



MARINE MAMMAL STRANDINGS IN THE PHILIPPINES FROM 2021 TO 2022



Lemnuel V. Aragonés
Alessandra Nicole L. Morado



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EXECUTIVE SUMMARY

Marine mammal strandings are complex and understanding this phenomenon requires continuous surveillance, monitoring, data collection and research. The Philippine Marine Mammal Stranding Network (PMMSN) has collected 1409 records of stranding events nationwide from 2005 to 2022. This Technical Report is a follow-up to the third Report (i.e., Aragones et al. 2022). As stated in the second Technical Report, the initial biennial analysis, the consequent series of Reports will cover two -year periods. Thus, this fourth Report covers the stranding dataset from 2021 to 2022. However, as in the previous Technical Reports, updates on the general trends for the larger data set (2005 to 2022) are also provided.

This Report showcases analyses of the stranding records from 2021 to 2022 (n=223) for trends in stranding frequency by province, region, year, season, month, species, sex, age class, disposition, category, and release and rehabilitation success. The spatial coverage presented in this report was specific to regions and provinces primarily for administrative purposes. Identification of more specific or smaller spatial areas (i.e., by municipality/city) for potential stranding hotspots was assessed using fishnet grids of 15 x 15 km size. In the previous report, total stranding frequency was used to determine stranding hotspots. In this technical report, mean annual stranding rates were used to identify critical stranding areas. The stranding data was also presented in the classic seasonal context of DJF, MAM, JJA, SON. As data analytics advances, future reports will be improved consequently.

Strandings in the Philippines have generally increased through time. In a moving average of the annual stranding frequencies from 2005 to 2022, the first six years (2005-2010) was 37, followed by the next six (2011-2016) was 84, and the last six years (2017-2022) was 114. The annual frequencies have apparently plateaued since 2014 but the plateau was starting to decline in 2021. Although a decline in the plateau was observed, the stranding events are still high, and oscillations are expected. The sustained high number of stranding events may be an artifact of various factors. The growing network of PMMSN, accessibility of electronic communication, and to roads, of the masses contribute to this sustained reporting. Aragones et al. (2023, manuscript submitted) identified that the strandings may be caused by various natural and anthropogenic factors including seasonal and oceanographic factors, fisheries interactions, chemical and noise pollution, and diseases. The PMMSN through the Marine Mammal Research and Conservation Laboratory of the UP IESM is continuously investigating the causes and effects of these factors on marine mammal strandings nationwide.

The previous Technical Report (TR) showed that there were distinct regional hotspots in each island group of Luzon, Visayas and Mindanao from 2005 to 2020 dataset. In that TR (Aragones et al. 2022), the top five regions were Region 1 (n=26), Region 5 (n=26), Region 6 (n=25), Region 4B (n=22) and Region 7 (n=23). In the current TR, the top five regions were Region 1 (n=52), Region 12 (n=25), Region 5 (n=24), Region 6 (n=24), and Region 4B (n=18). Region 1 had doubled its stranding events in the current TR (n=52) from the previous TR (n=26). Region 1, Region 4B, Region 5, and Region 6 remained as regional hotspots based on the previous TR and Region 12 emerged as a new regional hotspot in the current TR. These five regional hotspots accounted for 64% of the total stranding events from 2021 to 2022.

Grids of 15 x 15 km were employed via fishnet grids to visualize the specific areas where stranding events frequently occurred. About 35% of the total grids (495 of 1422) along the Philippine coastline had stranding events from 2005 to 2022 (see Figure 1). The grids with strandings were further

categorized into very high, high, medium and low based on mean annual stranding rates. A total of 33 municipality/city stranding hotspots were identified (see Table 2). Among the 33 stranding hotspots, seven municipalities/cities have very high mean annual stranding rate grid category. These were Santa Ana (with a mean annual stranding rate of 1.2778), Badoc-Southern Currimaao (1.2222), Dagupan City-Eastern Lingayen (1.1111), Western Lingayen-Labrador-Sual (0.9444), Pagudpud (0.8889), Cabugao-Sinait-San Juan (0.8889), and Sanchez Mira-Claveria (0.8333). Ilocos Region remains the primary region of concern since it hosts 14 stranding hotspot municipalities/cities. Moreover, Regions 2, 5, 11, and 12 were considered as areas of concern.

The identified municipal/city level areas of concern should be the primary or focal areas of interest for the concerned Provincial Fisheries Officers and BFAR Regional Directors in terms of strategic management or planning for training requests and the like (e.g., implementation of their stranding response). The top five provinces for 2021-2022 data were Sarangani (n=22), Ilocos Sur (n=20), Pangasinan (n=14), Ilocos Norte (n=11), and Cagayan (n=10). This is the first time that the top province (Sarangani) was outside of Luzon.

In terms of seasonality, 32% of the total strandings occurred during MAM season (n=72), 30% during JJA season (n=62), 21% during SON season (n=46), and 19% during DJF season (n=43). The majority of the strandings in 2021 to 2022 involved single stranding events (n=201). There were only six records of mass strandings, two out of habitat, and 14 UMEs. Note that most if not all of the UMEs were probably caused by dynamite blasts, and that ~86% (12 of 14) of the UMEs occurred in Region 1. Again, caution must be taken in interpreting these results as the dataset analyzed involved only two years.

The top six most frequently stranded species in this period were spinner dolphins (n=34), short-finned pilot whale (n=26), dugong (n=20), Risso's dolphin (n=17), Fraser's dolphin (n=16), and pantropical spotted dolphin (n=16). The sustained high stranding records of dugong has been alarming. Based on the previous TR, dugongs had a total of 84 stranding records for 16 years (from 2005 to 2020) nationwide. Meanwhile, from 2005 to 2022, the dugong strandings had increased to 104, with a 20-stranding difference after two years only. This resulted in an increase in the annual average of stranded dugongs from 5 (2005 – 2020) to 6 (2005 to 2022). The top three provinces with the most dugong stranding incidences in the 2-yr period were Sarangani (n=6), Palawan (n=4), and Guimaras (n=3).

Overall, about 55% (n=122) of the recorded events in 2021 and 2022 involved live marine mammals. The rest were found dead upon sighting (45%). Out of all stranded marine mammals found initially alive, 54% were released (n=66), 23% died (n=34), 8% rehabilitated (n=10), and 10% have undetermined status (n=12). Out of the 10 marine mammals rehabilitated, eight died, one released, and one transported to Ocean Adventure for long-term and professional care. Again, these trends and patterns of strandings, and releases and rehabilitations would not have been possible if not for the efforts of the PMMSN.

INTRODUCTION

A well-maintained stranding database is key to understanding marine mammal strandings as well as long-term environmental changes. Data collection and archiving of samples from stranded marine mammals provide insights on numerous rare and even endangered species. Also, long-term stranding datasets can account for marine mammal species composition, distribution, movement patterns, proxies to their population sizes (Norman et al. 2004, Pyenson 2011) and ocean and human health (Moore 2008, Bossart 2011). Moreover, beached specimens can yield valuable records on anatomy, life history, genetics, disease, parasites, contaminants and feeding ecology that are otherwise hard to obtain when studying marine mammals in the wild (Perrin and Geraci 2002, Vianna et al. 2016).

