely) to 10 (highly likely), the LIKELIHOOD that each of the impacts listed in the first column will occur over the time period from 2041-2060, and indicate your confidence in the estimate. \*

	1	2	3	4	5	6	7	8	9	10	Confidence	Other Thoughts
Change in pollutants											~	
Changes in recruitment of fish	0										~	
Change in interaction with other marine sectors			0	0							~	
Changes in processing opportunities											~	
Change in markets and market access	0		0		0	0	0				~	
Changes in growth of fish	0										~	
Change in seafood quality for human consumption											~	
Changes in range and distribution											~	

Change in disease and parasites						~	
Changes to connectivity of early life stages						~	
Changes to spawning habitats						~	
Changes in mortality of fish						~	
Changes in phenology of fish life stages						~	
Change in harmful algal blooms (HABs)						~	
Changes in distribution of protected species						~	
Change in ecosystem 1° and 2° productivity						~	
Changes in behaviour of fish						~	
Change in fishing opportunities						~	
Change in food web dynamics						~	
Change in damage to fishing gear rate						~	
Changes in migration routes						~	
Change in susceptibility to disease and pathogens						~	
Changes to nursery habitats						~	
Change in fisheries							

management measures								•	
Changes in overall stock productivity	0							~	
Changes in distribution of invasive species								~	
Changes in distribution jellyfish and salps								~	
Changes in fecundity of fish		0	0	0			0	~	

Please rate on a scale from 1 (unlikely) to 10 (highly likely), the LIKELIHOOD that each of the impacts listed in the first column will occur over the time period from 2061-2100, and indicate your confidence in the estimate. \*

	1	2	3	4	5	6	7	8	9	10	Confidence	Other Thoughts
Change in fisheries management measures											~	
Changes in mortality of fish			0								<b>~</b>	
Changes in recruitment of fish											~	
Changes in phenology of fish life stages											~	
Change in susceptibility to disease and pathogens	0	0	0	0	0	0	0	0	0		~	
Changes in distribution of protected species											~	
Changes in migration routes	0						0			0	~	
Changes in distribution of invasive species										$\bigcirc$	~	

ilivasive species								
Changes in growth of fish	0							~
Change in interaction with other marine sectors								~
Changes in distribution jellyfish and salps								~
Changes to connectivity of early life stages								~
Changes to spawning habitats								~
Changes in range and distribution								~
Changes in overall stock productivity								~
Changes to nursery habitats								~
Change in harmful algal blooms (HABs)		0		0	0			~
Change in fishing opportunities					0		0	~
Change in food web dynamics								~
Change in markets and market access	0	0		0	0		0	~
Changes in behaviour of fish	0	0		0	0		0	~
Change in seafood quality for human consumption								~
Change in ecosystem 1° and 2° productivity								~
Changes in								~

fecundity of fish						
Change in disease and parasites						~
Change in pollutants						~
Change in damage to fishing gear rate						~
Changes in processing opportunities						~

Please rate on a scale from 1 (none) to 10 (extreme), the MAGNITUDE that each of the impacts listed in the first column will will have on the fishing industry over the time period from 2021 until 2040, and indicate your confidence in your estimate \*

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	1	2	3	4	5	6	7	8	9	10	Confidence	Other Thoughts
Changes in mortality of fish					0		0				~	
Changes in distribution jellyfish and salps											~	
Change in seafood quality for human consumption											~	
Change in harmful algal blooms (HABs)											~	
Changes to spawning habitats											~	
Changes in distribution of invasive species											~	
Changes to nursery habitats											~	
Changes in fecundity of fish											~	
Changes in overall stock productivity		0			0		0			0	~	

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Change in disease and parasites	0				0		0			~
Change in interaction with other marine sectors										~
Changes in behaviour of fish										~
Changes in migration routes										~
Changes in distribution of protected species										~
Changes in growth of fish										~
Changes in phenology of fish life stages										~
Change in ecosystem 1° and 2° productivity										~
Change in susceptibility to disease and pathogens										~
Change in food web dynamics										~
Change in pollutants										~
Change in fishing opportunities										~
Changes in processing opportunities										~
Change in markets and market access										~
Changes to connectivity of early life stages		0	0	0	0	0	0	0		~
Ohanna in										

Change in fisheries management measures						~	
Changes in recruitment of fish						~	
Changes in range and distribution						~	
Change in damage to fishing gear rate						~	

Please rate on a scale from 1 (none) to 10 (extreme), the MAGNITUDE that each of the impacts listed in the first column will will have on the fishing industry over the time period from 2041 until 2060, and indicate your confidence in your estimate \*

	1	2	3	4	5	6	7	8	9	10	Confidence	Other Thoughts
Change in ecosystem 1° and 2° productivity											~	
Changes to spawning habitats		0	0		0						~	
Changes to nursery habitats											~	
Changes in mortality of fish											~	
Changes in behaviour of fish											~	
Change in fisheries management measures											~	
Changes in range and distribution	0	0	0		0		0				~	
Changes in recruitment of fish											~	
Change in damage to fishing gear rate										0	~	
Changes in fecundity of fish											~	

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Changes in phenology of fish life stages							~	
Change in fishing opportunities						0	~	
Changes in growth of fish							~	
Changes in migration routes							~	
Changes in distribution of invasive species							~	
Changes in distribution of protected species							~	
Changes in processing opportunities							~	
Change in harmful algal blooms (HABs)							~	
Changes in overall stock productivity							~	
Change in interaction with other marine sectors							~	
Change in markets and market access						0	~	
Change in food web dynamics						0	~	
Change in pollutants							~	
Change in seafood quality for human consumption							~	
Change in disease and parasites							~	
Change in								

susceptibility to disease and pathogens						<b>~</b>	
Changes in distribution jellyfish and salps						~	
Changes to connectivity of early life stages						~	

Please rate on a scale from 1 (none) to 10 (extreme), the MAGNITUDE that each of the impacts listed in the first column will will have on the fishing industry in the time period from 2061-2100, and indicate your confidence in your estimate \*

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	1	2	3	4	5	6	7	8	9	10	Confidence	Other Thoughts
Change in seafood quality for human consumption											~	
Changes in behaviour of fish	0	0									~	
Change in susceptibility to disease and pathogens											~	
Changes in growth of fish											~	
Changes in mortality of fish	0										~	
Change in damage to fishing gear rate	0										~	
Change in fisheries management measures	0	0	0	0	0	0	0	$\bigcirc$	$\bigcirc$		~	
Change in ecosystem 1° and 2° productivity	0		0	0	0	0	0		$\bigcirc$		~	
Changes in processing opportunities										0	~	
Changes in												

34 PM			Fl	sneries	ımpacıs	aue to	Ciimate	Change	
fecundity of fish								$\bigcirc$	~
Changes to spawning habitats									~
Change in interaction with other marine sectors									~
Changes in phenology of fish life stages									~
Changes to nursery habitats									~
Changes in overall stock productivity				0					~
Change in harmful algal blooms (HABs)									~
Changes in recruitment of fish									~
Changes in range and distribution									~
Change in markets and market access									~
Changes in migration routes									~
Changes in distribution of invasive species									~
Changes to connectivity of early life stages									~
Changes in distribution jellyfish and salps									~
Change in disease and parasites									~
Changes in distribution of protected species									~

Change in food						~	
web dynamics							
Change in fishing opportunities						~	
Change in pollutants	0					~	

Please add any impacts we might have missed or make any comments below:

Type here	
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You may save the form and come back to it later using the SAVE button at the bottom. An email will be sent to you with a link that you can use to work on the rest later.