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Mangroves of the Warm Temperate Northeast Pacific

NT

Luis Valderrama-Landeros[1], Francisco Flores-de-Santiago[2], Giovanni Ávila-Flores[3], Francisco Flores-Verdugo[4], José Alberto Alcántara-Maya[1], Carlos Troche-Souza[1], Samuel Velázquez-Salazar[1], Berenice Vázquez-Balderas[1], Edgar Villeda-Chávez[1], Marlenne Manzano-Sarabia[5], Juan Ignacio Valdez-Hernández[6], Olivia Millán-Aguilar[5], Ena L. Suárez[7]

[1] *Coordinación de Geomática, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), 4903 Liga Periférico-Insurgentes Sur, 14010, Tlalpan, CDMX, México.*
[2] *Instituto de Ciencias del Mar y Limnología, Unidad Académica Procesos Oceánicos y Costeros, Universidad Nacional Autónoma de México, A.P. 70-305, Av. Universidad 3000, Ciudad Universitaria, 04510, Coyoacán, CDMX, México.*
[3] *Departamento de Ciencias Marinas y Costeras, Universidad Autónoma de Baja California Sur, Carretera al Sur Km 5.5, 23080 La Paz, B.C.S, México.*
[4] *Instituto de Ciencias del Mar y Limnología, Unidad Académica Mazatlán, Universidad Nacional Autónoma de México, Av. Joel Montes Camarena s/n, 82040, Mazatlán, SIN, México.*
[5] *Facultad de Ciencias del Mar, Universidad Autónoma de Sinaloa, Paseo Claussen s/n, 82000, Mazatlán, Sinaloa, México.*
[6] *Ciencias Forestales, Colegio de Postgraduados. campus Montecillo. Estado de México.*
[7] *International Union for Conservation of Nature IUCN, Gland*, *Switzerland.*

Abstract

Mangroves of the Warm Temperate Northeast Pacific is a regional ecosystem subgroup (level 4 unit of the IUCN Global Ecosystem Typology). It includes the marine ecoregions of the South-Californian Pacific and the Gulf of California. The mapped extent of the Warm Temperate Northeast Pacific mangrove province in 2020 was 1,810.4 km², which represents 1.5% of the global mangrove area. There are three species of true mangroves that characterize the biota: *Rhizophora mangle, Laguncularia racemosa* and *Avicennia germinans*. These mangroves all grow on a southeast-northwest latitudinal axis, from greater to lesser structural complexity due to less favourable temperature conditions and availability of freshwater with increasing distance from the tropical zone.

The main threats to the mangrove ecosystem in this region derive from changes in hydrological and sediment regimes, almost always related to the development of local infrastructure, such as canals and roads or the construction of upstream dams. Another emerging threat is the increased incidence of hurricanes in the region, which have affected large areas mainly in the last five years.

Based on our analysis, it has been estimated that the Warm Temperate Northeast Pacific mangroves have expanded their coverage by 12.46 % since 1970. Nevertheless, the net area change has been -8.5 %. If this trend persists, it is anticipated that there will be 8.2 % reduction in coverage to 2055. Based on the IPCC RCP8.5 high sea-level rise scenario, it is estimated that the Warm Temperate Northeast Pacific mangroves will experience significant submergence of approximately 26.6 %, by the year 2060. Additionally, ~3 % of the mangrove ecosystem in the province is undergoing degradation currently, and this percentage is expected to increase to 8.7 % within the next 50 years. These estimated are based on a vegetation index decay analysis. The Warm Temperate Northeast Pacific mangrove ecosystem is currently assessed as **Near Threatened (NT).**

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Corresponding authors:
Valderrama-Landeros, L. (lvalderr@conabio.gob.mx)
Suárez, E. L. (ena.suarez@iucn.org)

Keywords:
Mangroves; Red List of ecosystems; Ecosystem collapse; threats.

Ecosystem classification:
MFT1.2 Intertidal forests and shrublands
Assessment's distribution:
Warm Temperate Northeast Pacific province
Summary of the assessment

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**LC**	**LC**	**DD**	**DD**	**NE**	
Subcriterion 2	**LC**	**LC**	**NT**	**LC**	**NE**	**NT**
Subcriterion 3	**DD**	**LC**	**DD**	**DD**	**NE**	

NT: NearThreatened, LC: Least Concern, DD Data Deficient, NE: Not Evaluated

Mangroves of the Warm Temperate Northeast Pacific

NT

1. Ecosystem Classification

IUCN Global Ecosystem Typology (version 2.1, Keith *et al.* 2022):

Transitional Marine-Freshwater-Terrestrial realm

MFT1 Brackish tidal biome

MFT1.2 Intertidal forests and shrublands

MFT1.2_4_MP_11 Mangroves of the Warm Temperate Northeast Pacific

IUCN Habitats Classification Scheme (version 3.1, IUCN 2012):

1 Forest

1.7 Forest – Subtropical/tropical mangrove vegetation above high tide level *below water level*[1]

12 Marine Intertidal

12.7 Mangrove Submerged Roots

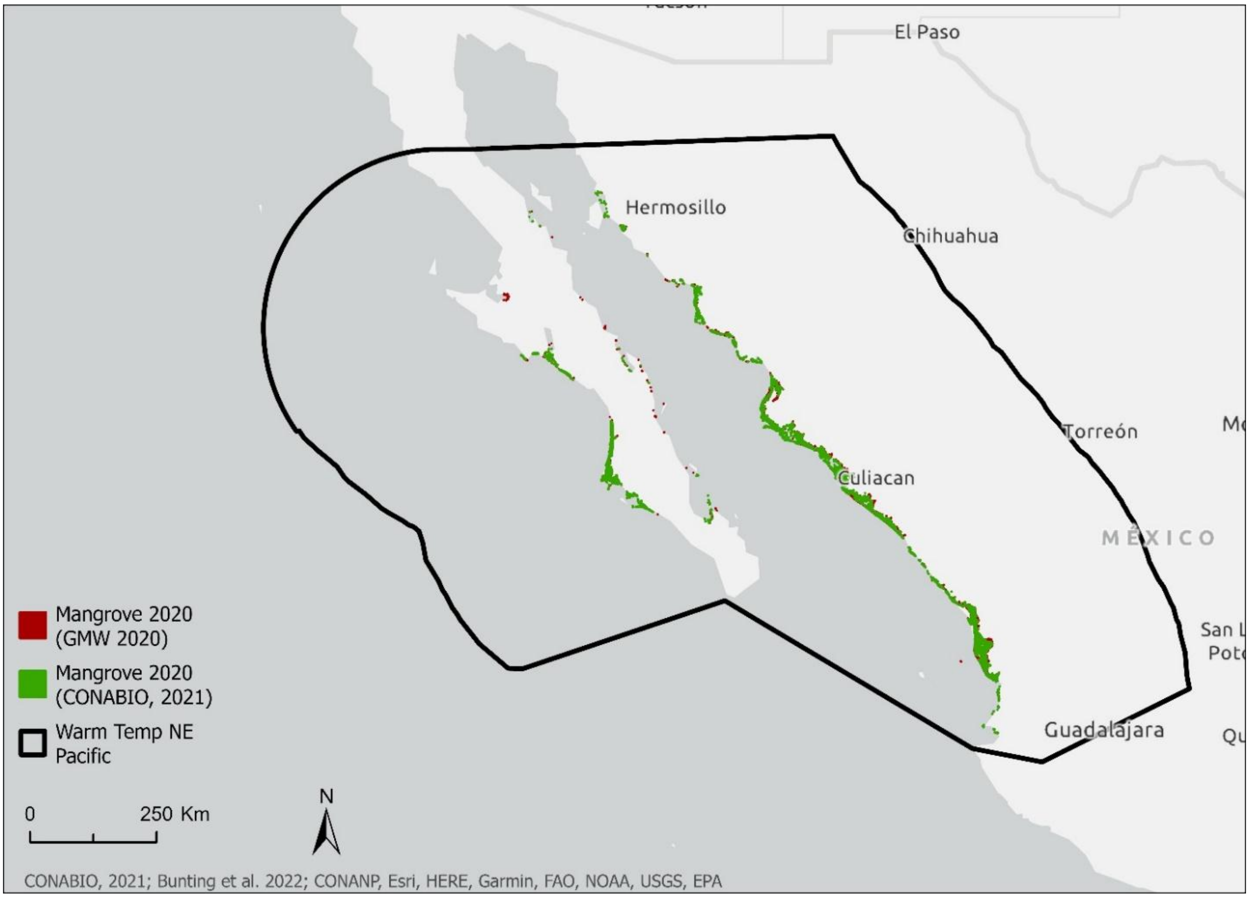

Figure 1. The mangroves of the Warm Temperate Northeast Pacific region.

[1]Note on the original classification scheme. This habitat should include mangrove vegetation below water level. Mangroves have spread into warm temperate regions to a limited extent and may occasionally occur in supratidal areas. However, the vast majority of the world's mangroves are found in tropical/subtropical intertidal areas.

2. Ecosystem Description

Spatial distribution

The mangrove ecosystem in the Wartm Temperate Northeast Pacific province. Left: An aerial view of a typical association between Rhizophora mangle s at the edge and Avicennia germinans towards the interior. Rigth A typical association between Rhizophora mangle and Laguncularia racemosa, in Magdalena Bay, Baja California Sur (Photo credits: Samuel Velázquez Salazar)

The Warm Temperate Northeast Pacific mangroves are a collection of intertidal trees and shrubs that are situated in the South-Californian Pacific and Gulf of California marine ecoregions of Mexico[2]. Although some global mangrove distribution maps (Ximenes *et al*., 2023) indicate the existence of mangroves as far north as San Diego California (*Avicennia marina*), Bardou *et al*., 2021 have clarified that these were introduced as part of an experiment in 1966 and 1969 and were eliminated in the 1990s as they were deemed to be invasive species (Mission Bay Park Natural Resource Management Plan, 1990).

The South-Californian Pacific ecoregion is situated along the west coast of the Baja California Peninsula, from 26.796°N to 24.28°N. It is characterized by estuaries that are protected by tied islands and barrier islands. The region is distinguished by the predominance of the cold California surface water current. On the other hand, the Gulf of California ecoregion is characterized by much warmer ocean waters (Rodríguez-Sobreyra *et al*., 2022), which enable mangroves to grow from 20.660803°N in the extreme north of the tropical zone to 29.35353°N in the El Sargento estuary in the state of Sonora (Velázquez-Salazar *et al*., 2021). This latitudinal limit marks the farthest natural distribution of mangroves in the Pacific Ocean basin on the American continent (Figure 1).

The Warm Temperate Northeast Pacific province exhibits a distinct geographical arrangement that enables the presence of gradients along the NW-SE latitudinal axis. The structural intricacy of mangrove patches generally diminishes towards the northern region, where mangroves occur only in small and isolated patches with individuals less than 1 m in height. In contrast, mangrove communities with larger trees reaching heights of over 20 m can be found towards the tropical zone. These communities have different strata in the canopy, depending on local environmental conditions (Valderrama-Landeros *et al*., 2022). Temperature extremes and low rainfall regimes at latitudes above the Tropic of Cancer limit mangrove development,

[2] https://www.biodiversidad.gob.mx/region/ecorregiones-marinas

while at latitudes below the Tropic of Cancer, conditions favour mangrove development. The different phenotypes shown by the mangrove species in this province demonstrate their genetic plasticity in the face of the environmental variations that are influenced by latitude.

True Mangrove Top-left: Rhizophora mangle (height 0.7 m), bottom-left: Laguncularia racemosa (0.8 m) and left-center Avicennia germinans (0.5 m) in Magdalena Bay, Baja California Sur, within the latitudinal limits of mangroves in the province. Top-right Rhizophora mangle (6 m), right center Avicennia germinans (8 m) and bottom-right Laguncularia racemosa (8 m) in Marismas Nacionales Nayarit. (Photo credits: Samuel Velázquez Salazar and Francisco Flores Verdugo

Bunting *et al*. (2022) have reported that the mangrove extent in the province reached 2247.8 km^2 in 2020, which comprises approximately 1.5 % of the global mangrove area. They have further stated that, since 1996, there has been a net change in the area of -5.5 %. In contrast, using data from the Mexican Mangrove Monitoring System (SMMM) of the National Commission for the Knowledge and Use of Biodiversity

(CONABIO), Velázquez-Salazar *et al*. (2021) have estimated the extent in 2020 at 1810.36 km^2, with a net change between 1970 and 2020 of -8.5 %. Although a formal comparison between the two maps is not available, the difference in the estimate for 2020 could be attributed to the different inputs and methods used for these two estimates. Valderrama *et al*. (2014) and Valderrama-Landeros *et al*. (2017) have documented their methodology for mapping the mangrove distribution.

Biotic components of the ecosystem (characteristic native biota)

In the Warm Temperate Northeast Pacific province, there are three species of genuine/true mangroves that have been identified: Red mangrove (*Rhizophora mangle*), White mangrove (*Laguncularia racemosa*), and Black mangrove (*Avicennia germinans*) (Flores-Verdugo *et al*., 1992; Félix-Pico *et al*., 2011; Valderrama-Landeros *et al*., 2021). Although the population trend of these species is “Declining” (Ellison *et al*., 2010), they are currently classified as Least Concern in the IUCN Red List.

