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GRAY WHALE'S BODY CONDITION IN LAGUNA SAN IGNACIO, B.C.S., MEXICO DURING UNUSUAL MORTALITY EVENT OF 2019-2022: 2023 UPDATE

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Abstract

The evaluation of a whale's body condition provides an indicator of it's health and reproductive condition and is indirectly an indicator of the health of the environment. During the 2023 season in Laguna San Ignacio (LSI), Baja California Sur, Mexico, 618 gray whales were photographed, from which the body condition of 444 single adult whales (male or female without a calf) and 82 mothers with calves (Mc) were evaluated. The percentage of single adult whales with "good body condition" was 70% (n=311), "fair" 21.2% (n=94) and "poor" 8.8% (n=39). The body condition of mothers with calves was 82.9% "good" (n=68), 13.5% "fair" (n=11) and 3.6% "poor' (n=3). The percentage of single whales with "good" and "fair" body conditions increased in 2023 compared to 2019-2022 period, meanwhile, the percentages of whales with "poor" body condition decreased, being the lowest since the Unusual Mortality Event (UME) began in 2019. The percentage of Mc with "fair" and "poor" body condition was the highest from the last 3 years, but the number of Mc observed in 2023 was the highest in the last 5 years. The data suggest an improvement on gray whale´s body condition and increasing reproduction (calving) rate.

Introduction

The Eastern North Pacific (ENP) gray whale population feeds mainly in the summer months in the Bering, Beaufort, and Chukchi seas, and migrates in the fall every year along the North American Pacific Coast to their wintering and breeding areas along the Pacific coast of the Baja California Peninsula, Mexico.

Gray whale´s body condition is an indicator of the success of summer foraging, which in turn allows analyzing trends in reproduction and survival at the individual and population level of the species (Solelade-Lemos *et al*., 2020)

The National Oceanic and Atmospheric Administration (NOAA) declared an Unusual Mortality Event Mortality (UME) beginning in 2019, due to the increase of gray whale stranding throughout their entire range. During a previous UME from1999-2000, and in

the 2019-2022 UME there has been evidence of poor body condition in some of the stranded gray whales (Ronzón-Contreras *et al.,* 2019, 2020, 2021; Valerio-Conchas *et al*., 2022). Stranded gray whales in poor body condition are also observed in some of the carcasses stranded along the Mexican Pacific Coast, (Urbán *et al.*, 2011; Martínez-Aguilar *et al.*, 2022), along with a reduction in the numbers of mother-calf pairs observed in the breeding and calving lagoons in Baja California (LeBoeuf *et al*., 2000; Urbán *et al*., 2003, 2019, 2020, 2021, 2022).

Gray whale body condition in San Ignacio lagoon during the 2023 winter was evaluated from digital photographic images using the method developed for Western North Pacific (WNP) gray whales (Bradford *et al.*, 2012; Weller *et al.*, 2002).

Method

Digital photographs of individual whales' head, scapula and flank were taken from a small boat (24 feet) inside of San Ignacio lagoon during the 2023 winter season. Each of these body parts was assigned a numerical score as "good", "fair" or "poor", depending upon the degree of loss of body fat that is found typically on a healthy individual (Bradford *et al.*, 2012; Weller *et al.*, 2002) (Fig. 1).

Results

Of the 618 gray whales photographed in 2023, body condition was evaluated for 526 individuals: 444 single adult whales (male or female without a calf) and 82 mothers with calves (Mc). The percentage of single whales with "good" body condition was 70% (n=311), "fair" 21.2% (n=94) and "poor" condition 8.8% (n=39). For the Mothers with calves, "good", "fair" and "poor" condition, were 82.9% (n=68), 13.5% (n=11) and 3.6% (n=3) respectively (Table 1).

Discussion

During the UME of 1999-2000 some gray whales were seen with poor body condition (i.e., skinny whales) and considered an indicator of nutritional stress and food resource limitation (Gulland et al., 2005). Following this UME the condition of the whales improved during the period from 2008 and 2011 to the percentage of single adult whales with a poor body condition at only between 7.6% (2009) and 4.9% (2011) (Ronzón-Contreras *et al.,* 2020). However in 2018, before the UME of 2019-2022, the percent of poor condition whales observed in Laguna San Ignacio increased to 8.2%, indicating the beginning of a a trend of declining body condition. Body condition for single adult whales observed in Laguna San Ignacio continued to decline for the next four winters: from 8.2% in 2018 percentage of poor condition single whales increased to 23% in 2019, 30% in 2020, 24% in 2021, 19.5% in 2022, and now 8.8% in 2023, the lowest percent of "poor" condition single adult whales since 2018.

