

## CCVA Report for CMM 2024-05 (Sharks)

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### Executive Summary

There are 72 species of shark found in WCPFC fisheries that are covered by the WCPF Convention and to which this CMM pertains to. However, in accordance with the prioritized list of shark species as per [2021-2030 Shark Research Plan](#), the assessment was undertaken based on information located for the key shark species set out in the research plan, as well as general information found in literature on Pacific based sharks.

The Climate Change Vulnerability Assessment (CCVA) for CMM 2024-05 (Sharks) reveals a **MEDIUM** overall climate risk rating, driven by high hazard, high exposure and a low vulnerability rating. Identified information gaps (“unknown” indicator scores) ranged between 6 and 9 across Exposure (9), Sensitivity (6) and Adaptive Capacity (7), highlighting the need for further investigation to strengthen the assessment findings.

The inherent biological characteristics of Pacific shark species in general, including high mobility, opportunistic feeding behaviours and large distributional ranges, equips them with a good level of adaptive capacity to balance their known sensitivities, reducing their overall vulnerability to low.

The existing management framework for sharks appears to be adequate in terms of maintaining healthy shark populations necessary to reduce climate risk, with best available stock health information for key Pacific shark species interacting with longline and purse seine fisheries concluding the majority of species are not overfished and not subject to overfishing (although there are exceptions). Further, the 2021-2030 Shark Research Plan demonstrates active progression towards filling known information gaps to provide greater certainty on the health status of key shark species.

Although the overall climate risk rating is low, there are significant information gaps that need attention to strengthen confidence in the overall assessment rating. Nevertheless, evidence of effective management is evident under the existing CMM arrangements with several key shark species having improved their health status from pre-2000's fishing, following implementation of strict measures such as the ban on shark finning. As better information becomes available both in terms of stock health of key shark species, non-key shark species, and climate changes in the Pacific, refined adjustments will be able to be made to the assessment to further ensure confidence that CMM 2024-05 remains fit-for purpose moving forward.

Priority actions within WCPFC's scope could include: enhanced monitoring of stock distribution and abundance patterns, strengthened data collection on Pacific sharks (key and non-key species), addressing identified CCVA information gaps, undertaking key shark species CCVAs, improved integration of climate considerations into key shark species stock assessments, and maintenance of flexible management measures that can adapt to changing conditions.

## Introduction

Conservation and Management Measure (CMM) 2024-05 relates to the conservation and management of Sharks including all species of sharks, skates, rays and chimaeras (Class Chondrichthyes) in the WCPFC Convention Area. The principal objective of this measure is to ensure the long-term conservation and sustainable use of WCPO sharks through science-based management approaches, including prohibitions (e.g., shark finning and retention of key species), bycatch and handling requirements, and reporting, research and capacity building requirements.

The current health status of key shark populations including North and South Pacific Bluefin Sharks, Silky shark, Southern hemisphere porbeagle shark, North Pacific Shortfin Mako Shark and Whale sharks are considered either not overfished or subject to overfishing, or are no longer subject to overfishing or are likely not at risk from WCPFC fisheries. However, others including the Oceanic white-tip and the Bigeye thresher shark are considered overfished and subject to overfishing, or have an unknown health status respectively.

Climate change poses various threats to Pacific sharks through direct impacts such as ocean warming, changes in ocean chemistry (e.g., ocean acidification), and altered current patterns, as well as indirect effects including shifts in prey distribution, seasonal cues, and altered ecosystem productivity. These climate-driven changes may affect the biological assumptions underlying current stock assessments and management measures.

This assessment aims to evaluate the climate change vulnerability of CMM 2024-05 using the WCPFC Climate Change Vulnerability Assessment (CCVA) Framework, providing evidence-based insights to support adaptive management and enhance the climate resilience of WCPFC's Shark conservation measure – CMM 2024-05.

## Method

The climate change vulnerability assessment for CMM 2024-05 (Sharks) was conducted using the WCPFC Climate Change Vulnerability Assessment (CCVA) Framework, an Excel based assessment tool. The assessment followed the approach and methodology outlined in the CCVA Framework guidance and information document.

Each of the four climate risk components (Hazard, Exposure, Sensitivity, and Adaptive Capacity) was evaluated using specific indicators grouped by theme. Indicators were scored using a five-point scale (High, Medium, Low, Unknown, N/A) based on available evidence.

For each indicator, supporting rationale was documented to justify scoring decisions and to identify information gaps. Where data were insufficient or uncertain, indicators were scored as "Unknown" to highlight areas requiring further research or assessment.

The assessment employed the standard five-year time horizon provided in the framework to evaluate potential climate change impacts and management responses within a policy-relevant timeframe.

## Data Sources and Approach

The assessment drew upon multiple data sources to evaluate climate vulnerability across the four risk components:

- Peer-reviewed scientific literature on shark biology, ecology, and climate change impacts
- WCPFC stock assessment reports and scientific committee documents
- Regional climate change projections and oceanographic data for the Pacific
- International scientific reports on shark responses to environmental variability
- WCPFC technical reports and meeting documents related to shark management

## Scope and Limitations

The assessment scope encompasses the high seas and EEZs of the WCPF Convention Area as described in CMM 2024-05. The five-year assessment timeframe focuses on near-term climate change impacts and management responses.