The collected data and samples from stranded marine mammals in the country have made many opportunities for studying several aspects of these rarely studied animals possible. For instance, in 2015, a comprehensive study on microbiology of stranded cetaceans was investigated by Obusan et al., detecting potentially pathogenic microbes. Similarly, stranding events from 2012 to 2013 and 2017 to 2018 provided information on the antibiotic resistance of pathogenic microorganisms from select stranded cetaceans (Obusan et al. 2018, Obusan et al. 2021). Obusan et al. 2019 also utilized stranding occurrences from October 2016 to August 2018 and detected the likelihood of toxoplasmosis and leptospirosis in cetaceans. Furthermore, De Guzman et al. 2020 examined toxoplasmosis molecularly from select samples from 2019. Studies examining the microbiology of marine mammals' aid in determining plausible pathogenic infections and antimicrobial resistance among and within populations. Similarly, a study by Bondoc et al. (2017) attempted to examine the causes of stranded marine mammals in the country using histopathological and hematological techniques. In the case of impacts of human interaction on marine mammal stranding, evidence was provided by the study of Obusan et al. 2016. Studies on acoustic trauma from blast fishing related stranded marine mammal victims were investigated by Paccini et al. (2016) as well as the transmission beam pattern of a rehabilitated spinner dolphin (Smith et al. 2019). Blood values for the data deficient spinner dolphins have been established from rehabilitated stranders (Suarez et al. 2019) enabling a better clinical approach for addressing the most common stranded species in the country. Contamination levels of polychlorinated biphenyls (PCBs) were analyzed in a stranded dwarf sperm whale in Camarines Sur and rough-toothed dolphin in Zambales (Bondoc et al. 2021). In 2023, the first case of cetacean morbillivirus was reported by Suarez et al. Some portions of the database were also used for elucidating the interactions of plastic pollution with marine megafauna in Southeast Asia (Omeyer et al. 2023). The comprehensive stranding database of the country has been utilized to elucidate the ecology of these animals (Aragones et al. submitted). An initial analysis was conducted by Aragones et al. 2010 using the compiled stranding data from 1998 to 2009 examining spatial and temporal trends as well as identifying potential geographical hotspots. More comprehensive analyses of the national stranding database from 2005 to 2016 was conducted by Aragones and his colleagues in 2017. The first Technical Report served as the primary assessment of the long-term (12 years) marine mammal stranding dataset collected since 2005. The second and third Technical Reports (Aragones and Laggui, 2019; Aragones et al. 2022) utilized biennial analyses to ensure early identification of issues related to stranded marine mammals nationwide.

This fourth Technical Report aims to continue what the third report did. That is to highlight the results of the ongoing investigation of the various aspects of marine mammal strandings in the Philippines. Specifically, the purpose of this report are to (1) map stranding events per region, and identify stranding hotspots on a municipality/city level using the previous (2005 to 2022) and recent (2021 to

2022) dataset, (2) examine trends of recent stranding data (2021 to 2022) regarding spatial (by regions and provinces) and temporal variation or patterns and other information, and (3) report general stranding information such as stranding category, disposition, age class, sex, species composition, proportions of refloated/released and rehabilitated stranded marine mammals.

These Technical Reports offer valuable information since data on marine mammals in the Philippines is wanting. This information is basic for the protection and conservation of marine mammals in the Philippines. Also, these reports identify marine mammal hotspot areas relevant to the municipal/city, provincial, and regional levels. The systematic collection and collation of stranding data in the country has been providing information on One Health: marine mammals, environment, and humans. The Memorandum of Agreements between PMMSN and the various Regional BFAR offices, authorizing PMMSN to conduct its five core activities: rescue, release or refloat, rehabilitate, repository of samples and research remains vital. Similarly, an enabling MOU exists between PMMSN and the Marine Mammal Research and Conservation Laboratory (MMRCL) of the Institute of Environmental Science & Meteorology of the University of the Philippines – Diliman, its research arm. The main strengths of this national stranding network are its empowered chapters and focus on science.

METHODS

The primary methods in collecting and collating stranding data followed the first Technical Report in 2017 (Aragones et al.). As in previous Technical Reports, the overall dataset is updated in this report, which now covers the period from 2005 to 2022, focusing on biennial years of 2021 to 2022. These recent stranding records were analyzed for general, regional, and provincial trends of stranding frequency by year, month, season, stranding category, initial disposition, age class, sex, species. The spatial coverage presented in this report was specific to regions, provinces, and municipalities/cities as these are important for administrative (management) purposes. The stranding data was also presented in the more classic seasonal context of December-January-February (DJF), March-April-May (MAM), June-July-August (JJA), September-October-November (SON).

A similar method (fishnet grids) was used in spatially simplifying the stranding data and determining the stranding hotspots. However, in this report, the mean annual stranding rates were used for the grids instead of the total stranding frequency. The stranding data that were collected from various sitio/barangay/municipality/city were projected into stranding points in ArcGIS 10.5. The stranding points were split into years (2005-2022), producing 18 shapefiles. Fishnet grids of 15 km x 15 km were produced along the Philippine coastline using the Fishnet tool in ArcGIS 10.5. The 15 x 15 km grid size was used based on the assumption that this size represents the extent or coverage of most municipalities or cities coastline. The grids were then spatially joined by each annual stranding point shapefile. The 18 spatially joined grids were then converted into raster to calculate the mean annual stranding rates using the Calculate Statistics Tool. The stranding fishnet grids were classified into four classes using the Natural Jenks classification scheme. The four classes were described as low, medium, high, and very high mean annual stranding rate grid. Those grids that were classified as high and very high grid were considered as stranding hotspots. The overlapping municipalities/cities in those grids were determined and identified as municipality/city stranding hotspots.

RESULTS

GENERAL TRENDS OF STRANDING EVENTS IN THE PHILIPPINES

There were a total of 1409 marine mammal stranding events recorded in the Philippines from 2005 to 2022 (18 years). From 2021 to 2022 (2-yr period), there were 223 recorded stranding events which accounts for 16% of the total strandings of the 18-yr period. Stranding events were increasing in the 18-yr period – in a moving average, the first six years had 37 events, the next six years had 84 events, and the last six years had 114 events.

A total of 1422 15 km x 15 km fishnet grids were generated along the Philippine coastline. Out of the 1422 grids, 495 grids or 35% had stranding occurrence (Figure 1 and Table 1). Figure 1 also shows the mean annual stranding rates per 15 km x 15 km grid from 2005 to 2022. Out of the 495 stranding grids, seven grids had very high mean annual stranding rates (0.7779 to 1.2780), 27 grids had high mean annual stranding rates (0.3890 to 0.7778), 82 grids had medium mean annual stranding rates (0.1668 to 0.3889), and low mean annual stranding rates (0.0556 to 0.1667). Municipalities/cities within the very high and high mean annual stranding rate grids were considered as stranding hotspots or areas of concern. The 33 stranding hotspots were listed in Table 2. About 70% of the stranding hotspots were in Luzon (23 municipalities/cities), 3% were in Visayas (1), and 27% were in Mindanao (9). Among regions, Region 1 had the most stranding hotspots – 14 municipalities/cities. Following Region 1, Region 5 and Region 12 had the second most stranding hotspots with 4 municipalities/cities each.

In 2021 and 2022, the 223 stranding events involved 260 marine mammal individuals (Table 4 and Figure 2). More events occurred in 2021 (n=116) than in 2022 (n=107). Region 1 remained the region with the most stranding events (n=52) in total in the 2 years. This was followed by Region 12 (n=25), Region 5 (n=24), and Region 6 (n=24). The region with the least stranding frequency in the 2-yr period was NCR (n=1) which occurred only in 2022.

In terms of provincial stranding events (Figure 8), Sarangani was the top province with the most stranding events having 11 strandings both in 2021 and 2022 (n=22). Ilocos Norte followed with 20 strandings in the 2-yr period and mostly all strandings occurred in 2022 (n=18). Other provinces included in the top five with the highest stranding events were Pangasinan (n=14), Ilocos Norte (n=11), and Cagayan (n=10). In these three provinces, most of the events occurred in 2022.

By season, stranding events mostly occurred during the MAM (n=72) and JJA (n=62) seasons in the 2-yr period. The DJF season had 43 events and the SON season had 46 events. Stranding frequency by season by region from 2021 to 2022 was shown in Figure 9. Many stranding events during the MAM season occurred in Region 1 (n=19), Region 5 (n=8), and Region 4B (n=7). During the JJA season, Region 1 (n=12), Region 12 (n=10), and Region 6 (n=8) had the most events.

Most stranding events involved single individuals (n=201), 108 events in 2021 and 93 events in 2022 (Figure 3). Meanwhile, six mass stranding events involved 2-25 individuals, two strandings involved out of habitat events of 51 to 76 individuals, and 14 strandings were UMEs. UMEs in these cases, involved one to two individuals in which dynamite fishing was the cause of strandings.

In 2021 and 2022, 55% of the stranding events (n=122) involved events in which the animal was initially seen alive (Figure 4). On the other hand, 45% (n=100) involved dead stranding events. Only one event involved mixed (alive and dead) animal disposition in which a mass stranding event happened. The percentage of live stranding events was high compared to the last biennial result in which only 38%

(n=81) were alive. Of the alive stranding events, 54% were released (n=66), 23% died (n=34), 8% rehabilitated (n=10), and 10% had undetermined status (n=12). As for the age classes of strandings, a high percentage (72%) of the incidences involved adults (n=161) (Figure 5). About 21% were subadults (n=47), 4.5% were calves (n=10), 1% involved mother-calf pairs (n=2), 1% had mixed age classes (n=2), and 0.4% was neonate (n=1).