For the 2023 percentage of single adult whales with a good body condition was 70%, an increase compared to the 2019-2021 period, and has been the been the highest percent since the UME started. Similarly, single whales in "fair" and "poor" conditions (21.2% and 8.8% respectively) decreased in 2023 and are the lowest percentages observed during the last five winters. (Figure 2). This suggests that a slow recovery has been progressing since 2021, but this recovery could be due to multiple different factors: the deaths of whales with suffering from fatal nutritional stress; the ENP population suffered a reduction from 27,000 to 16650 whales (Eguchi *et al*., 2022) during the current UME, and/or the food resources have been reduced and the available resources are not enough for the number of gray whales (the carrying capacity "K") in the population. Additional wintering and summer feeding areas need to be investigated to understand if this trend is local or is occurring throughout the range of ENP gray whale population.

Observations of Mother whales with calves in Laguna San Ignacio in 2023 reflected a high percentage of "good" body condition (82.9%), but not the highest in the previous five winers and ranged from 70% to 90% (Fig. 3, Table 1). In addition, the percentage of females with calves in "fair" condition is the highest from the last 3 years, and some mothers with calves showed "poor" condition, suggesting that the body condition of breeding females may be declining. This could be due to the high numbers of mothers with calves observed in 2023 (twice than 2022), that may not in the best condition, but their energetic reserves were sufficient to bring a new calf to term and successfully give birth. It is not known if these females will have sufficient energy reserves post-partum to complete the spring northward migration to the summer feeding areas.

Changes in environmental conditions are likely to affect whale body conditio through a direct impact on seasonal production of whale prey resources sources throughout their range (Blanchard *et al*., 2019; Burnham and Duffus, 2018; Feyrer and Duffus, 2015). Additional research on the correlation between environmental changes and gray whale prey production in relation to the body condition will aid our understanding of the effect of these changes on the ENP gray whale population during 2023 and in the future.

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Tables and Figures

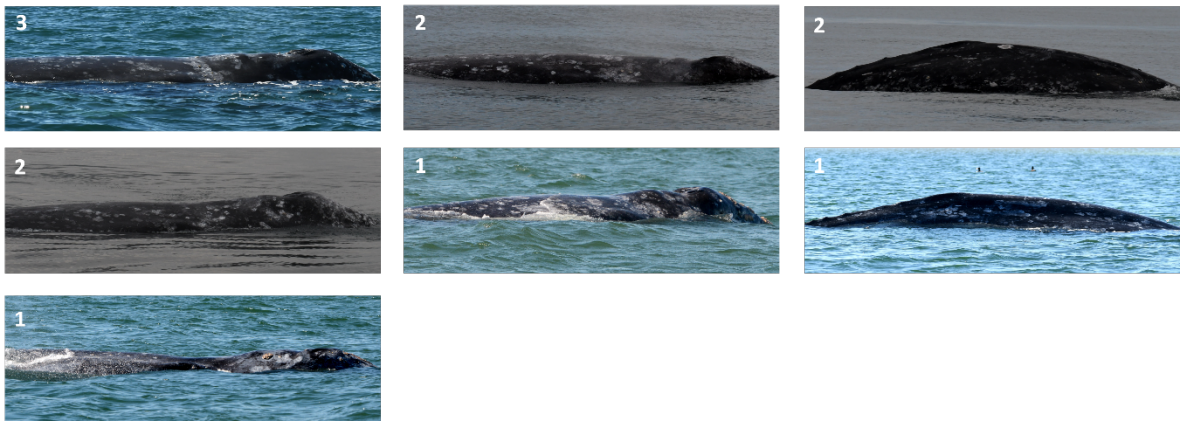

Figure 1. Example of the values assigned to determine body condition for the postcranial area (head), scapula and dorsal-flank. The highest values indicate the best condition.

