



# Laguna San Ignacio Ecosystem Science Program

A Project of the Ocean Foundation in Baja California Sur, Mexico

## LSIESP NEWS – SUMMER 2021

### LSIESP Researchers Selected to Present Research at SMM Conference

We are pleased to announce that several LSIESP Researchers and their collaborating colleagues have been selected to present their gray whale research findings at the forthcoming Society for Marine Mammalogy's 24<sup>th</sup> Biennial Conference in Palm Beach Florida in December 2021 (<https://marinemammalscience.org/conference/>).

Seven presentations by LSIESP researchers and their colleagues will be presented as oral talks or posters at the SMM 2021 conference. All of these present findings that are relevant to the ongoing gray whale Unusual Mortality Event (UME) that began in winter 2019 and continued through summer 2021. Early observations by LSIESP Researchers in Laguna San Ignacio and Bahía Magdalena detected a significant decrease in the number of calves seen in these areas, along with increases in the number of “skinny” whales during the 2018 to 2021 winters. Aerial photogrammetry from UAV-Drones obtained high resolution photographs of individual whales in Laguna San Ignacio, including female-calf pairs, confirming trends of decreasing body mass, and declining body condition which are believed to have contributed to the increased mortality and stranding of gray whales throughout their ranges during the UME ( see <https://www.sanignaciograywhales.org/new-publication-poor-body-condition-associated-with-gray-whale-mortality-event/>) .

We congratulate our researchers and their colleagues for being recognized by the prestigious Society for Marine Mammalogy, and for their collective contributions that grow our body of knowledge of gray whale biology, behavior, a response to environmental changes. Please take the time to review their presentation Abstracts for more details on these important findings.

### New Doctoral Graduate

We are pleased to announce that LSIESP acoustic researcher Ludovic Tenorio's will present his oral defense to complete his Ph.D. from Scripps Institution of Oceanography on July 29, 2021. Ludovic also recently published in the on-line Journal of the Acoustical Society of America (JASA) a new paper entitled “Using anisotropic and narrow band ambient noise for continuous measurements of relative clock drift between independent acoustic recorders” based on his

research in Laguna San Ignacio (<https://doi.org/10.1121/10.0004996>). Ludovic's major professor and academic advisor, Dr. Aaron Thode and his graduate students have researched marine acoustics and gray whale vocalizations in Laguna San Ignacio since 2005. Ludovic has accepted an National Research Council (NRC) Post-Doctoral position at the NOAA National Marine Fisheries Service's Southeast Fisheries Science Center in Miami, Florida beginning this fall. We wish him all the success in this next episode of his career.

### **Your Support Makes It All Possible!**

It is the generous ongoing support of our individual and organizational donors that make possible this research and the new knowledge that it produces, and also provides the support for our researchers as they continue to build their careers as our next generation of marine scientists and conservationists. If you are already a supporter, we thank you! If you are new to our program, we urge you to become a supporter of the Laguna San Ignacio Ecosystem Science Program's gray whale research efforts. Please visit our donation page on our website at:

<https://www.sanignaciograywhales.org/donate/>

*Society for Marine Mammalogy -2021*  
**CONFERENCE PRESENTATION ABSTRACTS**

**Floryser Ronzón Contreras (Lead Author)**, Sergio Martinez Aguila, Steven Swartz, Jorge Urbán, and Lorena Viloría Gomora.

**Title:** What we know about skinny whales: Assessment of Gray Whale Poor Body Condition During 2018-2021 Winter Breeding Seasons in San Ignacio Lagoon and Magdalena Bay, BCS, México

**Abstract:** The Eastern North Pacific gray whale (*Eschrichtius robustus*) population has successfully recovered from mass exploitation during the 19th and early 20th centuries. However, during the 2019-2021 unusual mortality event, many stranded whales were observed in poor Body Condition (BC). Assessing BC during the winter breeding season can be helpful to understand their nutritional condition in the summer feeding season around the Bering, Chukchi, and Beaufort Seas. Evaluation of BC is important for a better understanding the individual health and the overall population. This study was undertaken in two of the three most important areas for gray whale reproduction and breeding: San Ignacio Lagoon (SIL) and Magdalena Bay (BM). We used a non-invasive evaluation method developed for the Western North Pacific gray whales to assess BC. Digital photographs of the whales post-cranial, scapular, and dorsal areas were assigned a numerical score in three categories (good, fair, poor). Gray whale photographs were analyzed as two separate reproductive-sex groups: Females with calves (Fc), and Single whales (S) that could be a male or a female without a calf. The poor BC proportion for Fc in SIL during 2018-2021 were 2.5% (n=2), 0%, 5.5% (n=3), and 0%, respectively. For S, the poor condition whales increased from 8.2% (n=17), to 23.6 (n=125), 30% (n=150), and 24.4% (n=150), respectively. In BM from 2018-2020, poor condition Fc were, 3.7% (n=1), 7.6% (n=1), and 0%, respectively. For S, the poor condition were 24.3% (n=63), 41.3% (n=112), and 38.2% (n=143), respectively. While Fc did not reflect an increase in the poor BC, their abundance in LSI decreased more than 50% compared to previous years, and more than 50%, compared to the average of Fc photo-identified from 2011-2017 (n=226) to 2018-2021 (n=57). For S, the proportion of whales in poor BC is the highest recorded in the last 10 years.

