

Western Baja California Lagoons and Coastal Waters IMMA

Summary, continued.

for mating, calving, and nursing. While the Eastern North Pacific (ENP) population of gray whales that migrates to the IMMA from the West coast of North America is considered Least Concern (LC) on the IUCN Red List of Threatened Species, the Western gray whale subpopulation that migrates from feeding grounds off the Kamchatka Peninsula and Sakhalin Island is Endangered (EN) on the IUCN Red List. Individuals of both populations may interbreed in this reproductive area. The IMMA also supports blue whales (*Balaenoptera musculus*) and a diverse array of other marine mammals, including four species of pinnipeds, four species of dolphins, and four species of baleen whale.

Description:

The IMMA includes two lagoons and one lagoon complex: Ojo de Liebre Lagoon, San Ignacio Lagoon and the Bahía Magdalena-Bahía Almejas (BM-BA) Lagoon Complex. The area also includes an ocean corridor that connects the three lagoon complexes.

The Ojo de Liebre lagoon is located in the northwest of Baja California Sur, between 27°35' and 27°55' North latitude and 113°58' and 114°20' W longitude. It has an approximate area of 446 km² and irregular bathymetry, with many shallows and flat islands that are exposed during low tides. This lagoon, which empties into Sebastián Vizcaino Bay, is generally shallow but has channels more than 20 meters deep near the mouth. It is characterized by being a hypersaline-type lagoon because it does not receive



Area Size

17 834 km²

Qualifying Species and Criteria

Gray whale – *Eschrichtius robustus*

Criterion B (2); C (1, 3)

[Western gray whale subpopulation]

Criterion A; B (2); C (1, 3)

Blue whale – *Balaenoptera musculus*

Criterion A

Marine Mammal Diversity

Balaenoptera edeni, *Megaptera novaeangliae*,

Orcinus orca, *Tursiops truncatus*,

Delphinus delphis, *Lagenorhynchus obliquidens*,

Arctocephalus philippii townsendi,

Zalophus californianus, *Mirounga angustirostris*,

Phoca vitulina

Summary

The Western Baja California lagoons and coastal waters IMMA includes two separate lagoon features, and one lagoon complex: Ojo de Liebre Lagoon, San Ignacio Lagoon, and the Bahía Magdalena-Bahía Almejas (BM-BA) complex. The area also includes an ocean corridor that connects these three sites. Two gray whale (*Eschrichtius robustus*) populations use this IMMA during the Northern Hemisphere winter months

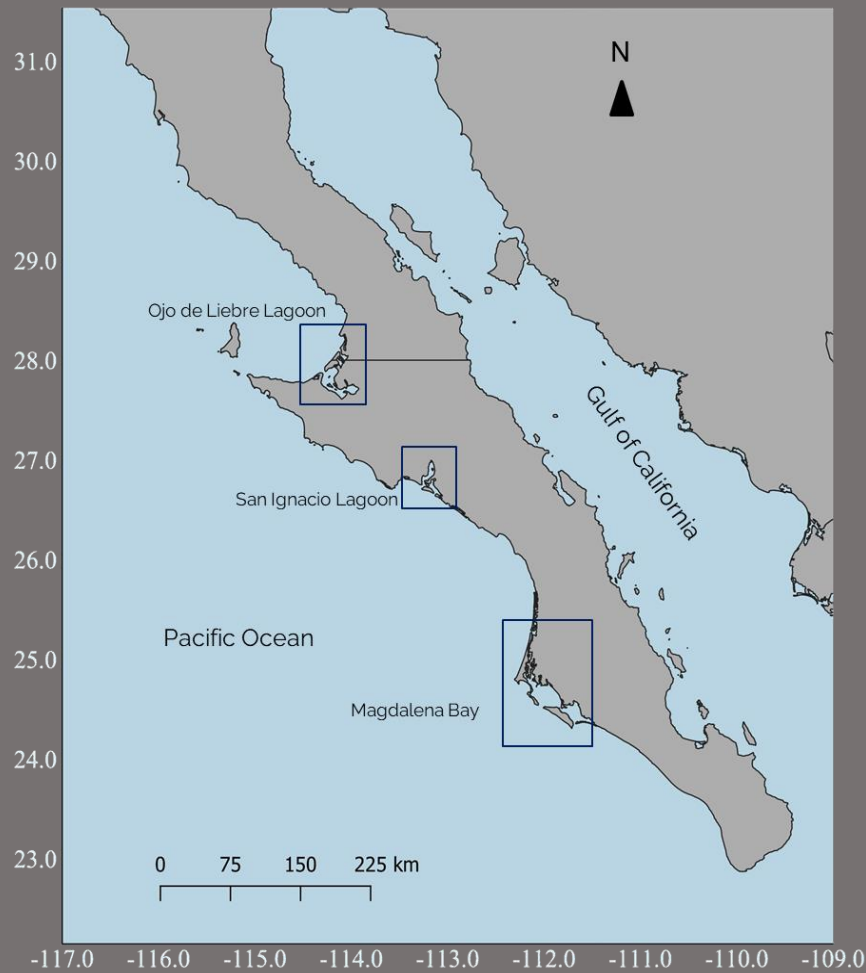


Figure 1: Gray whale's (*Eschrichtius robustus*) breeding and calving lagoons.

any contribution of fresh water and because it experiences a high degree of evaporation due to wind and insolation (Alvarado et al., 1986).