It is noteworthy that *Conocarpus erectus* (Buttonwood), a mangrove associate, also occurs in this ecoregion (Ochoa-Gómez *et al*., 2021). However, this species does not satisfy the criteria to be a true mangrove as defined by Tomlinson (2016) and is not listed by other studies (e.g. Ferreira-Quadros and Zimmer, 2017; FAO, 2023). Conversely, the Mexican laws NOM-059-SEMARNAT-2010 and NOM-022-SEMARNAT-2003, do recognize *C. erectus* as a true mangrove and has classified it in the same risk category "Threatened" as the other three species (Morzaria-Luna *et al*., 2014; Ávila-Flores *et al*., 2020).

Numerous other plant species are commonly linked with mangroves. These include *Maytenus phyllanthoides*, also known as sweet mangrove, which is classified as Least Concern, as well as *Salicornia bigelovii* and *Batis maritima*. It is noteworthy that, due to this ecoregion’s position at the northernmost limit of mangrove distribution in the northern Pacific, true mangrove species may sometimes be commingled with other ecosystems such as dune vegetation (Flores-de-Santiago *et al*., 2023), marshland, or xerophytic scrub.

True mangroves with associated vegetation in Ejido San Lucas, Baja California Sur: Conocarpus erectus intermingled Rhizophora mangle and Avicennia germinans (left) and The dune ridge with mangroves in Altamura Island, Sinaloa (right). (Photo credits: Giovanni Ávila Flores and Francisco Flores Verdugo (2018))

Research along the Pacific coast, from Marismas Nacionales Nayarit to the Baja California Peninsula, has revealed low variability and limited genetic differentiation among *Avicennia germinans* and *Rhizophora mangle* populations. However, genetic variability does decrease gradually in the bordering populations, which could be attributed to recent colonization events. While the black mangrove has demonstrated recent colonization of higher latitudes through propagule dispersal, no such phenomenon has been observed in the red mangrove. Nevertheless, given the onset of climate change and temperature increase, it is possible that the red mangrove may also colonize higher latitudes in the future (Sandoval-Castro *et al*., 2014)

The mangroves of the Warm Temperate Northeast Pacific region serve as a vital habitat for a wide range of species. The National Biodiversity Information System (SNIB) database (Soberón, 2022) reveals that at least 320 species—some in the category of threatened in the IUCN Red List—are associated with these mangroves (Figure 2). Similarly, Mexican legislation, such as the NOM-059-SEMARNAT-2010, recognizes that at least 677 species that depend on mangroves are protected.

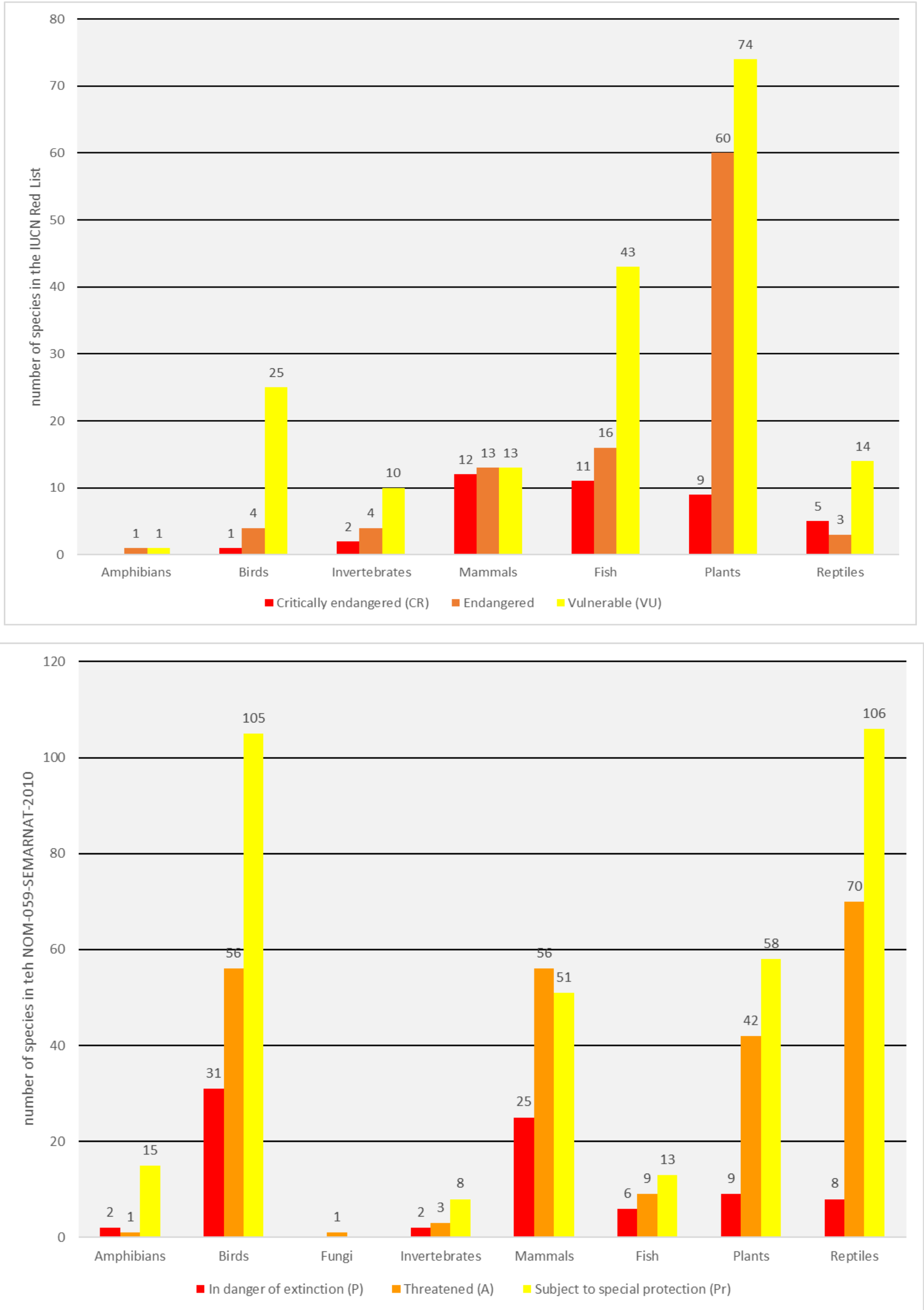

Figure 2. Number of mangrove-associated species threatened, or in need of special protection, according to the (top subfigure) IUCN Red List of Threatened Species and (bottom subfigure) NOM-059-SEMARNAT-2010.

There are varying levels of concern regarding the conservation status of several iconic species in the ecoregion. The jaguar (*Panthera onca*), for instance, is classified as Near Threatened (NT) in the IUCN Red List of Threatened Species (IUCN, 2022), while this species is considered Endangered (P) in NOM-059-SEMARNAT-2010. Similarly, the leatherback turtle (*Dermochelys coriacea)* is deemed Vulnerable (VU) by the IUCN RLTS but is classified as Endangered (P) in the NOM-059-SEMARNAT-2010. Other species of relevance due to their attractiveness associated with mangroves in this ecoregion include the green macaw (*Ara militaris*) with the categories Vulnerable (IUCN) and In danger of extinction (P) (NOM-059-SEMARNAT-2010); and the totoaba (*Totoaba macdonaldi*) with the category Critically Endangered (CR) (IUCN) and Endangered (P) (NOM-059-SEMARNAT-2010), and which is also an endemic species (CONABIO, 2023). Lastly, the Sonoran coral snake (*Micruroides euryxanthus*) is classified as Least Concern (LC) on the IUCN Red List, although it is considered Endangered (A) in the NOM-059-SEMARNAT-2010.

Bivalve species (macroinvertebrates) associated with the microenvironment provided by the roots of Rhizophora mangle. (Photo credit: José Alberto Alcántara Maya).

Crocodylus acutus (VU) in San Blas, Nayarit (Photo credit: Carlos Troche)

Abiotic Components of the Ecosystem

The mangrove ecosystems of the Warm Temperate Northeast Pacific ecoregion are impacted by a variety of abiotic factors that are highly interrelated, with climate playing a major role particularly at the northern limits of mangroves. There are two biogeographical realms divided by the Tropic of Cancer: Nearctic and Neotropical. To the north, the mangroves grow in a hot desert zone (BW, according to Köeppen's climate classification system in Mexico, modified by Garcia, 2004), which is part of the North American deserts and Tropical Dry Forest ecoregions, as per the National Institute of Statistics and Geography (INEGI), CONABIO, and the National Institute of Ecology (INE) (2007). To the south, where the climate is classified as Aw (sub-humid climate with summer rainfall), the ecoregions comprise of Tropical Dry Forest and Tropical-Humid Forest.

The northern section of the province, which encompasses the Gulf of California, is of tectonic and even volcanic origins. This area experiences an average annual rainfall ranging between 300 and 400 mm, with high rates of evapotranspiration (de la Lanza *et al*., 2013). Notwithstanding the low rainfall, tropical storms and hurricanes in the Pacific region have a significant seasonal impact here (Vizcaya-Martínez *et a*l., 2022). In fact, these atmospheric phenomena often serve as the primary source of freshwater for estuaries and coastal lagoons, which in turn, sustains the distribution of mangroves in this ecoregion.

The southern section, which is composed primarily of sedimentary formations, is characterized by a landscape that is covered largely by alluvial deposits from the Pleistocene era (de la Lanza *et al*. 2013). The presence of numerous hydroelectric dams has resulted in a decrease in the amount of sediment that flows into the mangroves from the rivers (Valderrama-Landeros and Flores de Santiago, 2019). In the summer season, this area is vulnerable to tropical storms and hurricanes, much like its northern counterpart. However, unlike the northern section, there is ample rainfall of 800 to 1500 mm annually.

The Baja California Peninsula boasts unique characteristics that distinguish it from other regions. Its mountain systems form small catchment basins that drain into the Pacific Ocean and the Gulf of California. However, these basins are unable to support large areas of deltaic deposits due to the harsh climate and limited catchment area, which limits mangrove expansion. Additionally, the cold California current that flows along the western coast poses another challenge to mangrove growth towards the north. Thus, mangroves in this region rely on the protection and more favourable conditions provided by bays, coastal lagoons, and tied islands.

Mangrove forests possess defined physiological limits for their northernmost and southernmost ranges that are determined primarily by low temperature (Stuart *et al*. 2006). However, the occurrence of freezing events has reduced due to climate change, leading to the expansion of mangrove species´ distribution in the Warm Temperate Northeast Pacific ecoregion. The average temperature ranges from 24 ºC in the northernmost part to 32 ºC in the southernmost area. The study conducted by Ochoa *et al*. (2021) found that atmospheric and sea surface temperatures increased by 0.2 to 0.3 ºC from 1988 to 2018. This trend could enable mangrove species to widen their range further towards the north.

Key processes and interactions

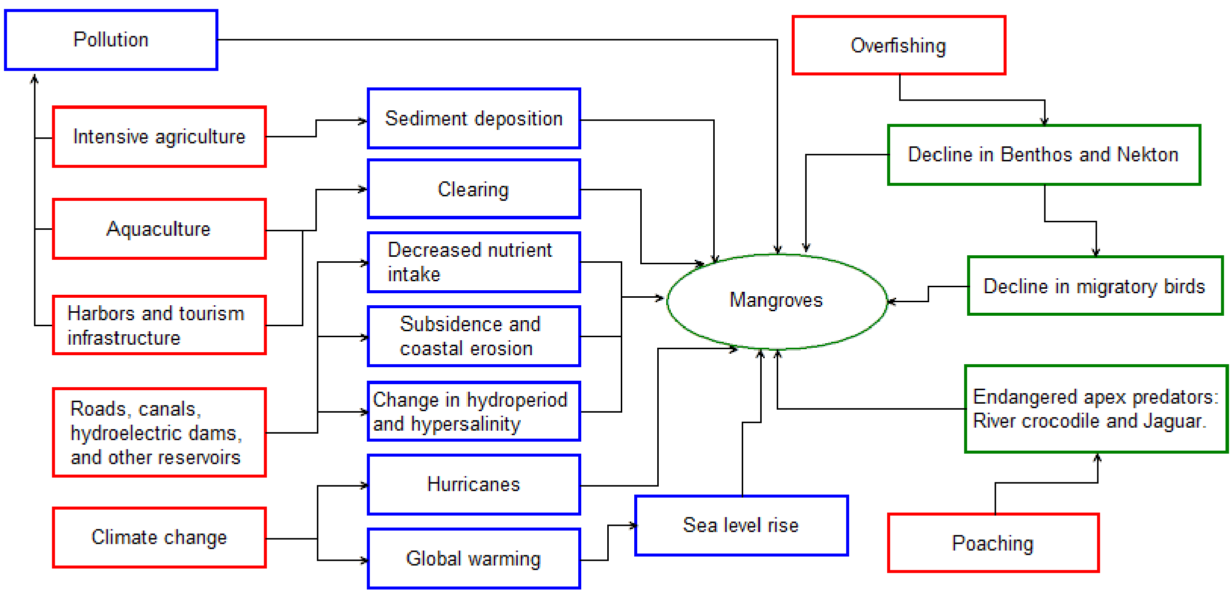

Figure 3. Conceptual model of the most relevant threats and processes (biotic and abiotic) for the risk analysis of mangroves in the WTNP region. Red boxes represent threats, blue boxes represent abiotic processes and green boxes represent biotic components.