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**Patricia Casanovas (Lead Author)**, Sergio Martinez Aguilar, Steven Swartz, Jorge Urban, Monica Farriols, Andrés González, and Jack William Daniel Heaven.

**Title:** Post-mortem macroscopic examination and discussion of juvenile and calf of *Eschrichtius robustus* stranded in Baja California (Mexico) and possible correlation towards nutritional status of Gray Whale population in 2020 Unusual Mortality Event 2020

**Abstract:** Occasional death and consequent stranding of cetaceans is part of their life cycle, however in the current case of *Eschrichtius robustus* (Gray Whale) recently increased mortality there has been established an unusual mortality event (UME). 215 whales stranded along the North Pacific Coast of North America in 2019, which caught the attention of the U.S. National Oceanic and Atmospheric Administration to declare a Gray Whale UME (NOAA 2020). Several institutions deployed their teams along the Canadian, USA and Mexican Pacific coasts to gather relevant information about the status of this species. *E. robustus* reproductive cycle takes part in the Pacific Coast of Baja California, Mexico. San Ignacio Lagoon and Ojo de Liebre Lagoon are two of the favorite areas for Gray Whales to gather in Mexican waters, and it is there where a team from Laguna San Ignacio Ecosystem Science Program (LSIESP) and Marine Mammal Investigation Program (PRIMMA) from Universidad de Baja California Sur (UABCS) examined carcasses of stranded individuals of *Eschrichtius robustus*. Date, geographical location, sex, age, morphometrics, nutritional status, Smithsonian score, scavenging, human interaction signs, blubber characteristics and, if possible due to decomposition status, anatomopathological findings were recorded. In this study we will specifically describe the macroscopic changes found in the anatomy of two stranded dead animals, a juvenile and a calf, whose carcasses were examined anatomopathologically given their Smithsonian score of 3 and 2, respectively, where we found significant multiorganic fat depletion, malnutrition signs, possible findings related to oil spill, cardiac abnormalities, and a post mortem human interaction. These post-mortem findings could unveil information from both individuals and population, explaining possible ethiology of death on each individual and an initial correlation between the increase in mortality and nutritional status of the *E. robustus* population.

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**Sergio Martinez Aguilar (Lead Author)**, Patricia Casanovas, Andrés González, Monica Farriols, Fabián Castillo-Romero, Everardo Meléndez, Noe López-Paz, Steven Swartz, Lorena Viloria Gomora, Floryser Ronzón Contreras, Minerva Valerio-Conchas, and Jorge Urban R.

**Title:** “Gray whale stranding records in Mexico during the Unusual Mortality Event (UME) 2019-2021.”

**Abstract:** Unusual Mortality Events (UME) occur when mortalities increase above an average annual rate. In 2019 the U.S. National Oceanic and Atmospheric Administration declared a gray whale UME along the North Pacific coast of North America. In Mexico, there were 217 gray whale stranding records between 2019 and 2021 (81, 87 and 49 respectively) The majority of the whales (76.6%) stranded in Ojo de Liebre lagoon and the surrounding areas. Ninety-eight of these whales were females, 76 males, and 43 were of undetermined sex. The age classes of the dead whales were: 94 adults, 50 subadults, 49 yearling whales and 21 calves. The number of strandings is likely an underestimate of actual mortalities, because of: differences in detectability, the dimensions of the area where the gray whales are distributed along the Baja California Peninsula and the differences in search effort conducted, mainly due to COVID-19 restrictions in 2020 and 2021. Even when the examination of some of the stranded whales suggested that a decline in body condition may have contributed to the increase in gray whale mortality, this hypothesis has not

been confirmed due to a high number of carcasses with an advanced decomposition, so the cause of UME for gray whales is still undetermined.