The San Ignacio Lagoon (LSI), with an area of 175 km² located between 27°12' and 26°27' north latitude and -113°16' and -112°50' west longitude, within the polygon which includes the "El Vizcaíno" Biosphere Reserve. The lagoon is surrounded by three mountain ranges, Sierra Santa Clara to the west, Sierra San Francisco to the north, and the Sierra de la Giganta to the east. At the same time, to the south, it is protected from the Pacific Ocean by Ana Island (INAFED, 2018). The interior of the lagoon is connected to the ocean through a system of channels, the main one measuring approximately 680 m wide with a maximum depth of six meters; this

channel expands and increases in depth as it enters the lagoon; so that approximately four kilometers from Punta Bronaugh it reaches a width of two kilometers with a depth of 9-14 m (Bermúdez-Almada, 2003).

The Bahía Magdalena-Bahía Almejas (BM-BA) lagoon complex begins between 24°16', 25°45' north latitude and between 111°20' and 112°18' west longitude, approximately 150 km south-southeast of LSI. The Canal de Santo Domingo or Canal Zone (137 km²) is in the northwest, Bahía Magdalena (883 km²) is in the centre of the complex, and Bahía Almejas is to the southeast (370 km²) (Álvarez-Borrego et al., 1975). The complex is protected from the Pacific Ocean by three islands: Magdalena, Margarita and Creciente.

Criterion A: Species or Population Vulnerability

The western subpopulation of gray whales is considered Endangered (EN) on the IUCN Red List of Threatened Species with a 2016 estimate of between 51 and 72 reproductive females (Cooke et al., 2018). Western gray whales feed in the Okhotsk Sea off Sakhalin Island, Russia, and in nearshore waters of the south-eastern Kamchatka Peninsula (southwestern Bering Sea). Historically this population was believed to migrate to breeding grounds in Asian waters (Japan/Korea), however it is unknown whether these wintering grounds are still used, and Cooke et al. (2019) estimated the proportion of the Sakhalin feeding population that migrates to the Eastern North Pacific (ENP) breeding grounds to be 45–80%. Although they have the opportunity to interbreed with Eastern North Pacific gray whales in this IMMA, they still appear to be genetically and demographically distinct (Cooke et al., 2018).

Blue whales are listed as Endangered (EN) on the IUCN Red List of Threatened Species (Cooke, 2018). The presence of blue whales on the western coast of Baja California has been known since the mid-nineteenth century when some specimens were captured (Scammon, 1874). From 1913 to 1914 Norwegian whalers hunted 83 blue whales outside Magdalena Bay. A decade later, in the same area, they captured almost half of all the blue whales hunted in the Northeast Pacific (Tonnessen & Johnsen, 1982). Blue whales are currently documented in locations near the western coast of Baja California during all seasons of the year. They were observed off the southwestern coast of Baja California in February, outside Magdalena Bay in June, and along the entire west coast of Baja California, in June, August, and October. In addition, according to reports from the Norwegian whaling fleet, the months of March to June represented the

best whaling season along this coast, where 989 blue whales were hunted between 1924–1929 and 1935 (Tonnessen & Johnsen, 1982). The months and locations of these hunts coincide with more recent observations of blue whale aggregations (Gendron, 2002).

Criterion B: Distribution and Abundance

Sub-criterion B2: Aggregations

Eastern North Pacific (ENP) gray whales' winter in the lagoons and adjacent waters of Baja California, Mexico, and then migrate northward in spring along the west coast of North America to feed in the Bering and Chukchi Seas during summer (Rice & Wolman, 1971). Photographic and genetic evidence indicates that at least 54 gray whales migrate from the feeding ground in Russia to the eastern Pacific and the wintering grounds encompassed by this IMMA in Baja California (Weller et al., 2012; Mate et al., 2015; Urbán et al., 2012). These whales represent close to 20% of the known Sakhalin Island gray whale population (Martínez-Aguilar et al., 2022).