Mangroves are vital ecosystems that serve a critical engineering function (Berke, 2010). They provide a variety of habitats for numerous species, enhance sedimentation and hydrodynamics, and mitigate disturbances, while simultaneously increasing the diversity and richness of associated species (Figure 3).

Mangrove ecosystems are of the utmost importance to local communities as they provide commercial fishery products such as fish, shrimp, crabs, and molluscs (Arreguín-Sánchez *et al*., 2017; Amezcua-Linares *et al*., 2022); timber products such as firewood and construction materials that are valuable to the local people (Valdez Hernández, 2002, 2004; Voorhies 2018); and recreational benefits such as ecotourism (Vargas-de-Río and Brenner, 2023).

Mangroves also support several key ecosystem services, such as habitat for the early juvenile development of aquatic fauna species (Muro-Torres *et al*., 2022); protection zones for terrestrial fauna species (those under special protection, or endangered) such as the American crocodile (*Crocodylus acutus*) (García-Grajales *et al*., 2021) and the jaguar (*Panthera onca*) (Figel *et al*., 2016; Núñez 2021). Mangroves also provide coastal protection against damage caused by the impact of tropical storms and hurricanes (Vizcaya-Martínez *et al*., 2022); increase carbon sequestration and storage-of blue carbon-(Torres et al., 2023); and have been shown to act as biofilters, decreasing by up to 50-63 % the concentration of inorganic nutrients (NH_4+, NO_2-, NO_3-, PO4-3) from aquaculture discharges (De-León-Herrera *et al*. 2015).

Mangrove forests and shrublands located in this ecoregion's arid and semi-arid zones, with low rainfall and high temperatures (Flores-Verdugo *et al*., 2018), exhibit relatively high primary production, despite the challenging conditions. The carbon storage varies greatly depending on the location, ranging from 54 Mg C ha^{-1} in Sonora (Torres *et al*., 2023) and 128 Mg C ha^{-1} in Marismas Nacionales (Valdés-Velarde *et al*., 2011), to 175 Mg C ha^{-1} in Baja California Sur (Ochoa-Gómez *et al*., 2019). The amount of organic matter that enters coastal lagoons and estuaries is directly proportional to the rate of primary productivity, which is determined by the aboveground biomass of the mangrove forest, as indicated by its basal area, density, and stem height (Flores-Verdugo et al., 2015; Ochoa-Gómez et al., 2018). The organic matter is remineralized into dissolved inorganic nutrients by bacteriological processes (Holguin *et al*., 2001; Benítez-Pardo *et al*., 2018), which are then assimilated by other primary producers in the water column, such as phytoplankton (Espinosa-Carreón and Escobedo-Urías, 2017). Furthermore, the organic matter from mangrove forests is exported to the coastal zone via tidal exchange (Serrano *et al*., 2020) and rivers during the rainy season (Flores-de-Santiago *et al*., 2023). These processes result in high primary production in coastal areas.

3. Ecosystem Threats and vulnerabilities

Main threatening process and pathways to degradation

The WTNP region in Mexico has the lowest levels of anthropization due to the climate and topography, especially in the Baja California Peninsula (Velázquez-Salazar *et al*. 2019). However, the coasts of the Gulf of California, particularly the eastern coast, have undergone major economic development over the past 50 years.

Intensive agriculture has had a significant adverse impact on coastal lagoons and mangroves by contributing five to 10 times more sediment than during pre-agricultural periods, primarily due to the deforestation of lowland deciduous forest (Flores-de-Santiago *et al*., 2023). In 2015, Velázquez-Salazar *et al*.

(2019) estimated that there were 491,846 ha of agriculture in a 5-km buffer zone around mangrove patches in the region, which is 27,775 ha more than in 2005. The continued siltation of mangrove forest zones causes a decrease in tidal influence, promotes an increase in interstitial salinity, and ultimately leads to a loss of fisheries and biodiversity (Flores-Verdugo *et al.*, 2018). The agricultural industry also contributes a large amount of pesticides, which greatly affects ecologically important fauna associated with coastal lagoons (García-Hernández *et al*., 2021).

Aquaculture, particularly shrimp farming, undergone substantial growth in the Gulf of California over the past 28 years, with estimations suggesting an increase of 1100 % (González-Rivas and Tapia-Silva, 2023). According to Velázquez-Salazar *et al*. (2019), the surface area of ponds has expanded by 24,727 ha, and 1,446 ha of hydraulic infrastructure, including canals and dikes, were constructed between 2005 and 2015. Regrettably, this expansion has come at the expense of mangrove forests, which are frequently supplanted by aquaculture farms (González-Rivas and Tapia-Silva, 2023). Additionally, the water discharges from aquaculture ponds contribute twice the amount of dissolved nutrients and organic matter compared to mangroves, resulting in eutrophication (Valenzuela-Sanchez *et al.*, 2021).

Hydroelectric dams have been found to have a significant adverse impact on the environment. Their construction results in the trapping of sediment from rivers, which in turn leads to beach erosion. The consequences of this can be severe, as mangroves are then exposed to direct waves and currents, causing them to suffer physical damage. The beach line of the Santiago River, for instance, has receded by one kilometre over the past four decades (Valderrama-Landeros *et al*., 2019). Moreover, dams tend to retain silts and clay, which can cause the soil to sink, leading to more flooding. In turn, this process can reduce the height of mangrove stems by as much as four metres (Flores-de-Santiago *et al*., 2017). Additionally, dams tend to retain freshwater, which tends to increase the salinity of coastal systems and decreases the hydraulic ability to maintain the mouth of estuarine systems open to the sea, mainly those with ephemeral mouths (Flores-de-Santiago *et al*., 2023). In arid zones, the lack of freshwater from rivers causes hypersaline stress conditions in mangroves, resulting in mortality and/or loss of forest structure (i.e., into scrub vegetation). Furthermore, it affects photosynthetic pigments, mainly chlorophyll a, which can decrease by 30 % in *Laguncularia racemosa* and *Avicennia germinans* and by up to 50 % in *Rhizophora mangle* (Flores-de-Santiago *et al*., 2012; Flores-de-Santiago *et al*., 2013).

Road construction activities have the potential to impede tidal water exchange, ultimately causing hydraulic fragmentation (Amezcua et al., 2019; Ávila-Flores, 2020). The consequences lead to water stagnation, which has the potential to degrade the mangrove forest. Conversely, the opening of canals causes hydrodynamic changes, both at the coastline and within coastal lagoons, which can result in severe consequences such as the total loss of the mangrove ecosystem (Valderrama-Landeros et al., 2020).

It is forecaste that the frequency of hurricanes will escalate in northwestern Mexico, which will expedite the recovery time of the forest canopy due to the wind and waves (Vizcaya-Martínez *et al*., 2022). The mangroves that are situated closest to the main flood channel will suffer degradation due to the anticipated rise in sea-level since their vertical distribution relies on the soil's microtopography. The disparity in vertical separation between *Rhizophora mangle* and *Laguncularia racemosa* is merely 40 cm, while the difference between *Laguncularia* racemosa and *Avicennia germinans* is only 30 cm (Flores-Verdugo *et al*., 2018). The regions that are most vulnerable to an escalation in the mean sea-level (MSL) are the Upper Gulf of California, Mazatlán (Sinaloa), and Los Cabos (BCS), based on regional evidence through flood scenario analysis (Díaz-Castro *et al*., 2012). Zavala-Hidalgo *et al*. (2010) have reported an MSL increase of 1.0 +2.2 mm/yr for La Paz (BCS), 1.9+3.3 mm/yr for Mazatlan, and 4.2 +1.7 mm/yr for Guaymas (Sonora). Although mangroves could adapt to these changes if they occur gradually, a rate of increase exceeding 7 mm/yr would impede their response and adaptation capacity (Saintilan *et al*. 2020).

The practice of overfishing has a profound impact on the populations of benthic and nektonic organisms, resulting in a reduction of the food source for migratory seabirds (Navedo and Fernández 2018). Illegal hunting of top predators such as the American crocodile (*Crocodylus acutus*) and the jaguar (*Panthera onca*) can cause the food chain to collapse due to a lack of natural predators in the region's mangroves (Núñez, 2021). Additionally, growth of invasive species has become a significant concern, destroying vegetation canopies and collapsing ecosystems. Ramírez-Carballo (2018) and Ramírez-García (2017), in addition to Cortés-Hernández (2017a, 2017b), have documented the effects of the vine, *Cissus verticillata*, on mangrove cover in Marismas Nacionales, Nayarit. They have identified changes in hydrological patterns, which favour low salinity conditions, as the primary cause. The increased frequency of hurricanes and tropical storms could be the reason for these changes. According to NOAA data, there has been a rise in the occurrence of these phenomena within 60 nautical miles (111 km) of *C. verticillata* in the last decade (Figure 4).

The invasive vine Cissus verticillata on the mangrove canopy in Marismas Nacionales (top-left and top-rigth), Nayarit. Canopy damage caused by the impact of hurricane Willa on Rhizophora mangle (bottom-left) and hurricane Roslyn on Laguncularia racemosa (bottom-rigth) in Marismas Nacionales (Photo credits: Francisco Flores de Santiago)

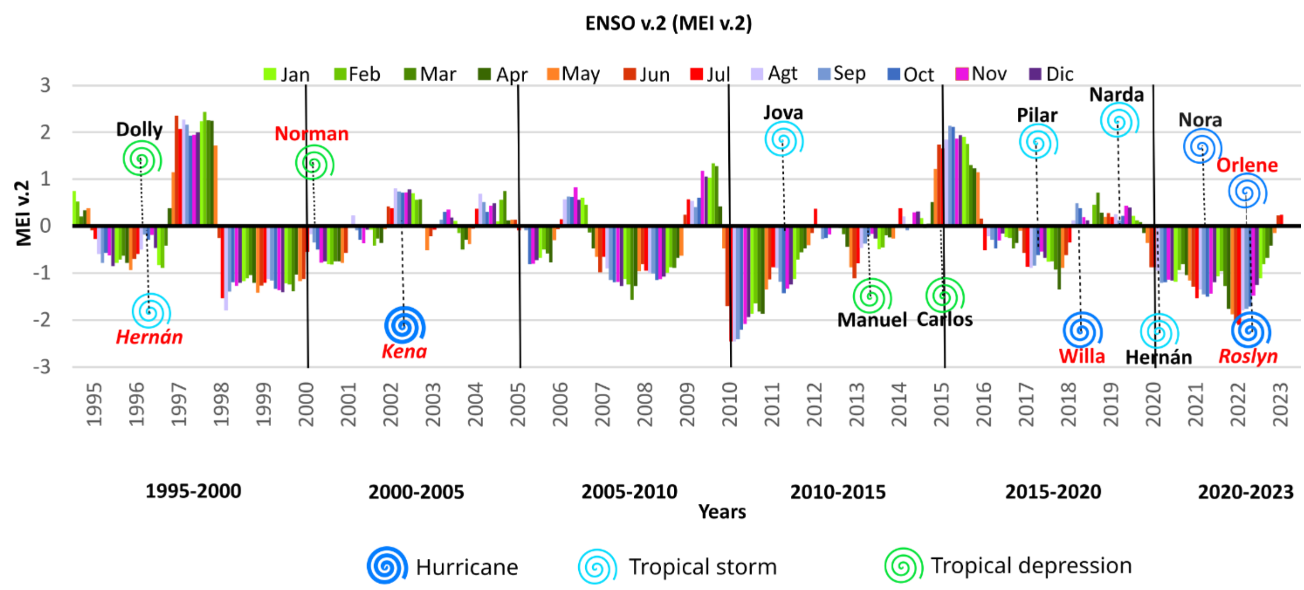

Figure 4. Time series of hydrometeorological events recorded within 60 nautical miles of Marismas Nacionales, Nayarit since 1995. In red letters are the names of those that impacted land. Graph elaborated by Luis Valderrama with data from NOAA (Historical hurricane tracks: https://coast.noaa.gov/hurricanes/#map=4/32/-80 and Multivariate ENSO Index version 2: https://psl.noaa.gov/enso/mei/).

In other areas of the province, similar events have been reported, but their documentation is inadequate and little research has been conducted on them. In Baja California, the changes in high tide levels in the El Dátil and El Cardón estuaries have been linked to the seagrass species *Zostera marina* being uprooted and deposited on the mangrove canopy, causing its collapse due to physical damage or salinization.