The sex of stranded marine mammals is shown in Figure 6. Many of the events involved females (31%) with 29 events in 2021 and 41 in 2022. For males, there were about 26% stranded in total in the 2-yr period – 35 events in 2021 and 23 in 2022. There were 2% with mixed sex (n=4) and 0.4% with female/male calf stranding incidence. A considerable percentage (40%) of the stranding events had undetermined sex (n=90), 49 events in 2021 and 41 in 2022.

A checklist of marine mammals confirmed in the Philippines with stranding records per region is shown in Table 3. The number of marine mammal species with stranding records per region ranged from 6 to 20. To date, Regions 2 and 11 have the highest number of species (n=20) and are the most diverse among the regions followed by Regions 5 and 6 (n=19). The NCR, which has the smallest coastal and marine area, consequently, has the lowest number of species (n=6) or is the least diverse. There were only two species that were present in all regions: spinner dolphin and melon-headed whale.

The species composition of stranded marine mammals in 2021 and 2022 is shown in Figure 7. There were 22 species of cetaceans plus dugong recorded in the 2-yr period. These figures were similar to the last biennial report (Aragones et al. 2022). The top six species in 2021 and 2022 were spinner dolphins (n=34), short-finned pilot whale (n=26), dugong (n=20), Risso's dolphin (n=17), Fraser's dolphin (n=16), and pantropical spotted dolphin (n=16).

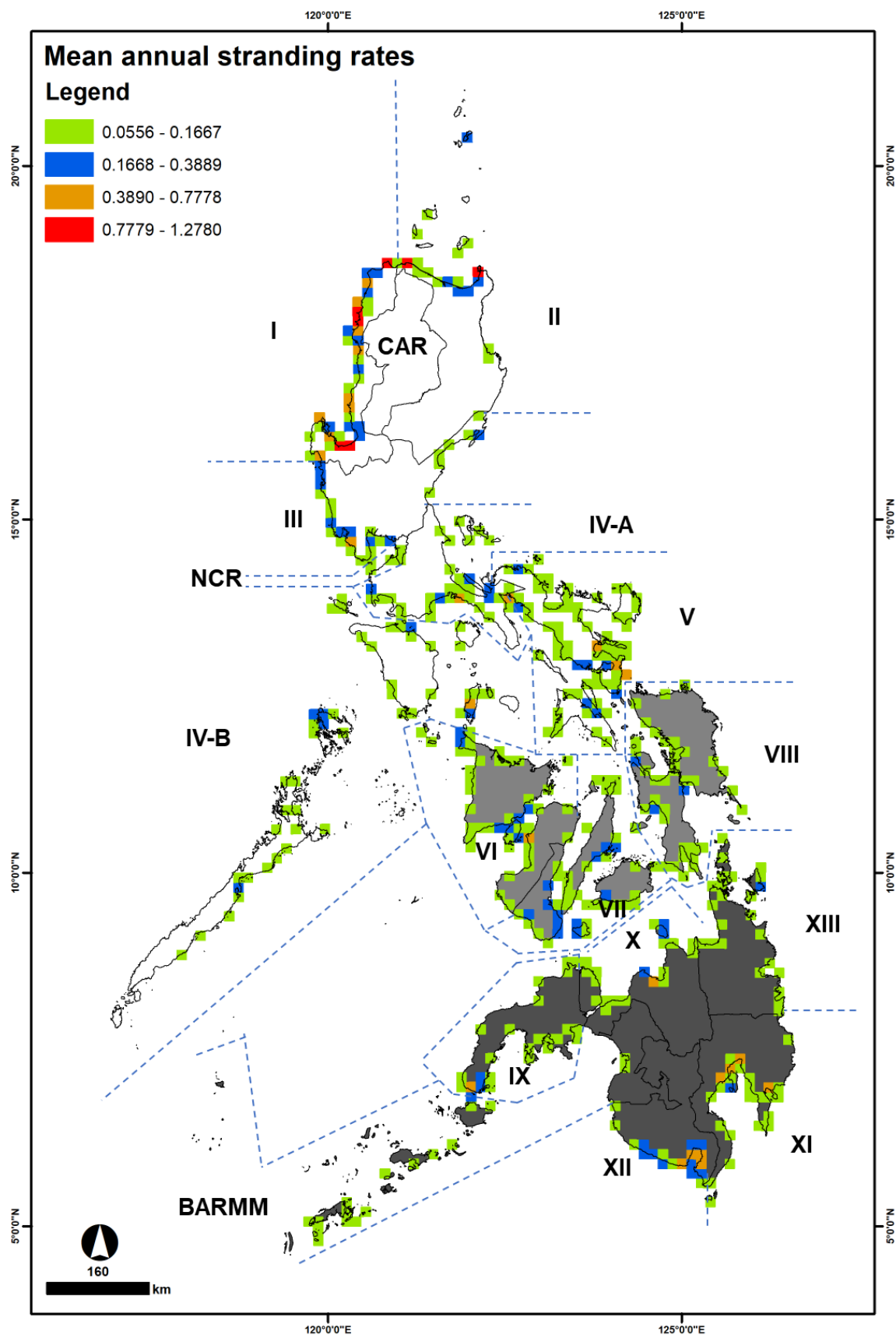


FIGURE 1. MEAN ANNUAL STRANDING RATES (2005-2022) PER 15 KM X 15 KM FISHNET GRIDS.

TABLE 1. TOTAL NUMBER OF 15 x 15 KM GRIDS WITH AND WITHOUT STRANDING RECORDS IN THE PHILIPPINES.

	Count
Total 15x 15 km grids along Philippine coast	1422
Number of grids with strandings	495
Number of grids with mean annual stranding rates of 0.0556 to 0.1667 (low rate)	379
Number of grids with mean annual stranding rates of 0.1668 to 0.3889 (medium rate)	82
Number of grids with mean annual stranding rates of 0.3890 to 0.7778 (high rate)	27
Number of grids with mean annual stranding rates of 0.7779 to 1.2780 (very high rate)	7

TABLE 2. STRANDING HOTSPOTS OR GRIDS WITH HIGH AND VERY HIGH MEAN ANNUAL STRANDING RATES.

Municipality/City	Province	Region	Mean annual stranding rate
Santa Ana	Cagayan	II	1.2778
Badoc-Southern Currimao	Ilocos Norte	I	1.2222
Dagupan City-Eastern Lingayen	Pangasinan	I	1.1111
Western Lingayen-Labrador-Sual	Pangasinan	I	0.9444
Pagudpud	Ilocos Norte	I	0.8889
Cabugao-Sinait-San Juan	Ilocos Sur	II	0.8889
Sanchez Mira-Claveria	Cagayan	II	0.8333
Alaminos City	Pangasinan	I	0.7778
Del Gallego	Camarines Sur	V	0.7778
Mati City	Davao Oriental	XI	0.7222
Malapatan-Alabel	Sarangani	XII	0.7222
Southern Davao City	Davao del Sur	XI	0.6667
Maco-Mabini-Tagum City	Compostela Valley-Davao del Norte	XI	0.6111
Pulupandan-Bago City	Negros Occidental	VI	0.6111
Pasuquin	Ilocos Norte	I	0.6111
Cagayan de Oro City	Misamis Oriental	X	0.5556
Glan	Sarangani	XII	0.5556
Narvacan	Ilocos Sur	I	0.5556
San Fernando City-Bauang	La Union	I	0.5556
Bolinao	Pangasinan	I	0.5556
Northern Davao City	Davao del Sur	XI	0.5000
Zamboanga City	Zamboanga del Sur	IX	0.5000
Maasim	Sarangani	XII	0.5000
Paoay-Northern Currimao	Ilocos Norte	I	0.5000
Magsingal-Santo Domingo	Ilocos Sur	I	0.5000
San Juan	La Union	I	0.5000
Padre Burgos-Agdangan	Quezon	IV-A	0.5000
General Santos City	South Cotabato	XII	0.4444
Dasol	Pangasinan	I	0.4444
Morong	Bataan	III	0.4444
Legazpi City	Albay	V	0.4444
Gubat	Sorsogon	V	0.4444
Barcelona	Sorsogon	V	0.4444
Odiongan	Romblon	IV-B	0.4444