Criterion C: Key Life Cycle Activities

Sub-criterion C1: Reproductive Areas

Gray whales from both the Eastern North Pacific (ENP) and the Western Gray Whale subpopulation spend about 3 months in the Mexican wintering areas, where they mate and give birth between December and April (Jones & Swartz, 1984; Swartz, 1986). Gray whale calving areas along the west coast of the Baja California Peninsula are Laguna Ojo de Liebre (Scammon's Lagoon); Laguna Guerrero Negro (at times when its entrance is open); Laguna San Ignacio; and Bahía Magdalena and adjacent waters (from Estero Las Animas to Bahía Almejas). About 70% of documented mothers with calves stay at Laguna Ojo de Liebre, 14% in Laguna San Ignacio and 16% in the Bahía Magdalena-Bahía Almejas (BM-BA)



Figure 2: Gray whale (*Eschrichtius robustus*) mother and calf. San Ignacio Lagoon. Photo credit: Sergio Martínez-Aguilar.

complex. The average duration in a breeding lagoon for adults is 10 days, although females with calves may stay a month or longer in one area (Urban et al., 2003). Most whales have departed from the Baja lagoons by late March. Genetic studies suggest interbreeding between Eastern and Western populations during the winter breeding season (Brüniche-Olsen et al., 2018; Lang et al., 2021).

Sub-criterion C3: Migration Routes

Individuals of both the eastern and western feeding populations have been photo-identified in the breeding lagoons in Mexico (Weller et al., 2012). The southward migration initiates in the autumn, led by females in late pregnancy, followed by adults and immature females, and lastly by immature males.

The trip averages 2 months, during which mating begins and continues in the winter congregation areas (Jones & Swartz, 1984; Urbán et al., 2021). The gray whales using the three lagoon (systems) travel following the coastline between lagoons during the course of the breeding season. Between 2012 and 2022, 42% of mothers with calves that were photo-identified in Bahía Magdalena were recaptured later in the season in Laguna San Ignacio (Annual Reports Laguna San Ignacio Ecosystem Science Program, 2022). As such, the Pacific coastal portions of this IMMA serve as an important migratory corridor for gray whales during the breeding season.



Figure 3: Gray whale (*Eschrichtius robustus*) in Bahía Magdalena. Photo credit: Ma. Laura Macías PRIMMA-UABCS.

Supporting Information

Alvarado, J., Galindo, J., Iwadane, M. and Migoya, R. 1986. Evaluación de los Parámetros Ambientales y su Relación con la Distribución y Movimientos de la Ballena Gris *Eschrichtius robustus* Lacepede 1804 en la Laguna Ojo de Liebre, BCS México.

Annual Reports of the Laguna San Ignacio Ecosystem Science Program. 2022.

<https://www.sanignaciograywhales.org/research/publications/>.

Bermúdez-Almada, B. 2003. Ficha Informativa de los Humedales Ramsar (FIR): Laguna Ojo de Liebre. 9 p. Recuperado de: http://ramsar.conanp.gob.mx/docs/sitios/FIR_RAMSAR/Baja_California_Sur/Laguna_San_Ignacio/Laguna%20San%20Ignacio.pdf.

Brüniche-Olsen, A., Urban, J., Vertyankin, V.V., Godard-Coding, C.A.J., Bickham, J.W. and DeWoody, J.A. 2018. 'Genetic data reveal mixed-stock aggregations of gray whales in the North Pacific Ocean'. *Biol. Lett.* 14:20180399. Available at: <http://doi.org/10.1098/rsbl.2018.0399> (Accessed 09 June, 2022).

Cooke, J.G. 2018. *Eschrichtius robustus*. The IUCN Red List of Threatened Species 2018: e.T8097A50353881. <https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T8097A50353881.en>. Accessed on 13 July 2022.

Cooke, J.G. 2018. *Balaenoptera musculus*. The IUCN Red List of Threatened Species 2018doi: <http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2477A50226195.en>.