Elevation of water in some estuaries near Laguna San Ignacio and damage to mangroves (Photo credit: Edgar Villeda Chávez)

Finally, research by Suyadi and Manullang (2020) suggests that the increase in plastic pollution is a problem that requires more investigation, since there are indications that it adversely affects mangrove ecosystems (Bijsterveldt *et al*., 2021). The fragmentation of plastic waste into microplastics (units smaller than 5 mm), can alter soil functionality according to Jia, *et. al*. (2023) and affect microbial communities (de Souza Machado *et al*., 2019). Chai *et al*. (2023) have documented the reduction of photosynthetic activity in *Kandelia obovata* by some types of microplastics.

Definition of the collapsed state of the ecosystem

Mangroves possess specialized traits that enable them to efficiently utilize nitrogen and resorb nutrients. As structural engineers, their presence significantly influences critical processes and functions within their ecosystem. Ecosystem collapse occurs when diagnostic true mangrove species experience 100 % loss of tree cover. These ecosystems exhibit remarkable adaptability to local shifts in sediment distribution, tidal patterns, and variations in inundation and salinity gradients. However, disruptive processes can trigger changes in these dynamics, potentially leading to ecosystem collapse if: a) the survival and recruitment of diagnostic true mangroves are restricted by adverse climatic conditions such as low temperatures; b) rainfall, river inputs, waves, and tidal currents alter and erode substrata, which hinders mangrove growth and recruitment; c) changes in rainfall patterns and tidal flushing increase salinity stress and nutrient loading, which can ultimately affect the overall survival of the mangroves.

There are documented instances in the WTNP where a decrease in mangrove cover and degradation of relevant sites has led to local collapse. The Marismas Nacionales system, situated in the states of Nayarit and southern Sinaloa, boasts the largest mangrove extension in the WTNP province, accounting for 30 % of the total mangrove area in this ecoregion. Anthropogenic interventions carried out since 1976 have significantly altered the hydrological and sediment dynamics of the site (Figure 5). Among these, the opening of the Cuautla Canal, which was originally designed to be 40 m long (Blanco and Correa, 2011), was aimed at promoting shrimp fishing in the Agua Brava lagoon. Presently, the canal's narrowest part spans 550 m while its most extensive section covers 1400 m. Consequently, the tidal ebb and flow in the entire subsystem known as Teacapán-Agua Brava has undergone radical and possibly irreversible changes.

Franco (2014) and Serrano *et. al*. (2019) demonstrated that the opening of the channel has led to a rise in salinity at the El Chumbeño lagoon site, resulting in the gradual degradation and disappearance of mangroves in the area. These changes have been documented by Berlanga-Robles and Ruiz Luna (2007) and by Velazquez-Salazar *et.al*. (2021). In addition, the opening of the channel has caused the loss of 805 hectares of beach in the region over a 49-year period (1970-2019), as reported by Valderrama-Landeros *et al*. (2020). As a result, the community of Palmar de Cuautla has lost the area they previously occupied.

Five dams now obstruct the Santiago River basin: Amado Nervo in 1976, San Rafael in 1994, Aguamilpa in 1993, El Cajón in 2006 and La Yesca in 2012. According to Valderrama-Landeros and Flores-de-Santiago (2019), satellite data analysis has revealed a disconcerting increase in erosion and deterioration of coastal areas. The cause of this trend is believed to be the decrease in sedimentary deposits, which has resulted in a loss of approximately 669 hectares of beach, mangrove, and other wetlands. Unfortunately, this concerning trend of shoreline loss and coastal mangrove collapse has continued to persist to the present day, thereby warranting attention and action.

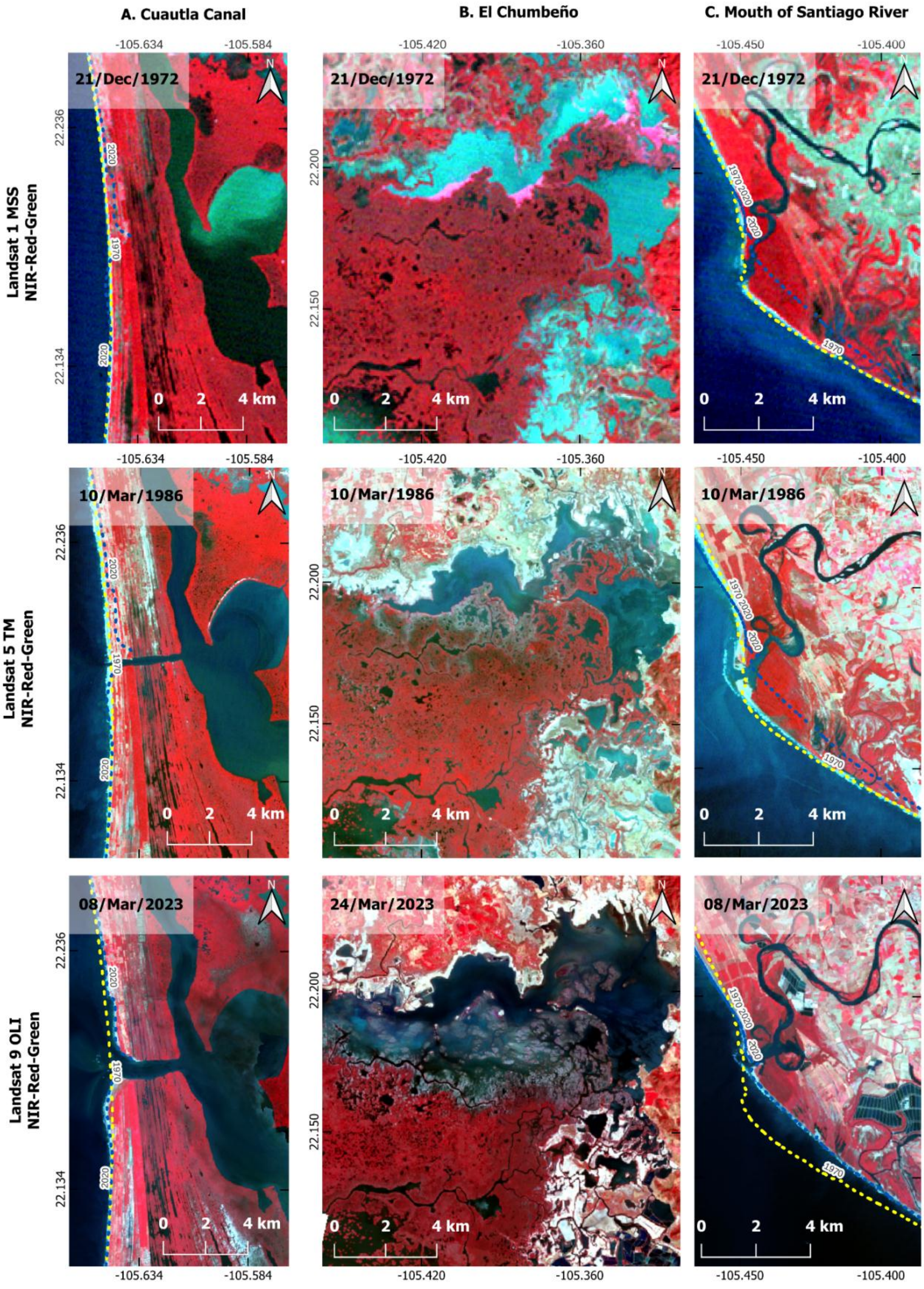

Figure 5. Landsat images showing: A) Opening and loss of mangrove cover in the Cuautla Canal. B) Degradation and loss of mangrove cover in El Chumbeño. C) Erosion and loss of mangrove cover at the mouth of the Santiago River. The dotted lines indicate the position of the coastline in 1970 and 2020.


Death of mangroves in El Chumbeño Lagoon in 2015 (left) and loss of beach and mangroves at the Santiago River mouth in 2023 (right) (Photo credits: Francisco Flores de Santiago)

Threat Classification

IUCN Threat Classification (version 3.3, IUCN-CMP, 2022) relevant to mangroves of the Warm Temperate Northeast Pacific province:

1. Residential & commercial development
- 1.1 Housing & urban areas
- 1.2 Commercial & industrial areas
- 1.3 Tourism & recreation areas

2. Agriculture & aquaculture
- 2.1 Annual & perennial non-timber crops
  - 2.1.1 Shifting agriculture
- 2.3 Livestock farming & ranching
  - 2.3.2 Small-holder grazing, ranching or farming
  - 2.3.3 Agro-industry grazing, ranching or farming
- 2.4 Marine & freshwater aquaculture
  - 2.4.1 Subsistence/artisanal aquaculture
  - 2.4.2 Industrial aquaculture

4. Transportation & service corridors
- 4.1 Roads & railroads

5. Biological resource use
  - 5.3.1 Intentional use: subsistence/small scale (species being assessed is the target [harvest]
- 5.4 Fishing & harvesting aquatic resources
  - 5.4.1 Intentional use: subsistence/small scale (species being assessed is the target)[harvest]

6. Human intrusions & disturbance
- 6.1 Recreational activities
- 6.3 Work & other activities

7. Natural system modifications
- 7.2 Dams & water management/use
  - 7.2.3 Abstraction of surface water (agricultural use)
  - 7.2.6 Abstraction of ground water (commercial use)
  - 7.2.7 Abstraction of ground water (agricultural use)
  - 7.2.10 Large dams
- 7.3 Other ecosystem modifications

8. Invasive & other problematic species, genes & diseases
- 8.1 Invasive non-native/alien species/diseases
  - 8.1.2 Named species
- 8.2 Problematic native species/diseases

- 8.2.2 Named species

9. Pollution

9.1 Domestic & urban waste water
- 9.1.1 Sewage
- 9.1.2 Run-off

9.3 Agricultural & forestry effluents
- 9.3.1 Nutrient loads
- 9.3.2 Soil erosion, sedimentation
- 9.3.3 Herbicides & pesticides

9.4 Garbage & solid waste

11. Climate change & severe weather

11.1 Habitat shifting & alteration
11.2 Droughts
11.3 Temperature extremes
11.4 Storms & flooding
11.5 Illegal logging and unauthorized wood harvesting.

4. Ecosystem Assessment

Criterion A: Reduction in Geographic Distribution

Subcriterion A1 measures the trend in the extent of the ecosystem over the last 50-year time. To assess the mangrove ecosystem of the NWTP province, we created a map of mangrove distribution using historical aerial photos from 1970 to 1987, with 81 % of photos collected from the 1970s (CONABIO, 2013a). We also utilized a series of maps elaborated every five years from 2005 to 2020 (CONABIO, 2013b; CONABIO, 2013c; CONABIO, 2016 and CONABIO, 2021). By analysing these data, we used criteria A1 (1970-2020) and A2b (2005-2055) to estimate the decrease in geographic distribution. We fitted a linear model on the available data to estimate the latter criterion.

The analysis conducted indicates that over the last 50 years (criterion A1) the mangrove distribution area in the province has decreased by 8.5 %, from 1978.95 km^2 in 1970 to 1810.36 km^2 in 2020. During this period, the rate of increase in the area of distribution was 0.25 % per year, whereas the rate of decrease is estimated to be -0.42 % per year. It is noteworthy that the loss of 8.5 % of mangrove area is less than the risk threshold of 30 %. Considering this, the mangrove ecosystem of the NWTP province is assessed as Least Concern (LC) under criterion A1.

Mangroves of the Warm Temperate Northeast Pacific	Area 2020* (km^2)	Area 1970* (km^2)	Net area Change (Km^2)	% Net Area Change	Rate of change (%/year)
	1810.36	1978.95	-206.12	-8.5	0.25

** Details on the methods and references used to estimate the mangrove area in 1970 are listed in appendix 3. Total mangrove area in 2020 is based on the Global Mangrove Watch Version 3 (GMW v3.0) dataset.*

Criterion A2 measures the change in the ecosystem extent over a 50-year period. To assess it, a linear regression model was fitted to the 1970, 2005, 2010, 2015, and 2020 area estimates in the CONABIO map series. The model shows a rate of change of approximately -0.16 % per year, with an r^2 of 0.86 (Figure 6). Predictions indicate that if this trend continues, the province is expected to experience an 8.2 % decrease from 2005 to 2055 (from 1865.46 km^2 to 1711.175 km^2 with a rate of change of -0.17 % per year). Because the predicted changes in mangrove extent are much less than the risk threshold of 30 %, the NWTP province's mangrove ecosystem is assessed as Least Concern (LC) under criteria A2a and A2b.