Key limitations include reliance on primarily Pacific-focused data and information sources (noting some key shark species are global in their distribution), limited spatial resolution of some climate projections, reliance on general shark information (noting there is limited information available on many species in the Pacific), and uncertainty regarding region-specific biological responses that may vary depending on the shark species across the WCPF Convention Area.

## Results

### Climate Risk Assessment

The CCVA yielded a **MEDIUM** overall climate risk rating for CMM 2024-05 (Sharks), determined by the combination of:

- **Hazard: High** (60% High indicators, 0% Medium, 40% Low)
- **Exposure: High** (38% High indicators, 37% Medium, 25% Low)
- **Sensitivity: Medium** (14% High indicators, 43% Medium, 43% Low)
- **Adaptive Capacity: High** (53% High indicators, 41% Medium, 6% Low)
- **Vulnerability: Low** (combination of Medium sensitivity and High adaptive capacity)

### Component Analysis

**Hazard (High Rating)** – The high hazard rating reflects significant levels of climate-related threats relevant to Pacific sharks. Key hazards scoring as "High" include temperature extremes, increased sea surface temperature, ocean acidification, deoxygenation, wind stress and current changes. These represent significant environmental stressors that could affect shark distribution, growth and development, feeding behaviours and reproductive success. Hazards including extreme weather events generally scored low, as a result of the predominately used pelagic shark information used to inform the assessment.

**Exposure (High Rating)** – The high exposure rating is driven by three high indicator scores associated with: 1) shark habitats (coastal, pelagic and bathyal), 2) Pacific shark populations, and 3) relevant fishing fleets. However, there was a total of nine indicators that were unable to be scored due to identified information gaps. As a result, only 8 indicators out of 17 (47%) were able to be scored to inform the exposure rating.

**Sensitivity (Medium Rating)** – The medium sensitivity rating resulted from a mixed bag of indicator scores, that included all five indicator score categories (five-point scale, refer Method section). While Pacific sharks show some sensitivity to environmental changes, their biological characteristics—including broad thermal tolerance, high mobility, and opportunistic feeding behaviour—provide resilience against the identified climate stressors. Indicators that scored high included the age at maturity of Pacific shark species (>5 years in general) and the reliance on seasonal cues for distribution (e.g., spawning aggregations) for some species.

**Adaptive Capacity (High Rating)** – The high adaptive capacity rating is driven by high indicator scores across both biological and management indicator themes. These scores suggest Pacific sharks and WCPFC are in a relatively good position to effectively respond and adapt to climate stressors as they increase over the medium term (over the next five years). The high mobility (including within the water column) of Pacific sharks, broad distribution, and opportunistic feeding behaviour provide Pacific sharks with natural adaptive capacity. Additionally, WCPFC's flexible management framework, 2021-2030 Shark Research Plan, and capacity for responsive decision-making contribute to institutional adaptive capacity. However, it must be noted that there were eight indicators (out of 24 (33%)) that were scored as "Unknown", again highlighting information gaps that require attention to strengthen overall confidence in the assessment.

## Discussion

### Interpretation of Climate Risk Assessment Results

The **MEDIUM** overall climate risk rating for Pacific sharks is driven by the low vulnerability rating resulting from a high adaptive capacity. The high adaptive capacity both biologically and through management, provides a good level of confidence that although Pacific sharks will be exposed to climate stressors, in general they will likely be able to respond well.

These assessment findings align well with recent scientific literature, however there are a clear number of identified information gaps that require attention in order to increase overall confidence in the climate risk score. Further, the biological and ecological themed indicators are based on key WCPFC shark species and general global shark information (generally pelagic species), which may require further attention to increase overall accuracy.

### Concurrence with Scientific Literature

The medium climate risk assessment is consistent (within limitations) to recent global shark scientific assessment literature. Recent scientific studies detail that although tropical, pelagic species will be subject to high levels of threat, they naturally have high biological and ecological tolerances and adaptability, enabling them to effectively reduce overall risk-rating to mid to mid-to-high ratings in the short-term with these possibly reducing over longer timeframes under different scenarios.

Studies have also shown that Pacific shark species like the North Pacific Blue Shark can readily adjust their distribution patterns in response to environmental changes, particularly temperature and prey availability shifts which naturally fluctuate. These attributes directly result in generally high adaptive capacity ratings, as reflected in scientific literature. However, it must be noted that the majority of climate assessment studies available focus on individual species, providing greater certainty through increased accuracy for these species.