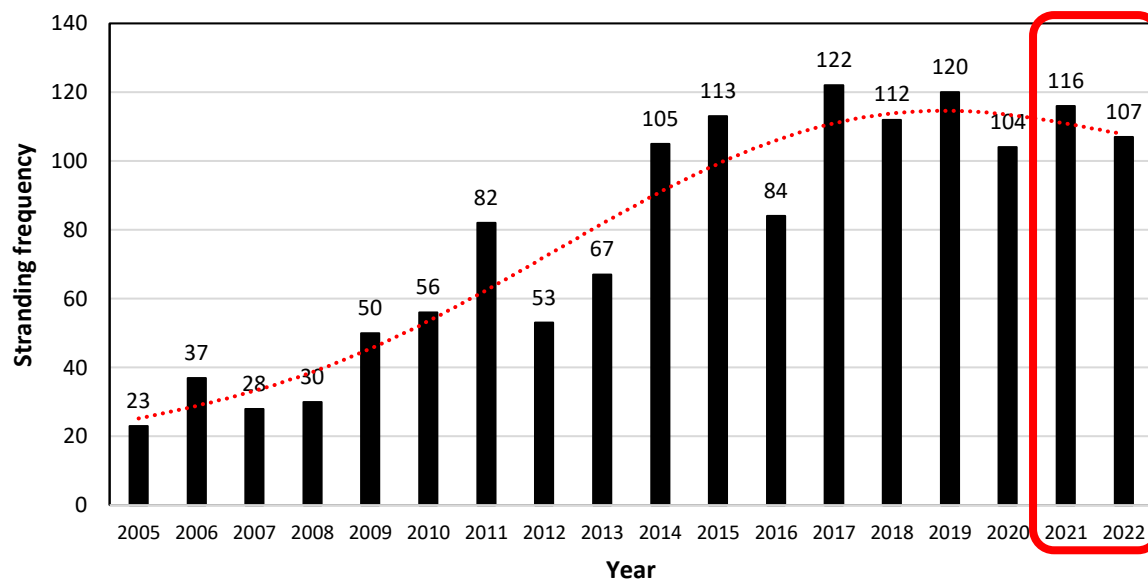


FIGURE 2. STRANDING EVENTS RECORDED FROM 2005 TO 2022.

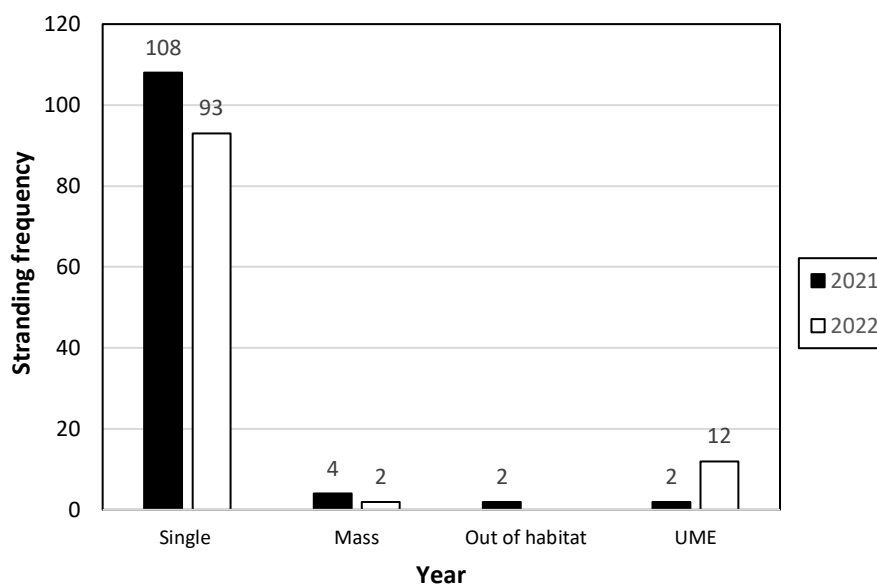


FIGURE 3. CATEGORIES OF STRANDINGS IN YEAR 2021 TO 2022.

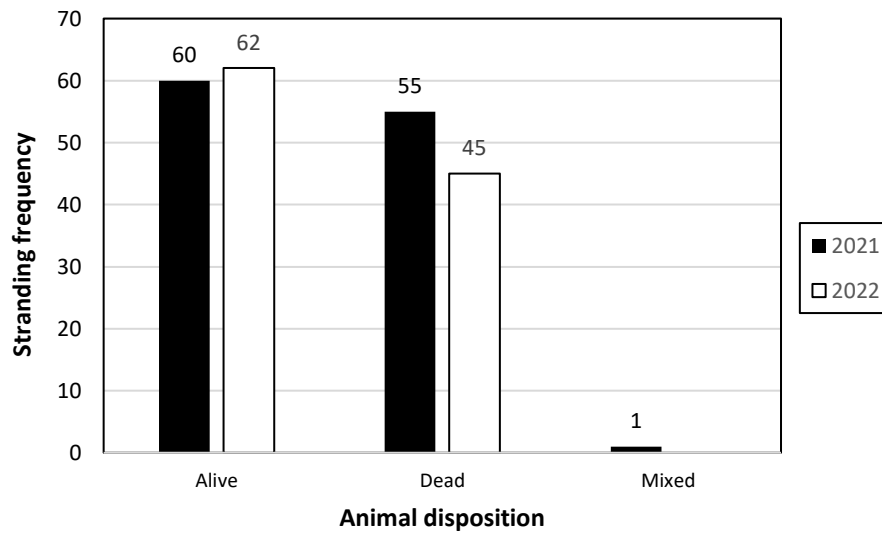


FIGURE 4. DISPOSITION OF STRANDED MARINE MAMMALS FROM 2020 TO 2021.

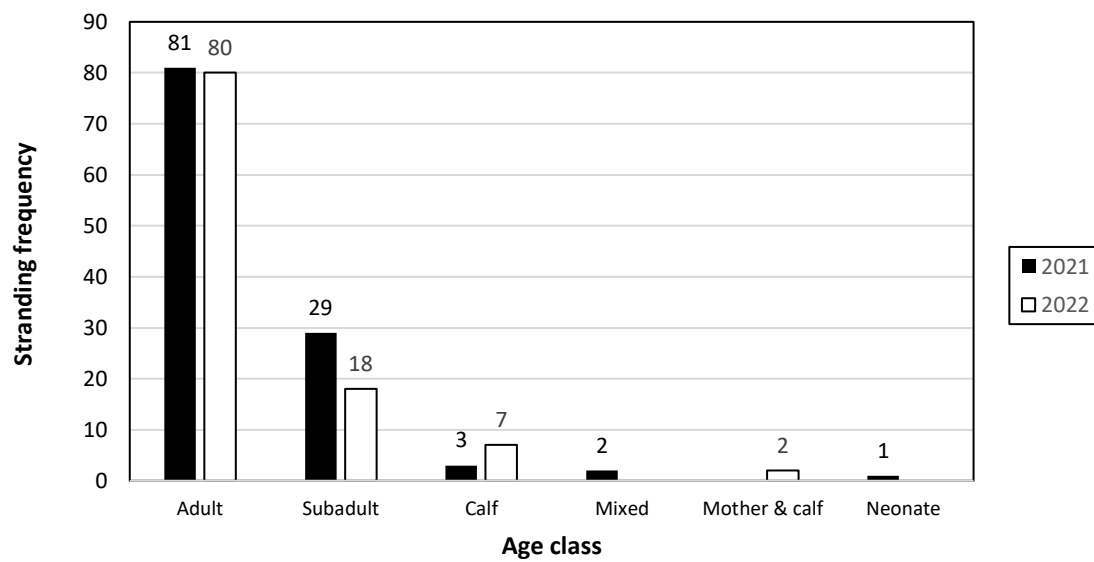


FIGURE 5. AGE CLASS OF STRANDED MARINE MAMMALS FROM 2021 TO 2022.