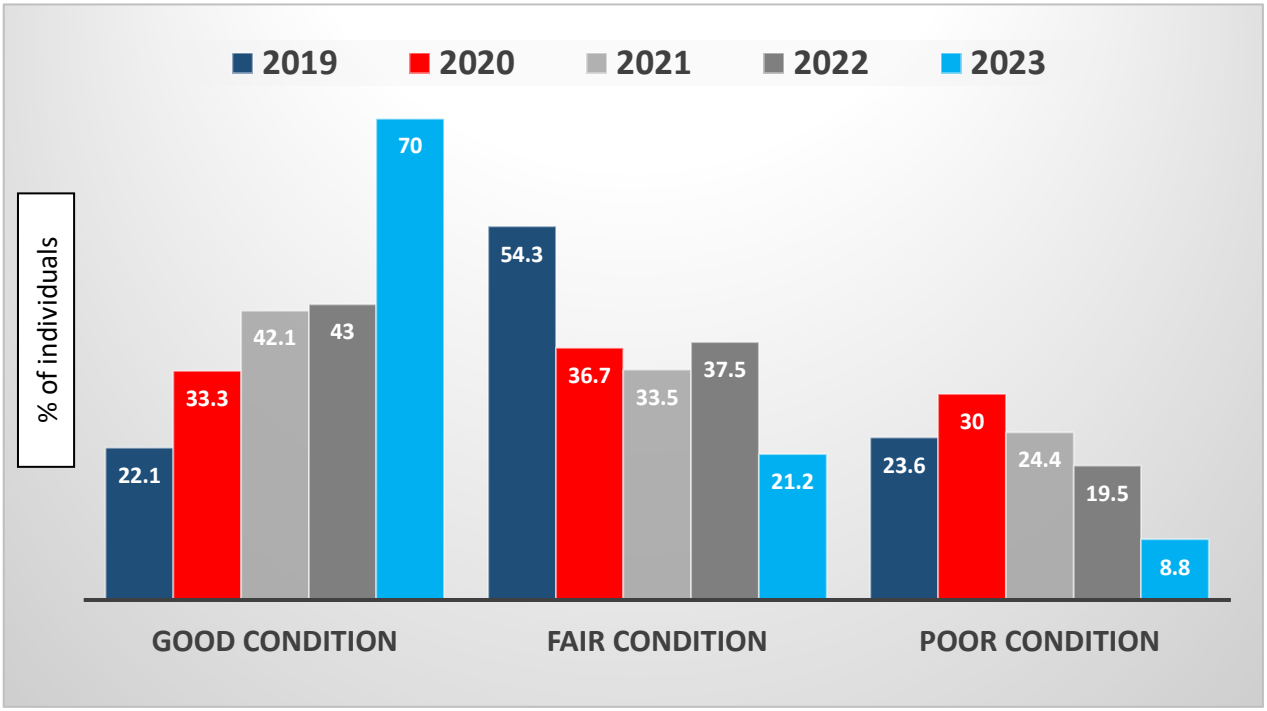

Figure 2. Percentage of single adult whales by body condition categories during 2019-2023

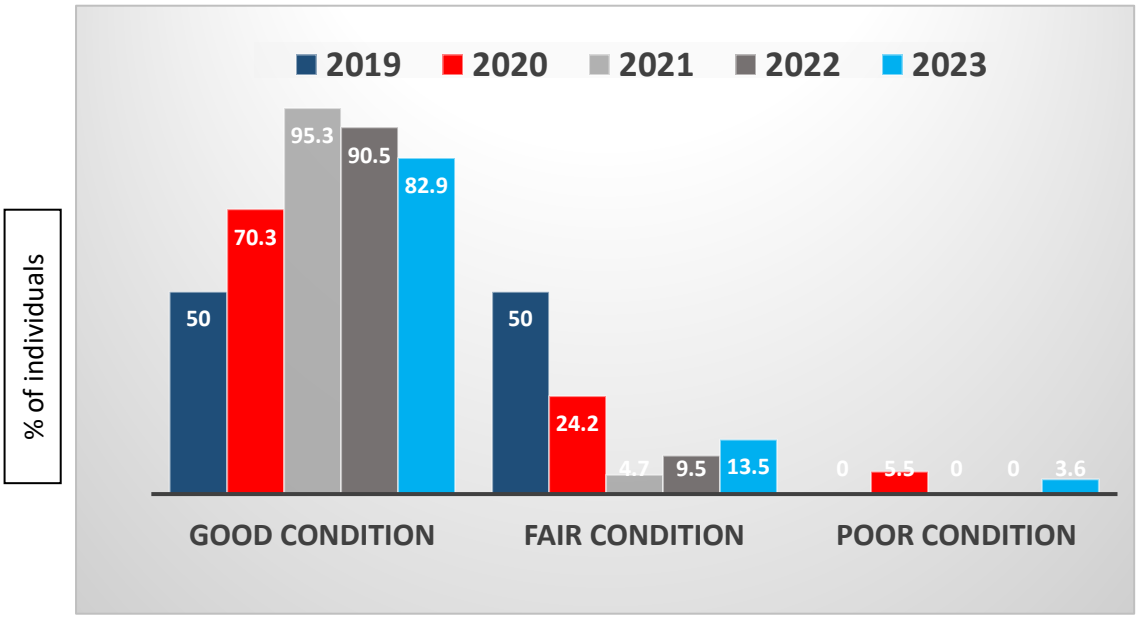

Figure 3. Percentage of Females with calf by body condition categories during 2019-2023

Table 1. Number and percentage of gray whales by body condition category and group type (Mc pairs and Single adult whales) from 2019 to 2023

Singles / Year	2019	2020	2021	2022	2023
No. whales Photo-identified	847	696	746	746	618
No. whales categorized	529	553	658	626	526
Good Condition	117	166	259	269	311
	22.1%	33.3%	42.1%	43%	70%
Fair Condition	287	183	206	235	94
	54.3%	36.7%	33.5%	37.5%	21.2%
Poor Condition	125	150	150	122	39
	23.6%	30%	24.4%	19.5%	8.8%

Mc / Year	2019	2020	2021	2022	2023
No. whales Photo-identified	41	56	43	42	83
No. whales categorized	40	54	41	42	82
Good Condition	20	38	41	38	68
	50%	70.3%	95.3%	90.5%	82.9%
Fair Condition	20	13	2	4	11
	50%	24.2%	4.7%	9.5%	13.5%
Poor Condition	0	3	0	0	3
	0%	5.5%	0%	0%	3.6%