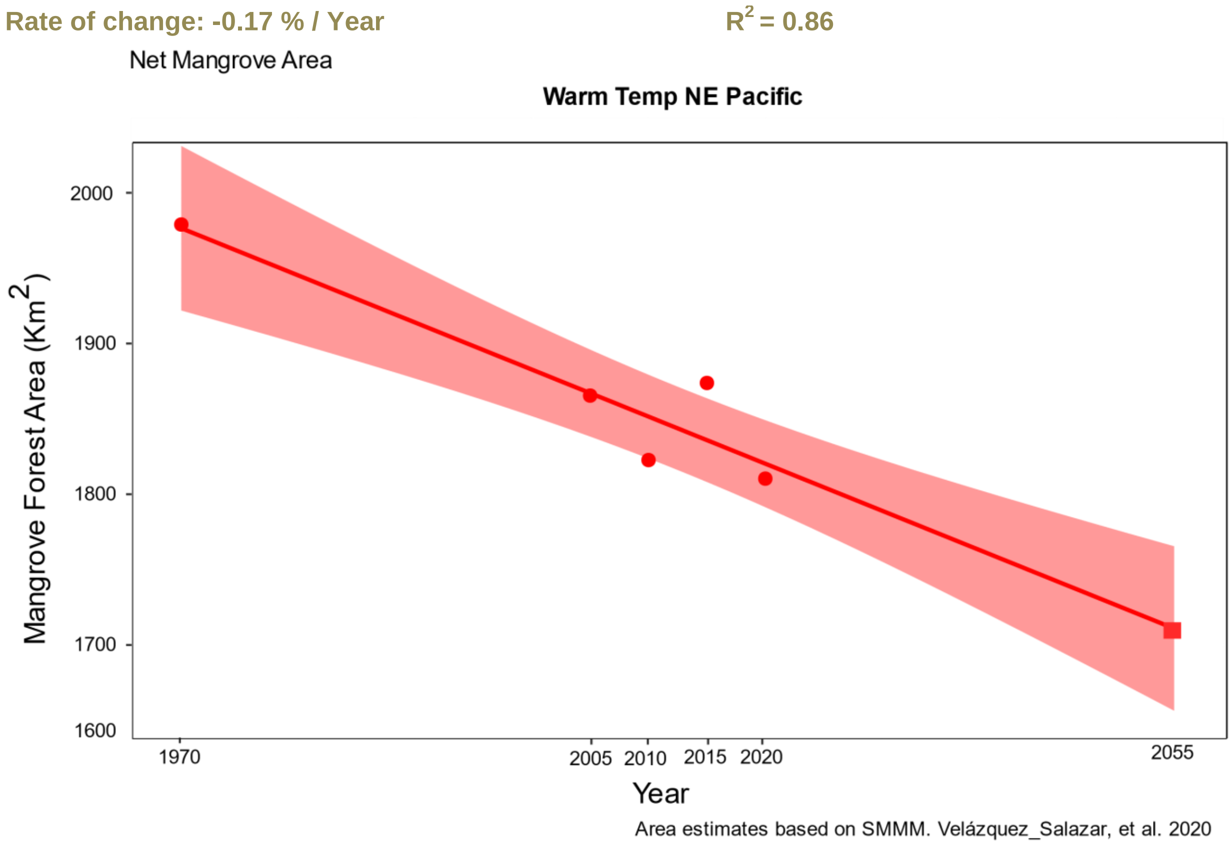

Figure 6. Projected extent of the Warm Temperate Northeast Pacific mangrove ecosystem to 2055. Circles represent the province mangrove area between 1970 and 2020 based on the CONABIO datasets and equations in Velázquez-Salazar *et al*. (2020). The solid line and shaded area are the linear regression and 95 % confidence intervals. Square show the Warm Temperate Northeast Pacific province predicted mangrove area for 2055 (R^2 = 0.86).

Criterion A3, on the other hand, measures changes in mangrove area since 1750. However, there is no reliable data on mangrove extent for the entire province during that period. As a result, the NWTP region's mangrove ecosystem is classified as Data Deficient (DD) under this criterion. Therefore, under criterion A, the ecosystem is assessed as **Least Concern (LC).**

Criterion B: Restricted Geographic Distribution

Province	Extent of Occurrence EOO (km^2)	Area of Occupancy (AOO) ≥1 %	Criterion B
The Warm Temperate Northeast Pacific	308850.5	211	**LC**

Criterion B measures the risk of ecosystem collapse associated with restricted geographical distribution based on standard metrics (Extent of Occurrence EOO, Area of Occupancy AOO, and Threat-defined locations). These parameters were calculated based on the 2020 Warm Temperate Northeast Pacific province mangrove extent (GMW v.3).

For 2020, AOO and EOO were measured as 211 grid cells 10 x 10 km and 308850.0 km^2, respectively (Figure 7). Excluding from the total of 349 those grid cells that contain patches of mangrove forest that account for less than 1 % of the grid cell area, (< 1 Km^2), the AOO is measured as **211, 10 x 10 km grid cells** (Figure 7, red grids).

Considering the very high number of threat-defined-locations, there is no evidence of plausible catastrophic threats leading to potential disappearance of mangroves across their extent. As a result, the Warm Temperate Northeast Pacific mangrove ecosystem is assessed as **Least Concern (LC) under criterion B.**

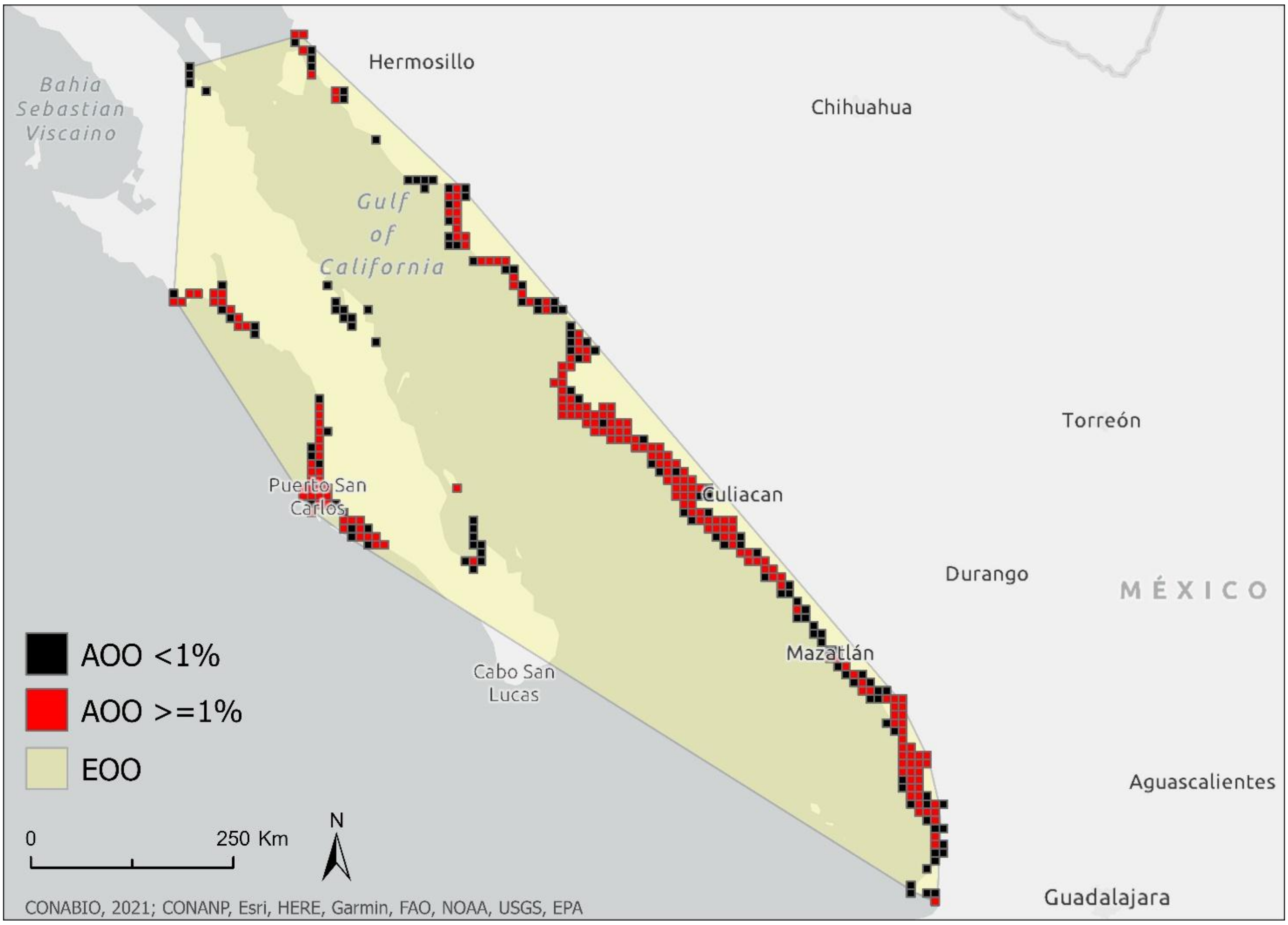

Figure 7. The Warm Temperate Northeast Pacific mangrove Extent Of Occurrence (EOO) and Area Of Occupancy (AOO) in 2020. Estimates based on 2020 CONABIO spatial layer (CONABIO, 2021). The red 10 x 10 km grids (n=211.) are more than 1 % covered by the ecosystem, and the black grids <1 % (n= 156).

Criterion C: Environmental Degradation

Criterion C is an important factor in evaluating the environmental degradation of abiotic variables necessary to sustain an ecosystem. Subcriterion C1 is used to measure environmental degradation over the past 50 years: Unfortunately, due to a lack of reliable data covering the entire province, it is not possible to estimate this subcriterion for the Warm Temperate Northeast Pacific mangrove ecosystem. Therefore, the ecosystem is classified as **Data Deficient (DD)** for subcriterion C1.

Subcriterion C2 is used to measure the degradation of the environment in the future or over any 50-year period, including from the present. To assess the impact of future sea level rise (SLR) on mangrove ecosystems, the methodology presented by Schuerch *et al.* (2018) was adopted. The model was designed to calculate the absolute and relative changes in the extent of wetland ecosystems under different regional SLR scenarios (i.e medium: RCP 4.5 and high: RCP 8.5), including sediment accretion. Thus, the Schuerch *et al*. (2018) model was applied to the Warm Temperate Northeast Pacific mangrove ecosystem boundary using the spatial extent from Giri *et al*. (2011) and assuming mangrove landward migration was not possible.

The results showed that, under an extreme sea-level rise scenario of a 1.1-metre rise by 2100, the projected submerged area is approximately -26.6 % by 2060, which remains below the 30 % risk threshold. Therefore, since no mangrove recruitment can occur in a submerged system (100 % relative severity), but -26.6 % of the ecosystem extent will be affected by SLR, the Warm Temperate Northeast Pacific mangrove ecosystem is assessed as **Near Threatened (NT)** for subcriterion C2.

Subcriterion C3 is used to measure changes in abiotic variables since 1750. Unfortunately, due to the lack of reliable historic data covering the entire province, it is not possible to assess environmental degradation for this subcriterion. Therefore, the Warm Temperate Northeast Pacific province is classified as Data Deficient (DD) for this subcriterion. Overall, the ecosystem is assessed as **Near Threatened (NT)** under criterion C.

Criterion D: Disruption of biotic processes or interactions

Assessment of the level of biotic degradation in the Warm Temperate Northeast Pacific province was conducted using the global mangrove degradation map developed by Worthington and Spalding (2018). The map utilized degradation metrics derived from vegetation indices such as NDVI, EVI, SAVI, NDMI, which are calculated using Landsat time series from approximately 2000 to 2017. These indices represent the vegetation greenness and moisture condition.

Degradation of the mangrove areas was calculated at a pixel scale of 30 m resolution on areas intersecting with the 2017 mangrove extent map (GMW v2). The mangrove pixels were classified as degraded if they meet two conditions: 1) at least 10 out of 12 degradation indices showed a decrease of over 40 % compared to the previous period; and 2) all twelve indices did not recover to within 20 % of their pre-2000 value (detailed methods and data are available at: maps.oceanwealth.org/mangrove-restoration/). The vegetation indices decay has been used to identify abrupt changes and mangrove degradation, such as mangrove die-back events, clear-cutting, fire damage, and logging. It has also been used to track mangrove regeneration (Lovelock *et al.*, 2017; Santana, 2018; Murray *et al.*, 2020; Aljahdali *et al.*, 2021; Lee *et al.*, 2021). However, it is important to consider that changes observed in the vegetation indices can also be influenced by data artifacts (Akbar *et al.*, 2020). To account for this, a relative severity level of more than 50%, but less than 80 %, was assumed.

Based on this analysis, approximately 2.9 % of the Warm Temperate Northeast Pacific mangrove area was classified as degraded over a period of around 17 years (from 2000 to 2017). This implies an average annual rate of degradation of 0.17%. If this trend persists, the Warm Temperate Northeast Pacific mangrove area will be classified as degraded by 8.4 % over a 50-year period. The Warm Temperate Northeast Pacific mangrove province is assessed as **Least Concern** (**LC**) under subcriterion D2b since less than 30 % of the ecosystem meets the category thresholds for criterion D.

Unfortunately, no data were found to assess the disruption of biotic processes and degradation over the past 50 years (subcriterion D1) or since 1750 (subcriterion D3). Consequently, both subcriteria are classified as **Data Deficient (DD).** As a result, it can be concluded that the Warm Temperate Northeast Pacific ecosystem is still classified as **Least Concern (LC)** under criterion D.

Criterion E: Quantitative Risk

No model was used to quantitatively assess the risk of ecosystem collapse for this ecosystem; hence criterion E was **Not Evaluated (NE)**.