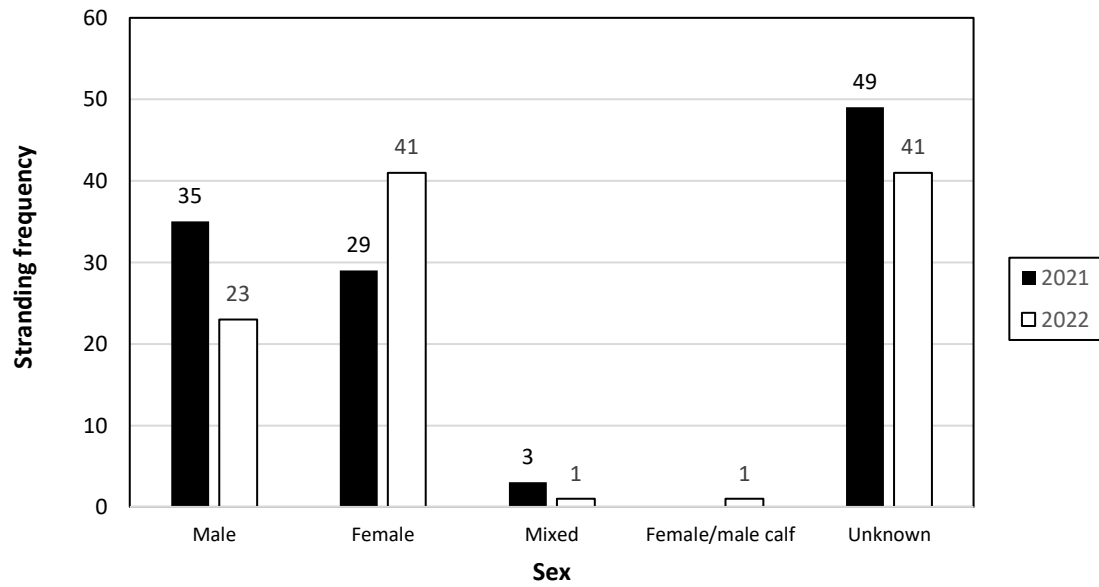


FIGURE 6. SEX OF STRANDED MARINE MAMMALS FROM 2021 TO 2022.

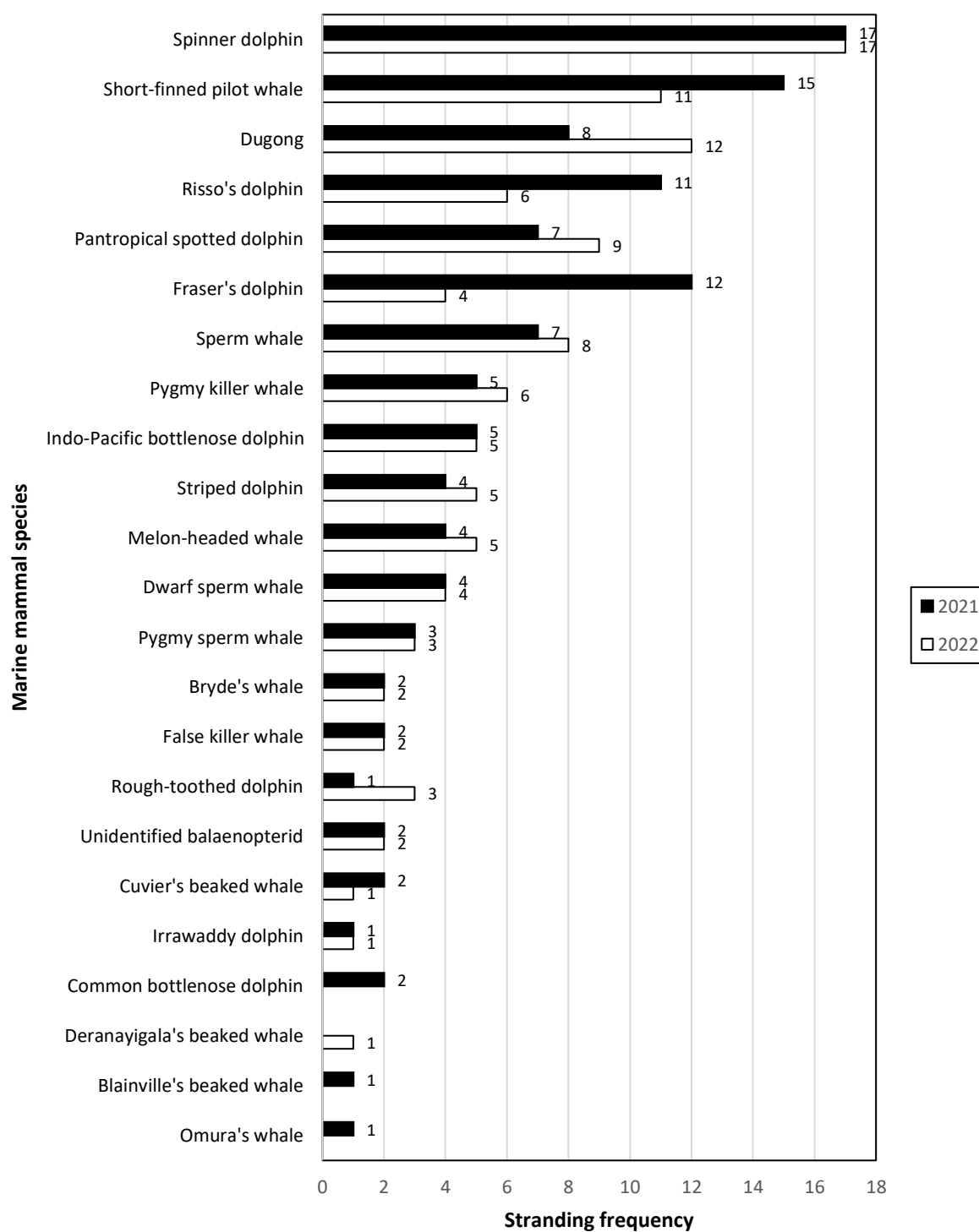


FIGURE 7. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022.

TABLE 3. CHECKLIST OF MARINE MAMMAL SPECIES CONFIRMED IN THE PHILIPPINES WITH RECORDED STRANDINGS PER REGION. (2003-2022)

SPECIES	1	2	3	4A	4B	5	6	7	8	9	10	11	12	13	BARMM	NCR
Spinner dolphin	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Fraser's dolphin	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Dugong			√	√	√	√	√	√		√	√	√	√	√	√	
Risso's dolphin	√	√	√	√	√	√	√	√	√	√	√	√				
Melon-headed whale	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Pygmy sperm whale	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Pantropical spotted dolphin	√	√	√	√	√	√	√	√		√	√	√	√	√		
Dwarf sperm whale	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√
Short-finned pilot whale	√	√	√		√	√	√	√		√	√	√	√		√	
Sperm whale	√	√		√	√	√	√	√	√	√		√	√	√	√	
Indo-pacific bottlenose dolphin	√	√	√	√	√	√	√	√	√	√	√	√	√	√		
Rough-toothed dolphin	√	√	√	√	√			√	√			√	√	√	√	
Common bottlenose dolphin	√	√		√	√	√	√	√		√	√					
Striped dolphin	√	√	√	√		√		√				√	√	√		√
Pygmy killer whale	√	√	√			√	√		√	√			√			
False killer whale	√	√	√	√	√	√	√	√		√	√	√	√		√	
Cuvier's beaked whale	√	√		√		√	√	√	√	√		√	√			
Bryde's whale		√	√	√	√	√	√		√		√	√		√	√	
Blainville's beaked whale	√	√		√	√			√			√	√	√	√		
Irrawaddy dolphin					√	√	√									
Humpback whale	√	√	√													
Omura's whale			√		√		√	√			√					√
Longman's beaked whale		√		√								√*				
Fin whale						√	√								√	
Deranayigala's beaked whale												√				
Ginkgo-toothed beaked whale			√													
Killer whale													√**			
Common dolphin												√				
Minke whale																√***
Blue whale																
TOTAL	18	20	18	18	18	19	19	18	12	15	15	20	17	13	11	6

*2003, **2004, *** (from Herre 1925)

TABLE 4. NUMBER OF STRANDING EVENTS AND INDIVIDUALS PER REGION FROM 2021 TO 2022.