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**L.C. Magallón-Flores (Lead Author)**, S. L. Swartz, J. Urbán R., G. I. Garrido-Fariña, S. Martínez-Aguilar, and L. Viloría-Gómora

**Title:** Area of Adipocytes as indicators of the energy reserve of gray whale *Eschrichtius robustus*, in the Laguna de San Ignacio, Baja California Sur, Mexico.

**Abstract:** Body condition (BC) is an indicator of the physical condition that gives a relative measure of an individual's energy reserves. Therefore, it is considered an indicator of reproductive success and general health. The evaluation of BC can be done through adipocytes, which are cells that store excess energy from food, transforming it into fat. In cetaceans, adipocytes make up a specialized tissue, the blubber. It is known that blubber adipocytes change their cell area in response to modifications in the use and accumulation of energy, dependent on migration and reproduction events. The present study proposes to evaluate the adipocyte area of the gray whale during its reproductive aggregation and to interpret the state of energy reserves as BC. During the 2020 aggregation season, 139 blubber biopsies were obtained, in Laguna de San Ignacio, BCS, Mexico. All were preserved for histological processing, that is, cutting, staining with Hematoxylin-Eosin, and permanently mounted on slides. All the slides were checked and 120 chosen for morphometric analysis. This analysis consisted of taking photomicrographs (10X) in fields with at least 100 adipocytes. After which, the cell area was measured. The analysis represented 65 single individuals, 24 mothers, and 31 calves. It was possible to associate 18 mothers with their respective calf. Preliminary results indicate that 15 single individuals can be classified as normal, 24 acceptable, 25 poor, and 1 unknown. In addition, they reveal a decrease in the area of the mother's adipocytes during the season (41,798 to 17,691  $\mu\text{m}^2$ ), in contrast to an increase in the calves (1,830 to 24,650  $\mu\text{m}^2$ ). However, for both groups it is not possible to define a BC categories (normal  $\bar{x}$  = 31,039  $\mu\text{m}^2$ , SD=4990.43; acceptable  $\bar{x}$  = 3,0268  $\mu\text{m}^2$ , SD=7346.47; poor  $\bar{x}$  = 28,537  $\mu\text{m}^2$ , SD=6828.16). The adipocyte area was a good indicator to evaluate BC.

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**Lorena Viloría Gómora (Lead Author)**, Mariana Hidalgo Reza, Rodrigo Huerta Patiño, Omar Casteñeda García, Steven Swartz, and Jorge Urbán R.

**Title:** Reduction in the number of gray whale calves (*Eschrichtius robustus*) in Bahía Magdalena Complex, BCS, Mexico, 2016-2021”

**Abstract:** The lagoon complex integrated by Bahía Magdalena, Bahía Almejas, and Canal de Santo Domingo, on the west coast of the Baja California peninsula, Mexico, is the southernmost breeding area for the gray whale. In this area, the gray whale mate, give birth and take care of

their calves. The Marine Mammal Research Program, UABCS, has been conducting censuses since 2012, but since 2016, it has allocated more effort for monitoring this area. Between 2016 and 2021, 141 surveys were conducted, including 22 censuses along fixed routes. A photo identification catalog and a database associated with all records have been achieved. Data analysis of these six years showed a seasonal cycle in the number of calves during the winter season, i.e., a gradual increase from January, which reaches a maximum in February and decreases in March. Except for 2018, where the peak was reached in March. Furthermore, it revealed a dramatic decrease in the number of calves. 71 % of the 307 calves registered in six years of monitoring were observed between 2016 and 2017. The annual number of calves change from 110 ( $\pm 20$ ) average per year in 2016 and 2017 to 22 ( $\pm 9$ ) calves per year from 2018 to 2021. In other whale species, reproductive success depends on good body condition and foraging success, among other factors. Therefore, we consider reducing the number of calves in the lagoon complex related to the “skinny whale” syndrome (poor body condition), registered in the last four years (2018-2021).

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**Leigh G. Torres (Lead Author)**, Clara Bird, KC Bierlich, Fredrik Christiansen, Lars Bejder, Jorge Urban R., Fabian Rodríguez-González, Amy Willoughby, and Lisa Hildebrand.

**Title:** Range-wide comparison of gray whale body condition and prey quality reveals contrasting sub-population health characteristics and vulnerability to environmental change.