5. Summary of the Assessment

CRITERION			
A. Reduction in Geographic Distribution	**A1** Past 50 years	**A2** Future or any 50 years period	**A3** Historical (1750)
	LC	LC	DD
B. Restricted Geo. Distribution	**B1** Extent of Occurrence	**B2** Area of Occupancy	**B3** # Threat-defined Locations < 5?
	LC	LC	LC
C. Environmental Degradation	**C1** Past 50 years (1970)	**C2** Future or any 50 years period	**C3** Historical (1750)
	DD	NT	DD
D. Disruption of biotic processes	**D1** Past 50 years (1970)	**D2** Future or any 50 years period	**D3** Historical (1750)
	DD	LC	DD
E. Quantitative Risk analysis	NE		
OVERALL RISK CATEGORY	NT		

NT= Near Threatened, LC = Least Concern, DD = Data Deficient;; NE = Not Evaluated

Overall, the status of the Warm Temperate Northeast Pacific mangrove ecosystem is assessed as **NT (Near Threatened).**

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Peer revision:

Donald Macintosh
Marcos Valderrábano

Web portal:

http://iucnrle.org/

7. Appendices

1. List of Key Mangrove Species

List of plant species considered true mangroves according to Red List of Threatened Species (RLTS) spatial data (IUCN, 2022). We included species whose range maps intersected with the boundary of the marine provinces/ecoregions described in the distribution section.

Class	Order	Family	Scientific name	RLTS category
Equisetopsida	Malpighiales	Rhizophoraceae	*Rhizophora mangle*	LC
Equisetopsida	Myrtales	Combretaceae	*Laguncularia racemosa*	LC
Equisetopsida	Lamiales	Acanthaceae	*Avicennia germinans*	LC

2. List of Associated Species

List of taxa that are associated with mangrove habitats in the Red List of Threatened Species (RLTS) database (IUCN, 2022). We filtered species with spatial point records in the SNIB-CONABIO within the extension area of the minimum convex polygon enclosing all mangrove occurrences. The common names are those shown in the SNIB-CONABIO database.

Class	Order	Family	Scientific name	RLTS category	Common name
Amphibia	Anura	Bufonidae	*Anaxyrus californicus*	EN	sapo, sapo de arroyo
Amphibia	Anura	Eleutherodactylidae	*Eleutherodactylus teretistes*	VU	rana ladrona silbadora, rana silbadora
Anthozoa	Scleractinia	Fungiidae	*Cycloseris curvata*	VU	coral verdadero
Anthozoa	Scleractinia	Pocilloporidae	*Pocillopora elegans*	VU	coral verdadero
Anthozoa	Scleractinia	Poritidae	*Porites sverdrupi*	VU	coral verdadero
Anthozoa	Scleractinia	Psammocoridae	*Psammocora stellata*	VU	coral verdadero
Aves	Psittaciformes	Psittacidae	*Amazona finschi*	EN	loro corona lila
Aves	Psittaciformes	Psittacidae	*Amazona oratrix*	EN	loro cabeza amarilla
Aves	Psittaciformes	Psittacidae	*Amazona oratrix tresmariae*	EN	loro cabeza amarilla
Aves	Psittaciformes	Psittacidae	*Ara militaris*	VU	guacamaya verde
Aves	Procellariiformes	Procellariidae	*Ardenna bulleri*	VU	pardela de Buller
Aves	Procellariiformes	Procellariidae	*Ardenna creatopus*	VU	pardela patas rosadas
Aves	Passeriformes	Calcariidae	*Calcarius ornatus*	VU	escribano collar castaño
Aves	Apodiformes	Apodidae	*Chaetura pelagica*	VU	vencejo de chimenea
Aves	Anseriformes	Anatidae	*Clangula hyemalis*	VU	pato cola larga
Aves	Passeriformes	Fringillidae	*Coccothraustes vespertinus*	VU	picogrueso norteño
Aves	Apodiformes	Apodidae	*Cypseloides niger*	VU	vencejo negro
Aves	Apodiformes	Trochilidae	*Eupherusa ridgwayi*	VU	ninfa mexicana
Aves	Psittaciformes	Psittacidae	*Eupsittula canicularis*	VU	perico frente naranja

Class	Order	Family	Scientific name	RLTS category	Common name
Aves	Passeriformes	Parulidae	*Geothlypis beldingi*	VU	mascarita bajacaliforniana, mascarita peninsular
Aves	Passeriformes	Parulidae	*Geothlypis beldingi beldingi*	VU	
Aves	Passeriformes	Parulidae	*Geothlypis beldingi goldmani*	VU	
Aves	Procellariiformes	Hydrobatidae	*Hydrobates leucorhous*	VU	paíño de Leach
Aves	Procellariiformes	Hydrobatidae	*Hydrobates leucorhous chapmani*	VU	
Aves	Podicipediformes	Podicipedidae	*Podiceps auritus*	VU	zambullidor cornudo
Aves	Podicipediformes	Podicipedidae	*Podiceps auritus cornutus*	VU	
Aves	Procellariiformes	Procellariidae	*Procellaria parkinsoni*	VU	petrel de Parkinson
Aves	Passeriformes	Hirundinidae	*Progne sinaloae*	VU	golondrina sinaloense
Aves	Procellariiformes	Procellariidae	*Pterodroma cookii*	VU	petrel de Cook
Aves	Procellariiformes	Procellariidae	*Pterodroma externa*	VU	petrel de Isla Juan Fernández, petrel de Juan Fernández
Aves	Procellariiformes	Procellariidae	*Puffinus auricularis*	CR	pardela de Islas Revillagigedo, pardela de Revillagigedo
Aves	Charadriiformes	Laridae	*Rissa tridactyla*	VU	gaviota patas negras
Aves	Charadriiformes	Alcidae	*Synthliboramphus craveri*	VU	mérgulo de Craveri
Aves	Charadriiformes	Alcidae	*Synthliboramphus hypoleucus*	EN	mérgulo de Xantus
Aves	Charadriiformes	Alcidae	*Synthliboramphus scrippsi*	VU	mérgulo de scripps
Aves	Passeriformes	Mimidae	*Toxostoma bendirei*	VU	cuicacoche pico corto
Chondrichthyes	Myliobatiformes	Myliobatidae	*Aetobatus laticeps*	VU	
Chondrichthyes	Myliobatiformes	Myliobatidae	*Aetobatus narinari*	EN	chucho, chucho pintado
Chondrichthyes	Lamniformes	Alopiidae	*Alopias pelagicus*	EN	zorro pelágico
Chondrichthyes	Lamniformes	Alopiidae	*Alopias superciliosus*	VU	tiburón zorro ojón
Chondrichthyes	Lamniformes	Alopiidae	*Alopias vulpinus*	VU	tiburón zorro común
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus albimarginatus*	VU	tiburón puntas blancas
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus brachyurus*	VU	tiburón rojizo
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus cerdale*	CR	tiburón poroso del Pacífico
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus falciformis*	VU	tiburón piloto, tiburón prieto
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus leucas*	VU	tiburón chato, tiburón toro

Class	Order	Family	Scientific name	RLTS category	Common name
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus limbatus*	VU	jaquetón, tiburón puntas negras
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus obscurus*	EN	tiburón gambuso, tiburón prieto
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus plumbeus*	EN	tiburón aleta de cartón, tiburón aletón
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Carcharhinus porosus*	CR	cazón poroso, tiburón poroso
Chondrichthyes	Lamniformes	Lamnidae	*Carcharodon carcharias*	VU	tiburón blanco
Chondrichthyes	Lamniformes	Cetorhinidae	*Cetorhinus maximus*	EN	tiburón peregrino
Chondrichthyes	Carcharhiniformes	Triakidae	*Galeorhinus galeus*	CR	tiburón aceitoso
Chondrichthyes	Orectolobiformes	Ginglymostomatidae	*Ginglymostoma unami*	EN	
Chondrichthyes	Myliobatiformes	Dasyatidae	*Hypanus dipterurus*	VU	raya látigo redonda
Chondrichthyes	Myliobatiformes	Dasyatidae	*Hypanus longus*	VU	raya levisa, raya látigo largo
Chondrichthyes	Myliobatiformes	Myliobatidae	*Mobula birostris*	EN	manta voladora
Chondrichthyes	Myliobatiformes	Myliobatidae	*Mobula mobular*	EN	manta arpón
Chondrichthyes	Myliobatiformes	Myliobatidae	*Mobula munkiana*	VU	manta chica
Chondrichthyes	Myliobatiformes	Myliobatidae	*Mobula tarapacana*	EN	manta cornuda
Chondrichthyes	Myliobatiformes	Myliobatidae	*Mobula thurstoni*	EN	manta doblada
Chondrichthyes	Myliobatiformes	Myliobatidae	*Myliobatis longirostris*	VU	águila picuda
Chondrichthyes	Torpediniformes	Narcinidae	*Narcine entemedor*	VU	raya eléctrica gigante
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Nasolamia velox*	EN	tiburón coyotito
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Negaprion brevirostris*	VU	tiburón Can-Xoc, tiburón limón
Chondrichthyes	Lamniformes	Odontaspididae	*Odontaspis ferox*	VU	tiburón dientes de perro
Chondrichthyes	Pristiformes	Pristidae	*Pristis pristis*	CR	pez sierra común
Chondrichthyes	Pristiformes	Rhinobatidae	*Pseudobatos buthi*	VU	
Chondrichthyes	Pristiformes	Rhinobatidae	*Pseudobatos glaucostigma*	VU	guitarra punteada
Chondrichthyes	Pristiformes	Rhinobatidae	*Pseudobatos leucorhynchus*	VU	guitarra trompa blanca
Chondrichthyes	Orectolobiformes	Rhincodontidae	*Rhincodon typus*	EN	tiburón ballena
Chondrichthyes	Carcharhiniformes	Carcharhinidae	*Rhizoprionodon longurio*	VU	cazón bironche
Chondrichthyes	Rajiformes	Rajidae	*Rostroraja equatorialis*	VU	raya ecuatorial
Chondrichthyes	Rajiformes	Rajidae	*Rostroraja velezi*	VU	raya chillona
Chondrichthyes	Carcharhiniformes	Sphyrnidae	*Sphyrna corona*	CR	cornuda coronada
Chondrichthyes	Carcharhiniformes	Sphyrnidae	*Sphyrna lewini*	CR	cornuda común
Chondrichthyes	Carcharhiniformes	Sphyrnidae	*Sphyrna media*	CR	cornuda cuchara

Class	Order	Family	Scientific name	RLTS category	Common name
Chondrichthyes	Carcharhiniformes	Sphyrnidae	*Sphyrna mokarran*	CR	cornuda blanca, cornuda gigante
Chondrichthyes	Carcharhiniformes	Sphyrnidae	*Sphyrna tiburo*	EN	cabeza de pala cornuda, cornuda cabeza de pala
Chondrichthyes	Carcharhiniformes	Sphyrnidae	*Sphyrna zygaena*	VU	cornuda prieta
Equisetopsida	Malvales	Malvaceae	*Abutilon grandidentatum*	EN	malva peluda
Equisetopsida	Fabales	Fabaceae	*Acaciella rosei*	VU	
Equisetopsida	Caryophyllales	Cactaceae	*Acanthocereus rosei*	VU	tasajillo de Sinaloa
Equisetopsida	Caryophyllales	Achatocarpaceae	*Achatocarpus gracilis*	EN	guasicuco (Tarasco), guisicuco, negrito
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) aktites*	VU	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) capensis*	EN	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) fortiflora*	CR	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) jaiboli*	VU	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) potatorum*	VU	agave, maguey, maguey de Tobalá
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) promontorii*	CR	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) shawii*	EN	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) shawii goldmaniana*	EN	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Agave) subsimplex*	VU	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Littaea) dasylirioides*	EN	maguey, maguey intrépido
Equisetopsida	Asparagales	Asparagaceae	*Agave (Littaea) felgeri*	VU	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave (Littaea) impressa*	EN	maguey, maguey masparillo
Equisetopsida	Asparagales	Asparagaceae	*Agave (Littaea) ornithobroma*	VU	maguey
Equisetopsida	Asparagales	Asparagaceae	*Agave azurea*	VU	
Equisetopsida	Sapindales	Anacardiaceae	*Amphipterygium adstringens*	VU	palo de rosa, palo santo
Equisetopsida	Sapindales	Rutaceae	*Amyris carterae*	VU	
Equisetopsida	Sapindales	Rutaceae	*Amyris lurida*	EN	
Equisetopsida	Fabales	Fabaceae	*Ateleia insularis*	EN	
Equisetopsida	Fabales	Fabaceae	*Ateleia standleyana*	EN	
Equisetopsida	Asparagales	Asparagaceae	*Beaucarnea recurvata*	CR	monja, palma petacona
Equisetopsida	Malpighiales	Euphorbiaceae	*Bernardia gentryana*	EN	