Region	2021 (no. of individuals)	2022 (no. of individuals)	Total (no. of individuals)
I (Ilocos Region)	12	40(45)	52(57)
II (Cagayan Valley)	3(5)	8(13)	11(18)
III (Central Luzon)	3	3	6
IV-A (CALABARZON)	6	3	9
IV-B (MIMAROPA)	14	4	18
V (Bicol Region)	18(43)	6	24(49)
VI (Western Visayas)	13	11	24
VII (Central Visayas)	6(7)	1	6(7)
VIII (Western Visayas)	8	3	11
IX (Zamboanga Peninsula)	6	2	8
X (Northern Mindanao)	4	3	7
XI (Davao Region)	3	3	6
XII (SOCCSKSARGEN)	11	14	25
XIII (Caraga)	6	2	8
BARMM	3	4	7
Total	116(143)	107(117)	223(260)

Marine mammal strandings in the Philippines from 2021 to 2022

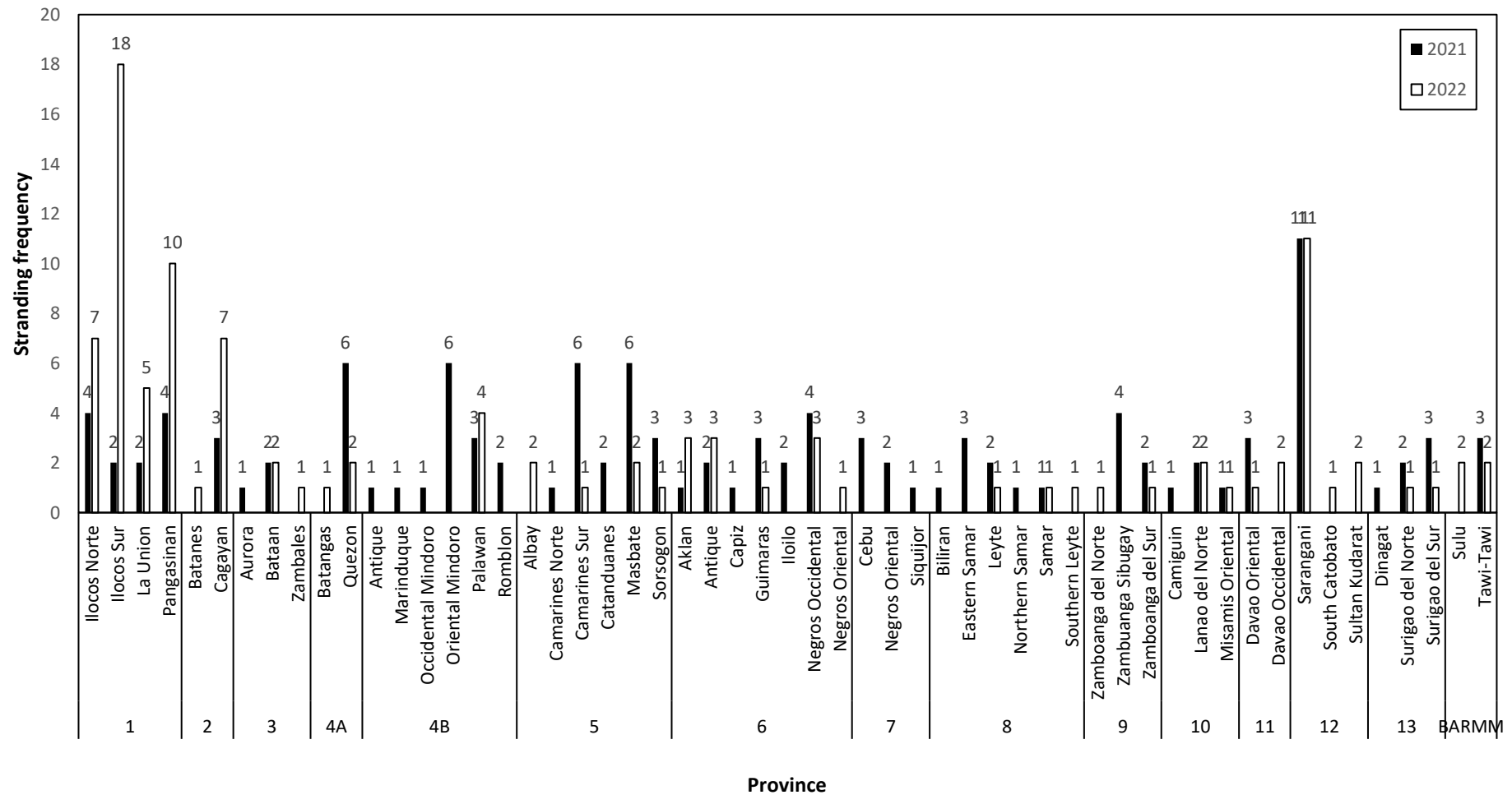


FIGURE 8. STRANDING FREQUENCY PER PROVINCE FROM 2021 TO 2022.

Marine mammal strandings in the Philippines from 2021 to 2022

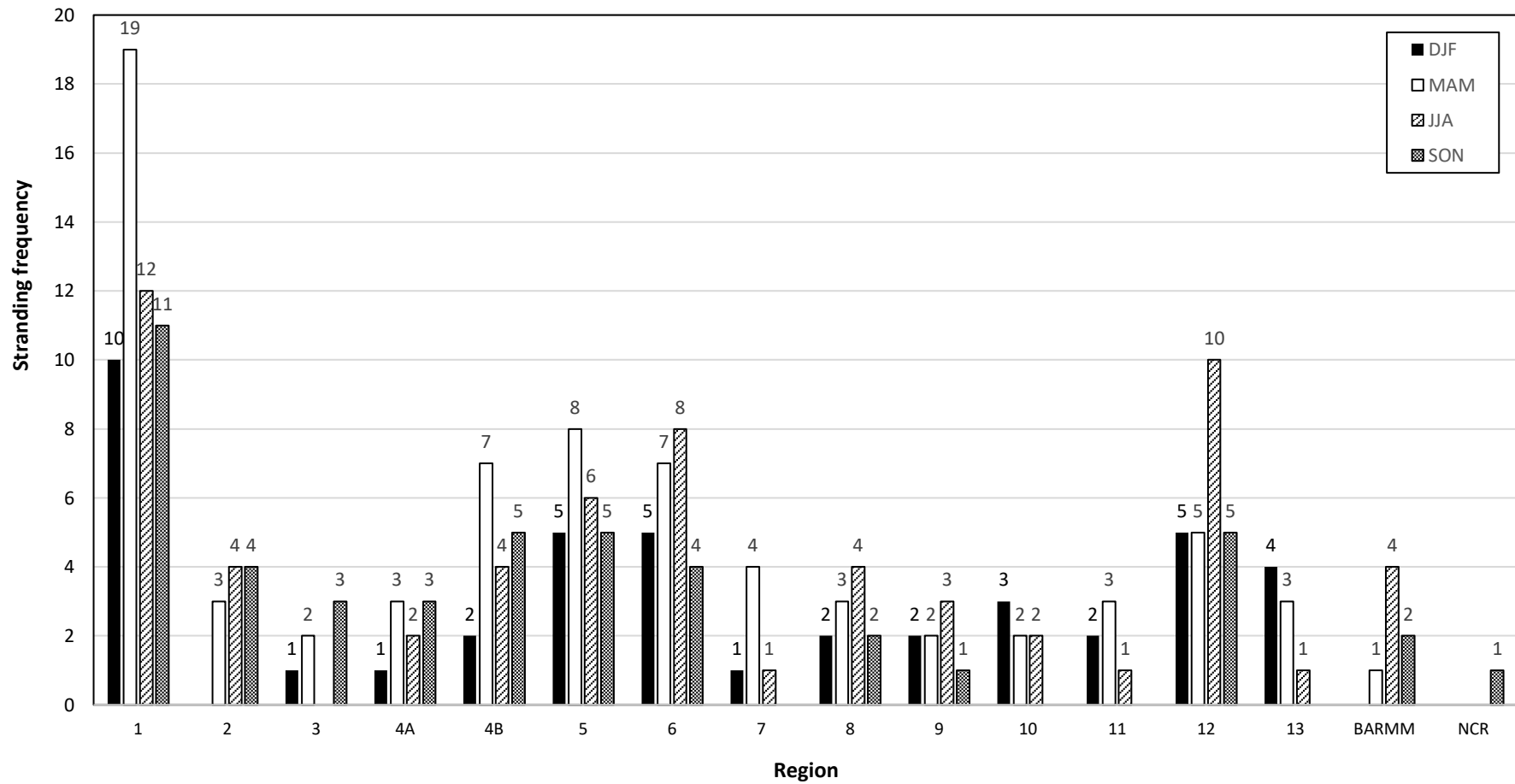


FIGURE 9. STRANDING FREQUENCY BY SEASON BY REGION FROM 2021 TO 2022.