### Assessment limitations and gaps

The assessment benefits from a good level of information on stock status of key shark species in the WCPFC, and a relatively rich amount of global studies related to climate change and sharks. In addition, the assessment directly identifies the WCPFC's management, research, capacity building and cooperative efforts to improve overall understanding and management of Pacific shark species, in recognition of the role they play in healthy marine ecosystem functionality. Key limitation and information gaps included:

**Spatial Resolution of Climate Impacts** – While the assessment utilized the best available information, there remains uncertainty about how climate impacts may vary spatially across the Pacific and how different shark species may be affected. Different areas within the WCPFC Convention Area may experience varying degrees of climate change impacts, potentially creating spatial heterogeneity in vulnerability that the current assessment may not fully capture.

**Species-specific Understanding** – Although the assessment drew on key WCPFC shark species information along with recent global shark assessment studies, the information used to score individual indicators was generalized based on best interpretation by the assessor of available information. As a result, the climate risk score provides a 'generalized' overview of how Pacific shark species collectively will fare in the face of climate change. However, key differences in species-specific health status and biological traits will drive climate risk potentially higher or lower for individual shark species.

**Ecosystem-Level Interactions** – The assessment focused primarily on direct impacts on key WCPFC shark species, however climate change will likely directly affect food distribution (including primary productivity some shark species rely on), which may result in broader ecosystem changes and increased levels of competition as sharks migrate poleward or encroach on other shark species habitats to hunt. These cumulative impacts are beyond the capability of the CCVA Framework to provide insights on, and bespoke research on this is considered necessary over the long-term (10 years) to more accurately understand how WCPFC marine ecosystem changes may influence shark vulnerability.

**Long-term Projections** – The five-year assessment timeframe, while appropriate for management planning, may not capture longer-term climate change impacts that could become more pronounced over decades. The general longevity of Pacific shark species (including the very long-live sleeper shark) means that some climate effects may manifest over longer time scales than the current assessment provides for.

**Member-Specific Capacity Variations** – The adaptive capacity assessment relied on general WCPFC-level information, but individual member capacity for monitoring, research, and management response varies, with clear evidence of members requiring capacity support to improve compliance found in annual compliance reporting. Some members may have greater

or lesser capacity to implement adaptive management measures, potentially affecting overall system resilience.

## Management Implications

### Maintaining Management Effectiveness

The Medium climate risk rating suggests that current management approaches are likely to remain effective under different projected climate scenarios for key WCPFC shark species. However, it is well documented that continued monitoring and strengthening of information is required to fully understand the population trends of Pacific sharks across WCPFC fisheries, and to identify suitable adaptive measures that can be taken to further strengthen the CMM to ensure long-term conservation and sustainable use of Pacific sharks.

### Addressing Data Gaps

The significant number of "Unknown" scores, particularly for exposure (53%) and adaptive capacity (29%), highlights the importance of targeted research and monitoring to reduce uncertainty. Priority areas include:

- Enhanced monitoring of environmental-biological relationships
- Improved understanding of key WCPFC shark species stock health
- Improved understanding of ecosystem considerations for sharks, including prey distribution, behaviours and competition
- Better characterization of spatial variability in climate impacts on Pacific shark species
- Assessment of member-specific adaptive capacity
- Enhanced socio-economic understanding in relation to Pacific sharks

### Strengthening Adaptive Management

While the current management framework shows high adaptive capacity, there are opportunities to further enhance climate resilience:

- Integration of environmental indicators into stock assessments
- Development of climate-informed reference points
- Enhanced early warning systems for detecting climate-related changes
- Improved coordination with other RFMOs managing shark species

### Proactive Conservation

The low vulnerability rating provides an opportunity to take proactive conservation measures that could help maintain this favourable status:

- Maintaining or continuing efforts to rebuild key WCPFC shark species towards healthy stock status to maximize population resilience to climate impacts
- Updated efforts to better understand the health status of non-key shark species, including skates and rays
- Protection of critical habitats and migration corridors

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- Minimization of other stressors that could or are known to compound climate impacts
- Greater investment in research and monitoring activities to strengthen available information

## Future Assessment Needs

Regular reassessment using the CCVA Framework will be important to track changes in vulnerability status and ensure management measures remain appropriate. Future assessments should prioritize:

- Incorporation of new climate research and projections
- Integration of ecosystem-level impact assessments
- Enhanced spatial analysis of vulnerability patterns
- Updated evaluation of adaptive capacity as management evolves
- Species-specific shark CCVAs to better understand specific management requirements and information gaps of key WCPFC shark species as identified in the [2021-2030 Shark Research Plan](#)

## Conclusions

The Climate Change Vulnerability Assessment for CMM 2024-05 (Sharks) reveals a **MEDIUM** overall climate risk, driven by high hazard and exposure ratings, offset by a low vulnerability rating. This outlook reflects the reality that Pacific sharks are under direct threat from climate change, but they have a high adaptive capacity through natural biological traits and current management and research plans to reduce the overall level of climate change risk. However, the Medium rating showcases that more work is required to both fill indicator information gaps and increase wider understanding of Pacific shark species in general (both key and non-key species) to better understand with greater certainty the level of climate risk faced. Further, individual CCVAs of individual Pacific shark species should be explored to better understand climate risk implications for both key and non-key shark species (particularly those that are currently overfished or subject to overfishing).



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