**Abstract:** A rise in stranded, emaciated eastern North Pacific (ENP) gray whales was declared an unusual mortality event (UME) in 2019. Within the larger ENP population (~25,000 individuals), which primarily forage in the Arctic on benthic amphipods, is a sub-group called the Pacific Coast Feeding Group (PCFG; ~250). The PCFG forages on epibenthic zooplankton in coastal habitats between northern California, USA and British Columbia, Canada. Bomb calorimetry revealed two common PCFG prey species have higher caloric values than the predominant Arctic prey. To determine if the ENP and PCFG populations responded differently to the UME, body condition was compared through drone photogrammetry collected during four years (2017-2020) of PCFG gray whales on their foraging grounds in Oregon, USA (n=129) and gray whales on their breeding grounds in Baja, Mexico (n=298). This analysis revealed (1) whales in Baja were in better body condition than Oregon PCFG whales; (2) concurrently, body condition improved in PCFG whales, while declining in Baja whales; (3) the mean body condition did not change during migration. From these findings we hypothesize that (1) the Baja dataset is mainly composed of ENP whales and few PCFG whales, (2) the UME is primarily impacting ENP whales, (3) PCFG whales typically have lower body condition compared to ENP whales, and (4) energetic costs of migration for gray whales are overall low. Photogrammetry analysis of opportunistic aerial images of Arctic gray whales (n=18) supports hypothesis 3: body condition of PCFG whales (n=30) was significantly lower ( $p=0.01$ ) despite having similar lengths. Synthesized, ENP whales appear to be suffering from reduced Arctic prey availability, while PCFG whales are recovering from poor prey conditions during the “warm blob” event of 2014-2016. Each group balances different energetic tradeoffs, while responding to different environmental forces on their foraging grounds, to ensure sufficient mass gain for population viability.

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**Deborah Fauquier (Lead Author)**, Jorge Urban Ramirez, Lorena Vilorio, Sergio Martínez, Steven Swartz, Stephen Raverty, Paul Cottrell, Sean MacConnachie, Tonya Wimmer, Laura Bourque, Pierre-Yves Daoust, Megan Jones, Stéphane Lair, Marion Jalenques, Matthew Hardy, Hilary Moors-Murphy, Angelia Vanderlaan, Stephanie Ratelle, Brett Gilchrist, Elise Lavigne, Jessica Huggins, Jim Rice, Barbie Halaska, Moe Flannery, Michael Garner, Pdraig Duignan, Kathy Burek Huntington, Frances Gulland Tracey Goldstein, John Calambokidis, Sue Moore, Michael Moore, William McLellan, Alex Costidis, Sarah Sharp, Kimberly Durham, Allison DePerte, Megan Stolen, David Rotstein, Craig Harms, Jason Baker, Kerri Danil, Kate Savage, David Weller, Joshua Stewart, Kristin Wilkinson, Justin Viezbicke, Justin Greenman, Mandy Keogh, Allison Henry, Sean Hayes, Diane Borggaard, Barb Zoodsma, Mendy Garron, Ainsley Smith, Erin Fougères, Blair Mase-Guthrie, Denise Greig, Eric Patterson, Caroline Good, Trevor Spradlin, Sarah Wilkin, and Teresa Rowles

**Title:** Large whale transboundary Unusual Mortality Events: Best practices and investigation through coordination and collaboration.

**Abstract:** Transboundary Unusual Mortality Events (UMEs) have been declared by the United States National Marine Fisheries Service for North Atlantic right whales (*Eubalaena glacialis*, 2017-present) in the Atlantic Ocean and gray whales (*Eschrichtius robustus*, 2019-present) in the eastern North Pacific Ocean. To date, mortality and injury events have been documented for 49 right whales across two countries (Canada and U.S.) and 430 gray whales across three countries (Canada, Mexico, and U.S.). The UME for critically endangered North Atlantic right whales has species-level consequences given that population abundance is estimated to be fewer than 400 individuals. Eastern North Pacific gray whales are not endangered, however recent abundance estimates found a ~24% decrease in the population between 2016 and 2020, which is thought to be an outcome of the UME. Causes of the right whale UME have preliminarily been attributed to entanglements and vessel strikes. Causes of the gray whale UME are undetermined, although some mortality has been linked to killer whale predation, entanglements and vessel strikes, and more tentatively to poor body condition related to ecosystem changes occurring in Arctic feeding areas. Transboundary coordination and collaboration has been essential to document the number of animals affected throughout their range, facilitate consistent sample and data collection protocols, and ensure analysis methods can be used in an integrated way. Members of the UME investigation teams include federal, state, and provincial agencies, tribes, academic, and non-governmental partners. These teams meet monthly and communicate in real-time as needed. Additionally, case reviews have been held annually to discuss findings, refine protocols, and provide information for management. This work would not have been accomplished without the response, collaboration, and dedication of the marine mammal stranding networks in Canada, Mexico, and the U.S.