Stranding per region*REGION 1 (ILOCOS REGION)*

Ilocos Region remains the top region with the highest marine mammal stranding incidences (n=52; see Table 4). The distribution of stranding events in 2021 and 2022 in the region is shown in Figure 10. There were 12 stranding events in 2021 and 40 stranding events in 2022. At the provincial level, Ilocos Sur had the most stranding events in total (n=20) (Figure 11). It had 18 stranding events in 2022 and only two in 2021. Following Ilocos Sur, Pangasinan was the second province with the most strandings (n=14). Ilocos Norte had a total of 11 stranding events (four in 2021 and seven in 2022) and La Union had a total of seven stranding events (two in 2021 and five in 2022).

Region 1 hosts the highest number of municipality/city hotspots (n=14) (see Table 2 and Figure 10). The mean annual stranding rate fishnet grids shown in Figure 10 covers the 2005 to 2022 dataset. There was a total of 36 grids with strandings along the Ilocos Region coastline. There were 11 low grids, ten medium grids, eight high grids, and six very high grids. The stranding municipality/city hotspots in Region 1 were as follows: high grids – Pasuquin (0.6111), Narvacan (0.5556), San Fernando City-Bauang (0.5556), Bolinao (0.5556), Paoay-Northern Currimaao (0.5000), Magsingal-Santo Domingo (0.5000), San Juan (0.5000), and Dasol (0.4444) and very high grids – Badoc-Southern Currimaao (1.2222), Dagupan City-Eastern Lingayen (1.1111), Western Lingayen-Labrador-Sual (0.9444), Pagudpud (0.8889), Cabugao-Sinait-San Juan (0.8889), and Alaminos City (0.7778).

All months had strandings in total in the 2-yr period (Figure 12). Among months, March had the highest stranding incidence (n=9) but with only one stranding in 2021. This was followed by June and December in which both had six stranding events. August and October had the least stranding incidence with only one stranding event each.

In terms of seasonality, about 37% of the strandings occurred in the MAM season (n=19), 23% in the JJA season, 21% in the SON season, and 5.2% in the DJF season (n=10) (Figure 13). Ilocos Sur had the highest stranding events during the DJF season (n=7) in 2022 and had strandings in each season of 2022. Meanwhile, Pangasinan had significantly the highest strandings during the MAM season of 2022 (n=8). Ilocos Norte had strandings in all seasons of 2021 and 2022. La Union had low and intermittent seasonal strandings.

There were 14 marine mammal species that stranded in Ilocos Region in the 2-yr period (Figure 14). Spinner dolphin was the species with the most stranding incidences in the region (n=11) with significantly high strandings in 2022 (n=10). Next to the spinner dolphin is the short-finned pilot whale with eight strandings in 2022 and no stranding in 2021. The other top species were pantropical spotted dolphin (n=8), pygmy killer whale (n=6), Fraser's dolphin (n=5), and melon-headed whale (n=5).

There were 39 single stranding events, one mass stranding, and 12 UMEs recorded in Region 1 (Figure 15). The mass stranding event occurred in Ilocos Sur in 2022 that involved two spinner dolphins. The UMEs recorded occurred in Ilocos Sur (n=6), Pangasinan (n=5), and La Union (n=1) in 2022. The UMEs involved short-finned pilot whales and the cause of strandings was most likely dynamite fishing. Note that there was a total of 14 UMEs for this entire TR. Thus, Region 1 has 86% (n=12) of all the UMEs. In our recent cetacean survey in Lingayen Gulf, our team recorded dynamite blasts using hydrophone in several instances and places within the coastlines of La Union and Pangasinan. It is alarming as these blasts are now most likely remotely detonated underwater, and with no surface water splashes occurring.

Marine mammal strandings in the Philippines from 2021 to 2022

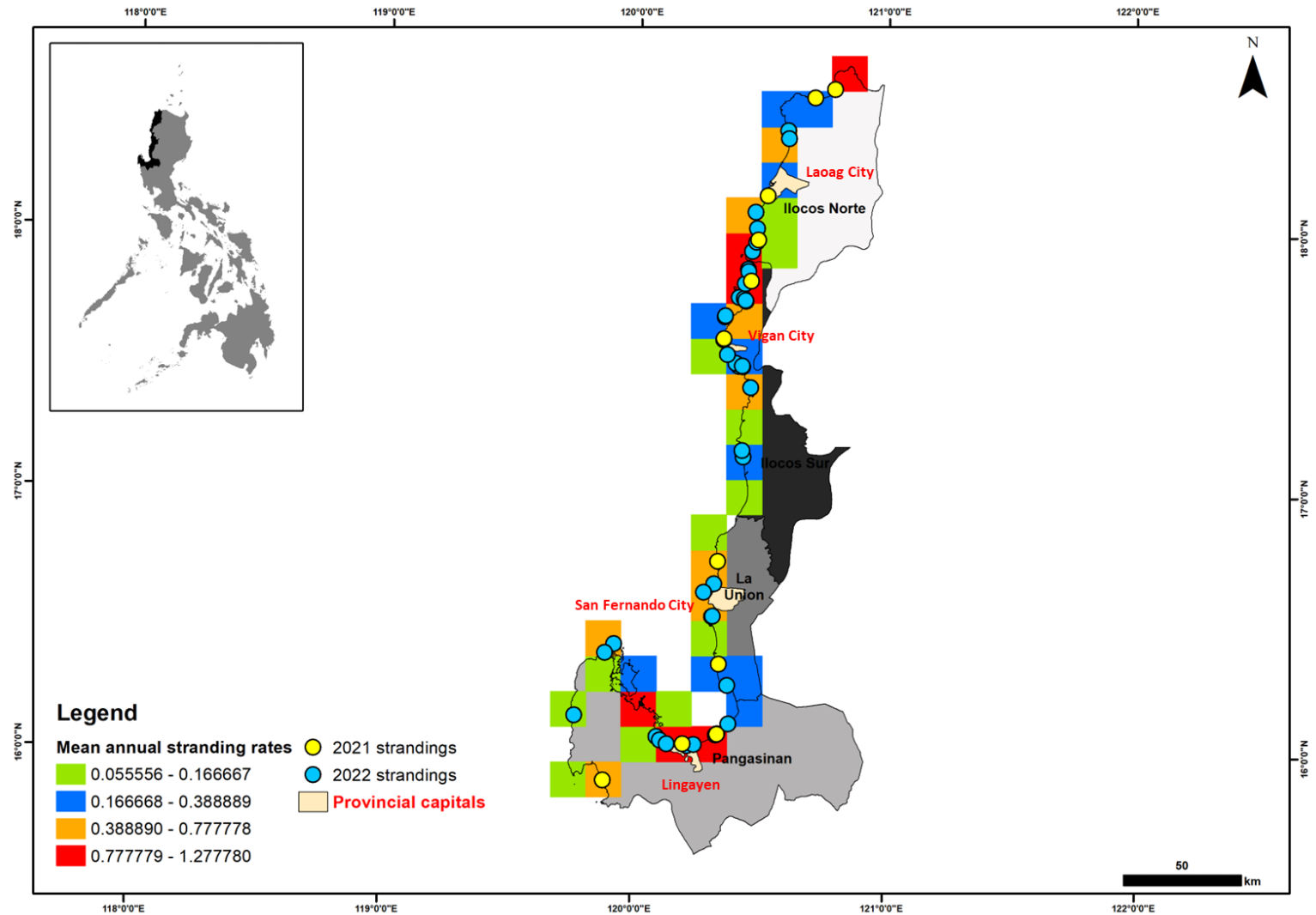


FIGURE 10. MARINE MAMMAL STRANDING STATUS IN REGION 1 (ILOCOS).