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Equisetopsida	Asparagales	Orchidaceae	*Bletia warnockii*	EN	
Equisetopsida	Boraginales	Ehretiaceae	*Bourreria rubra*	EN	
Equisetopsida	Boraginales	Ehretiaceae	*Bourreria superba*	EN	
Equisetopsida	Fabales	Fabaceae	*Brongniartia glabrata*	VU	hierba de la víbora
Equisetopsida	Fabales	Fabaceae	*Brongniartia trifoliata*	EN	
Equisetopsida	Sapindales	Burseraceae	*Bursera cerasifolia*	VU	
Equisetopsida	Sapindales	Burseraceae	*Bursera collina*	EN	
Equisetopsida	Sapindales	Burseraceae	*Bursera confusa*	VU	copal, torote, torote chutama
Equisetopsida	Sapindales	Burseraceae	*Bursera filicifolia*	VU	tacamaca (Náhuatl)
Equisetopsida	Sapindales	Simaroubaceae	*Castela retusa*	EN	palo amargoso
Equisetopsida	Sapindales	Meliaceae	*Cedrela odorata*	VU	cedrillo, cedro
Equisetopsida	Lamiales	Verbenaceae	*Citharexylum ellipticum*	VU	
Equisetopsida	Malpighiales	Euphorbiaceae	*Cnidoscolus elasticus*	VU	chilte colorado, chilte rojo
Equisetopsida	Malpighiales	Euphorbiaceae	*Cnidoscolus sinaloensis*	EN	
Equisetopsida	Malpighiales	Euphorbiaceae	*Cnidoscolus tepiquensis*	VU	chilte blanco
Equisetopsida	Caryophyllales	Cactaceae	*Cochemiea capensis*	EN	biznaga de los cabos
Equisetopsida	Caryophyllales	Cactaceae	*Cochemiea halei*	VU	biznaga de Isla Magdalena
Equisetopsida	Caryophyllales	Cactaceae	*Cochemiea multidigitata*	VU	biznaga de muchos dedos
Equisetopsida	Gentianales	Rubiaceae	*Coffea arabica*	EN	cafeto, café pergamino garnica
Equisetopsida	Boraginales	Cordiaceae	*Cordia globulifera*	VU	
Equisetopsida	Caryophyllales	Cactaceae	*Corynopuntia reflexispina*	CR	choya, nopal cardo lacio
Equisetopsida	Celastrales	Celastraceae	*Crossopetalum uragoga*	EN	
Equisetopsida	Caryophyllales	Cactaceae	*Cylindropuntia santamaria*	VU	cholla de Santa María
Equisetopsida	Malvales	Thymelaeaceae	*Daphnopsis lagunae*	EN	
Equisetopsida	Fabales	Fabaceae	*Ebenopsis caesalpinioides*	EN	
Equisetopsida	Caryophyllales	Cactaceae	*Echinocereus barthelowanus*	EN	alicoche de Santa María
Equisetopsida	Caryophyllales	Cactaceae	*Echinocereus leucanthus*	EN	alicoche de flor blanca, órgano pequeño de flor blanca
Equisetopsida	Caryophyllales	Cactaceae	*Echinocereus maritimus*	VU	alicoche de ensenada
Equisetopsida	Caryophyllales	Cactaceae	*Echinocereus sciurus*	EN	alicoche ardilla, órgano pequeño ardilla
Equisetopsida	Caryophyllales	Cactaceae	*Echinocereus*	EN	alicoche de

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			sciurus floresii		Topolobampo
Equisetopsida	Rosales	Rhamnaceae	*Endotropis crocea ilicifolia*	EN	
Equisetopsida	Fabales	Fabaceae	*Erythrostemon standleyi*	EN	huetapochi (Guarijío), margarita
Equisetopsida	Sapindales	Rutaceae	*Esenbeckia berlandieri*	EN	guayacán, hueso de tigre
Equisetopsida	Sapindales	Rutaceae	*Esenbeckia berlandieri acapulcensis*	VU	
Equisetopsida	Sapindales	Rutaceae	*Esenbeckia flava*	VU	palo amarillo
Equisetopsida	Sapindales	Rutaceae	*Esenbeckia hartmanii*	VU	naranjito, palo amarillo
Equisetopsida	Myrtales	Myrtaceae	*Eugenia salamensis*	EN	
Equisetopsida	Myrtales	Myrtaceae	*Eugenia sinaloae*	VU	
Equisetopsida	Caryophyllales	Cactaceae	*Ferocactus chrysacanthus*	EN	biznaga, biznaga barril de isla de cedros
Equisetopsida	Caryophyllales	Cactaceae	*Ferocactus chrysacanthus grandiflorus*	EN	biznaga barril de flores grandes
Equisetopsida	Caryophyllales	Cactaceae	*Ferocactus fordii*	VU	biznaga barril de Baja California
Equisetopsida	Caryophyllales	Cactaceae	*Ferocactus herrerae*	VU	biznaga, biznaga barril de Sinaloa
Equisetopsida	Caryophyllales	Cactaceae	*Ferocactus tiburonensis*	VU	biznaga, biznaga barril de isla tiburón
Equisetopsida	Caryophyllales	Cactaceae	*Ferocactus wislizeni*	VU	biznaga, biznaga de agua
Equisetopsida	Lamiales	Oleaceae	*Forestiera macrocarpa*	EN	
Equisetopsida	Ericales	Fouquieriaceae	*Fouquieria burragei*	EN	ocotillo blanco, ocotillo de flor blanca
Equisetopsida	Ericales	Fouquieriaceae	*Fouquieria columnaris*	VU	cirio, cótootaj (Seri)
Equisetopsida	Ericales	Fouquieriaceae	*Fouquieria diguetii*	VU	ocotillo, palo adán
Equisetopsida	Garryales	Garryaceae	*Garrya salicifolia*	VU	rama prieta
Equisetopsida	Gentianales	Rubiaceae	*Glossostipula blepharophylla*	VU	
Equisetopsida	Malvales	Malvaceae	*Gossypium aridum*	VU	
Equisetopsida	Malvales	Malvaceae	*Gossypium armourianum*	CR	
Equisetopsida	Malvales	Malvaceae	*Gossypium davidsonii*	VU	
Equisetopsida	Malvales	Malvaceae	*Gossypium harknessii*	EN	algodón silvestre
Equisetopsida	Malvales	Malvaceae	*Gossypium hirsutum*	VU	algodoncillo, algodonero
Equisetopsida	Malvales	Malvaceae	*Gossypium turneri*	CR	

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Equisetopsida	Zygophyllales	Zygophyllaceae	*Guaiacum coulteri*	VU	guayacan, palo santo
Equisetopsida	Zygophyllales	Zygophyllaceae	*Guaiacum coulteri palmeri*	VU	
Equisetopsida	Zygophyllales	Zygophyllaceae	*Guaiacum unijugum*	CR	guayacán, palo santo
Equisetopsida	Sapindales	Meliaceae	*Guarea glabra*	VU	Cedrillo colorado, agotope
Equisetopsida	Sapindales	Meliaceae	*Guarea glabra excelsa*	VU	
Equisetopsida	Sapindales	Meliaceae	*Guarea glabra glabrescens*	VU	
Equisetopsida	Gentianales	Rubiaceae	*Guettarda elliptica*	CR	cascarillo, crucecilla
Equisetopsida	Malpighiales	Euphorbiaceae	*Gymnanthes insolita*	VU	
Equisetopsida	Lamiales	Bignoniaceae	*Handroanthus chrysanthus*	VU	amapa, amapa amarilla
Equisetopsida	Aquifoliales	Aquifoliaceae	*Ilex tolucana*	VU	aceituna, aceitunillo
Equisetopsida	Malpighiales	Euphorbiaceae	*Jatropha mcvaughii*	EN	
Equisetopsida	Malpighiales	Euphorbiaceae	*Jatropha ortegae*	EN	
Equisetopsida	Malpighiales	Euphorbiaceae	*Jatropha sympetala*	VU	papelillo, piñon de la costa
Equisetopsida	Malpighiales	Euphorbiaceae	*Jatropha vernicosa*	VU	sangre de grado
Equisetopsida	Fabales	Fabaceae	*Leucaena diversifolia*	VU	guaje, guaje blanco
Equisetopsida	Fabales	Fabaceae	*Lonchocarpus minor*	VU	
Equisetopsida	Caryophyllales	Cactaceae	*Lophocereus gatesii*	VU	senita espinosa
Equisetopsida	Fabales	Fabaceae	*Lotus nuttallianus*	EN	
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria armillata*	VU	biznaga de brazalete
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria bocensis*	VU	biznaga de bacubirito rojiza, biznaga de las bocas
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria johnstonii*	EN	biznaga de bahía de san carlos, cabeza de viejo
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria peninsularis*	EN	biznaga pitayita
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria petrophila*	VU	biznaga saxícola
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria petrophila arida*	VU	biznaga de Isla Pichilingue
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria petrophila baxteriana*	VU	biznaga de san bartolo, biznaga del Pacífico
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria petrophila petrophila*	VU	biznaga vieja
Equisetopsida	Caryophyllales	Cactaceae	*Mammillaria schumannii*	EN	biznaga de schumann

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Equisetopsida	Fabales	Fabaceae	*Mimosa coelocarpa*	EN	
Equisetopsida	Fabales	Fabaceae	*Mimosa costenya*	VU	
Equisetopsida	Asterales	Asteraceae	*Nahuatlea arborescens*	VU	
Equisetopsida	Asparagales	Asparagaceae	*Nolina beldingii*	VU	palmilla, sotol
Equisetopsida	Asparagales	Asparagaceae	*Nolina brandegeei*	VU	
Equisetopsida	Malvales	Malvaceae	*Pavonia pleuranthera*	VU	
Equisetopsida	Fabales	Fabaceae	*Phaseolus carterae*	EN	
Equisetopsida	Malpighiales	Phyllanthaceae	*Phyllanthus coalcomanensis*	EN	
Equisetopsida	Solanales	Solanaceae	*Physalis (Rydbergis) hastatula*	EN	
Equisetopsida	Pinales	Pinaceae	*Pinus (Strobus) cembroides lagunae*	VU	pino, piñón de la Laguna
Equisetopsida	Malpighiales	Picrodendraceae	*Piranhea mexicana*	VU	guayabillo, guayabillo borcelano
Equisetopsida	Malpighiales	Salicaceae	*Populus brandegeei*	VU	
Equisetopsida	Malpighiales	Salicaceae	*Populus brandegeei brandegeei*	VU	
Equisetopsida	Fagales	Fagaceae	*Quercus (Quercus) ajoensis*	VU	
Equisetopsida	Fagales	Fagaceae	*Quercus (Quercus) brandegeei*	EN	bellota de encino, encino
Equisetopsida	Fagales	Fagaceae	*Quercus (Quercus) cedrosensis*	VU	
Equisetopsida	Fagales	Fagaceae	*Quercus (Quercus) devia*	EN	encino, encino colorado
Equisetopsida	Fagales	Fagaceae	*Quercus (Quercus) engelmannii*	EN	
Equisetopsida	Fagales	Fagaceae	*Quercus (Quercus) radiata*	EN	encino cucharillo, encino hueja
Equisetopsida	Arecales	Arecaceae	*Sabal pumos*	VU	palma, palma real
Equisetopsida	Arecales	Arecaceae	*Sabal uresana*	VU	palma, palma blanca
Equisetopsida	Celastrales	Celastraceae	*Schaefferia frutescens*	EN	chicharroncillo, limoncillo
Equisetopsida	Celastrales	Celastraceae	*Schaefferia pilosa*	VU	
Equisetopsida	Santalales	Schoepfiaceae	*Schoepfia shreveana*	EN	
Equisetopsida	Ericales	Sapotaceae	*Sideroxylon peninsulare*	EN	
Equisetopsida	Solanales	Solanaceae	*Solanum (Solanum) axillifolium*	EN	

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Equisetopsida	Caryophyllales	Cactaceae	*Stenocereus alamosensis*	VU	cina, nacido
Equisetopsida	Caryophyllales	Cactaceae	*Stenocereus martinezii*	EN	pitahaya, pitahayo
Equisetopsida	Ericales	Styracaceae	*Styrax gentryi*	EN	
Equisetopsida	Sapindales	Meliaceae	*Swietenia humilis*	EN	caoba, caoba del pacífico
Equisetopsida	Lamiales	Lamiaceae	*Tectona grandis*	EN	
Equisetopsida	Gentianales	Apocynaceae	*Vallesia baileyana*	EN	
Equisetopsida	Boraginales	Cordiaceae	*Varronia urticacea*	CR	
Equisetopsida	Asparagales	Asparagaceae	*Yucca capensis*	EN	
Gastropoda	Lepetellida	Haliotidae	*Haliotis corrugata*	CR	abulón amarillo
Gastropoda	Lepetellida	Haliotidae	*Haliotis fulgens*	CR	abulón azul, abulón verde
Holothuroidea	Aspidochirotida	Stichopodidae	*Apostichopus parvimensis*	VU	pepino de mar
Holothuroidea	Aspidochirotida	Stichopodidae	*Isostichopus fuscus*	EN	pepino de mar
Insecta	Hymenoptera	Apidae	*Bombus (Crotchiibombus) crotchii*	EN	
Insecta	Hymenoptera	Apidae	*Bombus (Fervidobombus) pensylvanicus*	VU	
Insecta	Hymenoptera	Apidae	*Bombus (Fervidobombus) steindachneri*	EN	
Insecta	Lepidoptera	Nymphalidae	*Danaus plexippus plexippus*	EN	mariposa monarca, mariposa viajera
Insecta	Odonata	Coenagrionidae	*Leptobasis melinogaster*	VU	caballitos del diablo
Insecta	Odonata	Lestidae	*Lestes simplex*	VU	caballitos del diablo
Malacostraca	Decapoda	Atyidae	*Atya ortmannioides*	VU	
Malacostraca	Decapoda	Palaemonidae	*Macrobrachium acanthochirus*	VU	acamaya, camarón de agua dulce
Mammalia	Artiodactyla	Antilocapridae	*Antilocapra americana peninsularis*	EN	
Mammalia	Cetacea	Balaenopteridae	*Balaenoptera borealis*	EN	ballena boreal, ballena sei
Mammalia	Cetacea	Balaenopteridae	*Balaenoptera borealis borealis*	EN	
Mammalia	Cetacea	Balaenopteridae	*Balaenoptera musculus*	EN	ballena azul
Mammalia	Cetacea	Balaenopteridae	*Balaenoptera musculus musculus*	EN	
Mammalia	Cetacea	Balaenopteridae	*Balaenoptera physalus*	VU	ballena boba, ballena de aleta
Mammalia	Cetacea	Balaenopteridae	*Balaenoptera physalus physalus*	VU	
Mammalia	Carnivora	Otariidae	*Callorhinus*	VU	