- Cooke, J.G., Taylor, B.L., Reeves, R. and Brownell, R.L. Jr. 2018. *Eschrichtius robustus* (western subpopulation). The IUCN Red List of Threatened Species 2018: e.T8099A50345475. doi: 10.2305/IUCN.UK.2018-2.RLTS.T8099A50345475.en.
- Gendron, D. 2002. Population ecology of the blue whales, *Balaenoptera musculus*, of the Baja California Peninsula. Ph.D. thesis, Centro de Investigación Científica y de Educación superior de Ensenada (CICESE), Mexico. 112 pp.
- Guerrero Ruíz, M., Urbán R.J. and Rojas Bracho, L. 2006. Las ballenas del Golfo de California. México. Secretaría de Medio Ambiente y Recursos Naturales; Instituto Nacional de Ecología. 537 p.
- Jones, M.L. and Swartz, S.L. 1984. 'Demography and phenology of gray whales and evaluation of whale-watching activities in Laguna San Ignacio, Baja California Sur, Mexico', in *The Gray Whale, Eschrichtius robustus*, eds Jones, M.L., Swartz, S.L., and Leatherwood, S. (Cambridge: Academic Press Inc), 309–374. doi: 10.1016/b978-0-08-092372-7.50020-0.
- Lang, A. R., Weller, D. W., Burdin, A. M., Robertson, K., Sychenko, O., Urbán, J. R., Martínez-Aguilar, S., Pease, V. L., LeDuc, R. G., Litovka, D. I., Burkanov, V. N., & Brownell, R. L. Jr. 2022. Population structure of North Pacific gray whales in light of trans-Pacific movements. *Marine Mammal Science*, 38(2), 433-468 <https://doi.org/10.1111/mms.1287536>.
- Leatherwood, S., Reeves, R.R., Perrin, W.F., Evans, W. E. and Hobbs, L. 1982. Whales, dolphins, and porpoises of the eastern North Pacific and adjacent arctic waters: A guide to their identification. Dover publications Inc. New York. 245 pp.
- Mate, B.R., Yu Ilyashenko, V.Y., Bradford, A.L., Vertyankin, V.V., Tsidulko, G.A., Rozhnov, V.V., et al. 2015. 'Critically endangered western gray whales migrate to the eastern North Pacific'. *Biol. Lett.* 11:20150071. doi:10.1098/rsbl.2015.0071.
- Martien, K. K., Taylor, B. L., Lang, A. R., Clapham, P. J., Weller, D. W., Archer, F. I., and Calambokidis, J. (2023). The migratory whale herd concept: A novel unit to conserve under the ecological paradigm. *Marine Mammal Science*, 1–26. <https://doi.org/10.1111/mms.13026>.
- Martínez-Aguilar, S.J. Urbán R., Weller, D., Tyurneva, O., Bradford, A., Burdin, A., Lang, A., Swartz, S., Sychenko, O., Vilorio-Gómora, L., Hernández, E. and Yakovlev, Y. 2022. 'Gray whale (*Eschrichtius robustus*) migratory movements between the western North Pacific and the Mexican breeding grounds: 2022 Update'. Paper SC/68d/CMP/09 presented to the IWC Scientific Committee, Available at www.iwcoffice.org.
- Rice, D.W. and Wolman, A.A. 1971. 'The Life History and Ecology of the Gray Whale (*Eschrichtius robustus*)'. ASM, Special Publication 3. Lawrence: American Society Mammalogist, 142.
- Scammon, C.M. 1874. *The Marine Mammals of the North-western Coast of North America: Described and Illustrated Together with an Account of the American Whole-fishery*. (Carmany), (Putnam).
- Swartz, S.L. 1986. 'Gray whale migratory, social and breeding behavior'. *Rep. Int. Whaling Comm.* 8, 207–229.
- Tønnessen, J.N. and Johnsen, A.O. 1982. *The history of modern whaling*. Berkeley and Los Angeles.

Urbán, R.J., Rojas-Bracho, L., Pérez-Cortéz, H., Gómez-Gallardo, A.U., Swartz, S., Ludwing, S., et al. 2003. 'A review of gray whales on their wintering grounds in Mexican waters. J. Cetacean Res. Manag. 5, 281–295.

Urbán R.J., Weller, D.W., Tyurneva, O., Swartz, S., Bradford A., Yakovlev, Y., Sychenko, O., Rosales N., Martínez, S., Burdin, A.M., Gómez-Gallardo U.A. Yakovlev Y.M., Tyurneva O.Y. and Tombach Wright. 2012. 'Report on the photographic comparison of the Sakhalin Island and Kamchatka Peninsula with the Mexican gray whale catalogs'. Paper SC/65a/BRGo4 presented to the IWC Scientific Committee, Available at www.iwcoffice.org.

Urbán, R.J., Jiménez-López, E., Guzmán, H.M. and Vilorio-Gómora, L. 2021. Migratory Behavior of an Eastern North Pacific Gray Whale From Baja California Sur to Chirikov Basin, Alaska. *Front. Mar. Sci.* 8:619290. doi: 10.3389/fmars.2021.619290.

Weller, D.W., Klimek, A., Bradford, A.L., Calambokidis, J., Lang, A.R., Gisborne, B., Burdin, A.M., Szaniszlo, W., Urbán, J., Gomez-Gallardo Unzueta, A., Swartz, S. and Brownell, R.L., Jr. 2012. 'Movements of gray whales between the western and eastern North Pacific. *Endangered Species Research* 18:193-199.

Acknowledgements

We would like to thank the participants of the 2022 hybrid IMMA Regional Expert Workshop for the identification of IMMAs in the South East Tropical and Temperate Pacific Ocean. Funding for the identification of this IMMA was provided by the Global Ocean Biodiversity Initiative funded by the German government's International Climate Initiative (IKI). Support was also provided by Whale and Dolphin Conservation, the Promar Foundation, and the Tethys Research Institute.