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			ursinus		
Mammalia	Rodentia	Heteromyidae	*Chaetodipus ammophilus dalquesti*	VU	ratón de abazones del Cabo
Mammalia	Cetacea	Eschrichtiidae	*Eschrichtius robustus*	EN	ballena gris
Mammalia	Chiroptera	Phyllostomidae	*Leptonycteris nivalis*	EN	murciélago, murciélago hocicudo mayor
Mammalia	Lagomorpha	Leporidae	*Lepus californicus insularis*	VU	liebre negra
Mammalia	Chiroptera	Vespertilionidae	*Myotis findleyi*	EN	miotis de Tres Marías
Mammalia	Chiroptera	Vespertilionidae	*Myotis velifer peninsularis*	EN	miotis peninsular, murciélago
Mammalia	Chiroptera	Vespertilionidae	*Myotis vivesi*	VU	miotis pescador, murciélago
Mammalia	Rodentia	Sciuridae	*Otospermophilus beecheyi atricapillus*	EN	ardilla terrestre, ardillón
Mammalia	Rodentia	Cricetidae	*Peromyscus caniceps*	CR	ratón de Monserrat
Mammalia	Rodentia	Cricetidae	*Peromyscus dickeyi*	CR	ratón de tortuga
Mammalia	Rodentia	Cricetidae	*Peromyscus guardia*	CR	ratón de campo, ratón de la isla Ángel de la Guarda
Mammalia	Rodentia	Cricetidae	*Peromyscus guardia mejiae*	CR	
Mammalia	Rodentia	Cricetidae	*Peromyscus interparietalis*	CR	ratón de San Lorenzo
Mammalia	Rodentia	Cricetidae	*Peromyscus interparietalis interparietalis*	CR	ratón de San Lorenzo
Mammalia	Rodentia	Cricetidae	*Peromyscus interparietalis lorenzi*	CR	ratón de San Lorenzo
Mammalia	Rodentia	Cricetidae	*Peromyscus interparietalis ryckmani*	CR	
Mammalia	Rodentia	Cricetidae	*Peromyscus madrensis*	EN	ratón arbustero, ratón de María Madre
Mammalia	Rodentia	Cricetidae	*Peromyscus pseudocrinitus*	CR	ratón de Cedros
Mammalia	Rodentia	Cricetidae	*Peromyscus sejugis*	EN	ratón de Santa Cruz
Mammalia	Rodentia	Cricetidae	*Peromyscus simulus*	VU	ratón de campo, ratón nayarita
Mammalia	Rodentia	Cricetidae	*Peromyscus slevini*	CR	ratón de Santa Catalina
Mammalia	Rodentia	Cricetidae	*Peromyscus stephani*	CR	ratón de San Esteban
Mammalia	Cetacea	Physeteridae	*Physeter macrocephalus*	VU	cachalote
Mammalia	Rodentia	Cricetidae	*Sigmodon alleni*	VU	rata algodonera de Allen, rata

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					cañera
Mammalia	Carnivora	Mephitidae	*Spilogale putorius*	VU	zorrillo manchado, zorrillo manchado común
Mammalia	Carnivora	Mephitidae	*Spilogale pygmaea*	VU	zorrillo manchado pigmeo, zorrillo pigmeo
Mammalia	Carnivora	Mephitidae	*Spilogale pygmaea pygmaea*	VU	
Mammalia	Cetacea	Delphinidae	*Stenella longirostris orientalis*	VU	
Mammalia	Lagomorpha	Leporidae	*Sylvilagus bachmani mansuetus*	CR	conejo de isla San José
Mammalia	Lagomorpha	Leporidae	*Sylvilagus graysoni*	EN	conejo de Tres Marías, conejo de las Islas Marías
Osteichthyes	Acanthuriformes	Sciaenidae	*Cynoscion othonopterus*	VU	corvina golfina
Osteichthyes	Perciformes	Serranidae	*Epinephelus itajara*	VU	cherna, mero guasa
Osteichthyes	Cyprinodontiformes	Fundulidae	*Fundulus lima*	EN	killifish sardinilla, sardinilla de la península
Osteichthyes	Cypriniformes	Cyprinidae	*Gila robusta*	VU	carpa cola redonda, carpa del Gila
Osteichthyes	Gobiiformes	Gobiidae	*Gillichthys seta*	VU	chupalodo chico
Osteichthyes	Gobiesociformes	Gobiesocidae	*Gobiesox juniperoserrai*	CR	cucharita peninsular
Osteichthyes	Labriformes	Labridae	*Halichoeres insularis*	VU	señorita de Socorro
Osteichthyes	Syngnathiformes	Syngnathidae	*Hippocampus ingens*	VU	caballito del Pacífico
Osteichthyes	Perciformes	Pomacanthidae	*Holacanthus clarionensis*	VU	ángel de Clarión
Osteichthyes	Perciformes	Serranidae	*Hyporthodus acanthistius*	VU	baqueta
Osteichthyes	Perciformes	Serranidae	*Hyporthodus niveatus*	VU	cherna pintada
Osteichthyes	Siluriformes	Ictaluridae	*Ictalurus pricei*	EN	bagre yaqui
Osteichthyes	Istiophoriformes	Istiophoridae	*Istiophorus platypterus*	VU	pez vela
Osteichthyes	Blenniiformes	Labrisomidae	*Labrisomus socorroensis*	VU	trambollo de Socorro
Osteichthyes	Istiophoriformes	Istiophoridae	*Makaira nigricans*	VU	marlin azul del Indo-Pacífico, marlín azul
Osteichthyes	Tetraodontiformes	Molidae	*Mola mola*	VU	mola
Osteichthyes	Perciformes	Serranidae	*Mycteroperca jordani*	EN	baya
Osteichthyes	Holocentriformes	Holocentridae	*Myripristis*	VU	soldado amarillo

Class	Order	Family	Scientific name	RLTS category	Common name
			clarionensis		
Osteichthyes	Blenniiformes	Labrisomidae	*Paraclinus walkeri*	CR	trambollito de San Quintín
Osteichthyes	Scombriformes	Scombridae	*Scomberomorus concolor*	VU	sierra golfina
Osteichthyes	Labriformes	Labridae	*Semicossyphus pulcher*	VU	vieja californiana
Osteichthyes	Incertae sedis	Pomacentridae	*Stegastes leucorus*	VU	jaqueta rabo blanco
Osteichthyes	Incertae sedis	Pomacentridae	*Stegastes redemptus*	VU	jaqueta azafranada
Osteichthyes	Perciformes	Polyprionidae	*Stereolepis gigas*	CR	bass pescara, pescara
Osteichthyes	Labriformes	Labridae	*Thalassoma virens*	VU	señorita esmeralda
Osteichthyes	Acanthuriformes	Sciaenidae	*Totoaba macdonaldi*	VU	totoaba
Reptilia	Squamata	Teiidae	*Aspidoscelis catalinensis*	VU	huico de isla Santa Catalina, huico de la Isla Santa Catalina
Reptilia	Squamata	Teiidae	*Aspidoscelis labialis*	VU	huico de Baja California
Reptilia	Squamata	Teiidae	*Aspidoscelis martyris*	VU	huico de San Pedro Martír
Reptilia	Testudines	Cheloniidae	*Chelonia mydas*	EN	parlama, tortuga marina verde del Atlántico
Reptilia	Crocodylia	Crocodylidae	*Crocodylus acutus*	VU	caimán, caimán aguja
Reptilia	Squamata	Viperidae	*Crotalus catalinensis*	CR	cascabel de Santa Catalina, víbora sorda
Reptilia	Squamata	Viperidae	*Crotalus stejnegeri*	VU	cascabel cola-larga, víbora cascabel cola larga
Reptilia	Squamata	Iguanidae	*Ctenosaura conspicuosa*	VU	garrobo de Isla San Esteban, iguana
Reptilia	Squamata	Iguanidae	*Ctenosaura nolascensis*	VU	garrobo de Isla San San Pedro Nolasco
Reptilia	Testudines	Cheloniidae	*Eretmochelys imbricata*	CR	perico, tortuga carey
Reptilia	Testudines	Testudinidae	*Gopherus evgoodei*	VU	
Reptilia	Testudines	Kinosternidae	*Kinosternon vogti*	CR	casquito de Vallarta
Reptilia	Testudines	Cheloniidae	*Lepidochelys kempii*	CR	tortuga lora
Reptilia	Testudines	Cheloniidae	*Lepidochelys olivacea*	VU	tortuga golfina, tortuga marina escamosa del Pacífico
Reptilia	Squamata	Colubridae	*Masticophis anthonyi*	CR	culebra chirriadora de Isla Clarion, culebra de la

Class	Order	Family	Scientific name	RLTS category	Common name
					Isla Clarión
Reptilia	Squamata	Iguanidae	*Sauromalus hispidus*	EN	chacahuala de la Isla Ángel de la Guarda
Reptilia	Squamata	Iguanidae	*Sauromalus klauberi*	VU	chacahuala de la Isla Santa Catalina, iguana de pared manchada
Reptilia	Squamata	Iguanidae	*Sauromalus varius*	VU	chacahuala de la Isla San Esteban, iguana de oared de piebald
Reptilia	Squamata	Natricidae	*Thamnophis melanogaster*	EN	culebra de agua, culebra de agua de panza negra
Reptilia	Testudines	Emydidae	*Trachemys ornata*	VU	jicotea, jicotea occidental
Reptilia	Squamata	Phrynosomatidae	*Urosaurus clarionensis*	VU	lagartija arbolera de Clarion, lagartija de árbol de la Isla Clarión
Reptilia	Squamata	Phrynosomatidae	*Uta palmeri*	VU	lagartija costado manchado de San Pedro

3. National Estimates for subcriterion A1

To estimate the Warm Temperate Northeast Pacific mangrove ecosystem extent in 1970, we gathered reliable information on the mangrove area for each country within the province around this period. In this case, the extent of the province is in a single country (Mexico) where the National Commission for the Knowledge and Use of Biodiversity (CONABIO), supports the Mexican Mangrove Monitoring System project, which produced a map of the extent of mangroves for the 1970s with historical aerial photos. Additionally, the SMMM has produced maps of the extent of mangrove cover in the province for the years 2005, 2010, 2015 and 2020. Table (a) shows the references to such data accessible through the geoportal: http://geoportal.conabio.gob.mx/

Table a. List of references to the maps produced by CONABIO of the Warm Temperate Northeast Pacific province.

Year	Mangrove Area (km^2)	Reference
1970	1978.95	CONABIO, 2013a. ‘Distribución de los manglares en México en 1970/1980’, escala: 1:50000. Edición: 1. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Proyecto: GQ004, Los manglares de México: Estado actual y establecimiento de un programa de monitoreo a largo plazo: 2da y 3era etapas. México, DF.
2005	1865.46	CONABIO, 2013b. 'Mapa de uso del suelo y vegetación de la zona costera asociada a los manglares, Region Pacífico Norte (2005).', escala: 1:50000. edición: 1. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Proyecto: GQ004, Los manglares de México: Estado actual y establecimiento de un programa de monitoreo a largo plazo: 2da y 3era etapas. México, DF.
2010	1822.68	CONABIO, 2013c. 'Mapa de uso del suelo y vegetación de la zona costera asociada a los manglares, Region Pacífico Norte (2010).', escala: 1:50000. edición: 1. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Proyecto: GQ004, Los manglares de México: Estado actual y establecimiento de un programa de monitoreo a largo plazo: 2da y 3era etapas. México, DF.
2015	1873.83	CONABIO, 2016. 'Mapa de uso del suelo y vegetación de la zona costera asociada a los manglares, Región Pacífico Norte (2015).', escala: 1:50000. edición: 1. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Sistema de Monitoreo de los Manglares de México (SMMM). Ciudad de México, México
2020	1810.36	CONABIO, 2021. 'Distribución de los manglares en México en 2020', escala: 1:50000. edición: 1. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Sistema de Monitoreo de los Manglares de México (SMMM). Ciudad de México, México