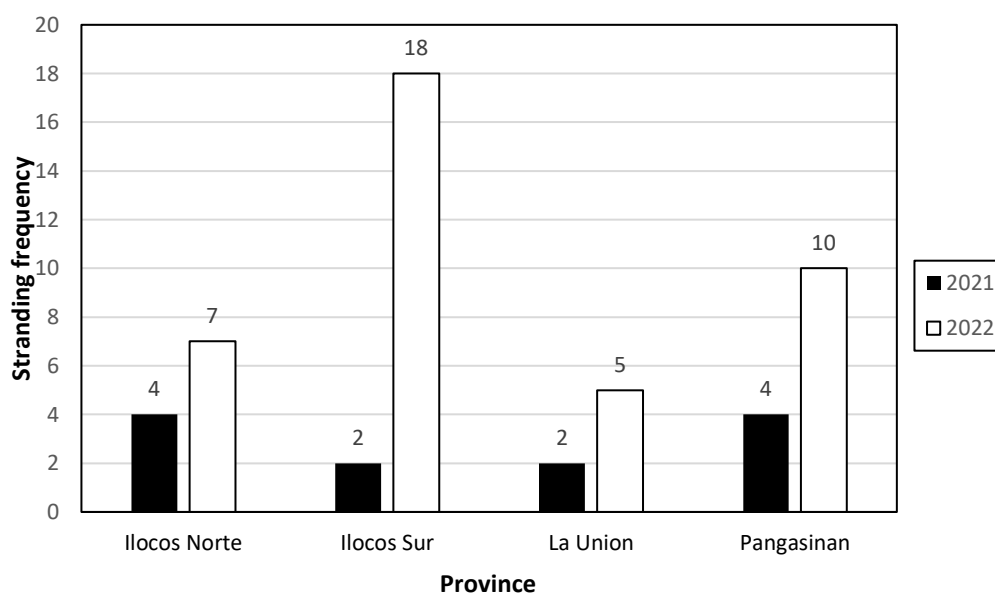


FIGURE 11. STRANDINGS PER PROVINCE FROM 2021 AND 2022 IN ILOCOS REGION.

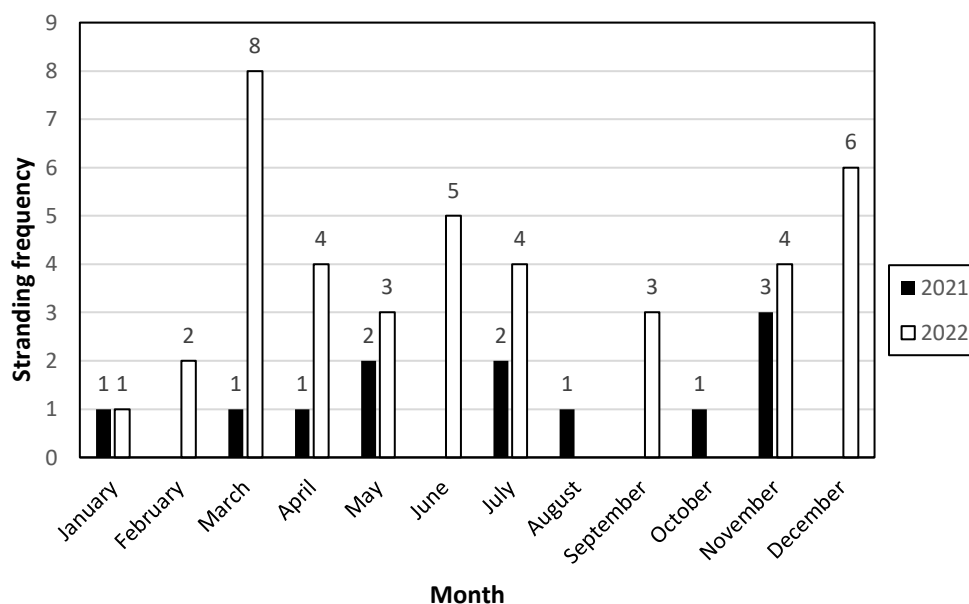


FIGURE 12. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 AND 2022 IN ILOCOS REGION.

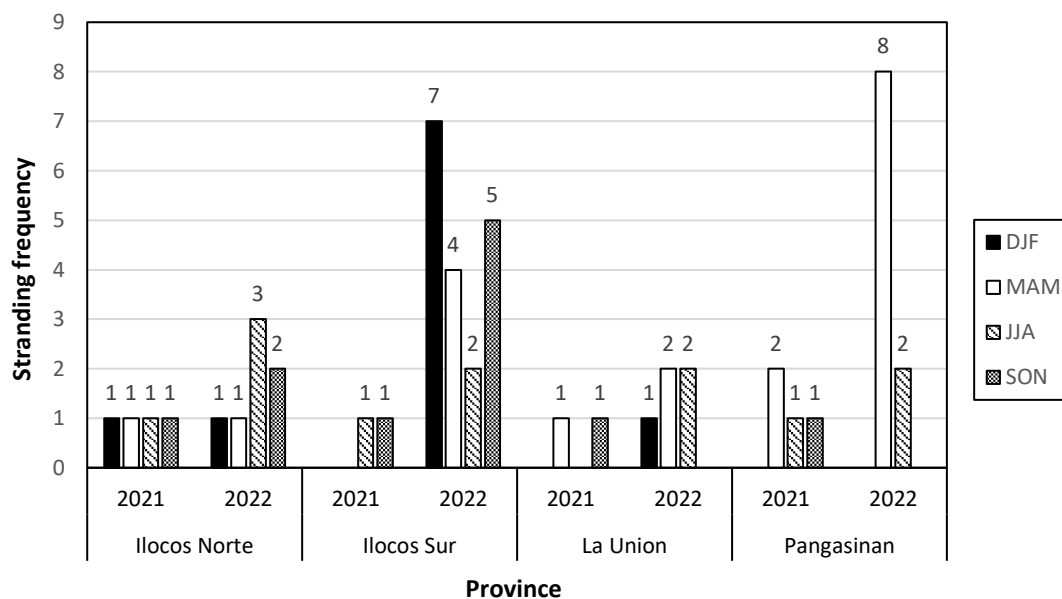


FIGURE 13. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 AND 2022 IN ILOCOS REGION.

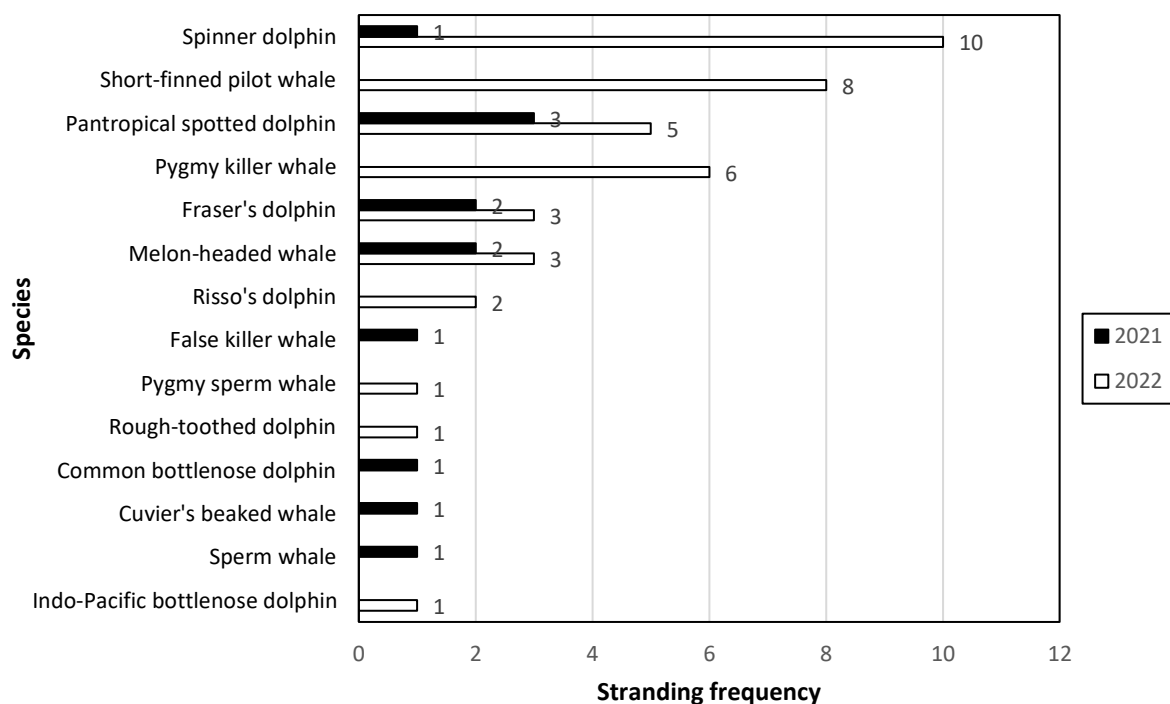


FIGURE 14. STRANDED MARINE MAMMAL SPECIES FROM 2021 AND 2022 IN ILOCOS REGION.

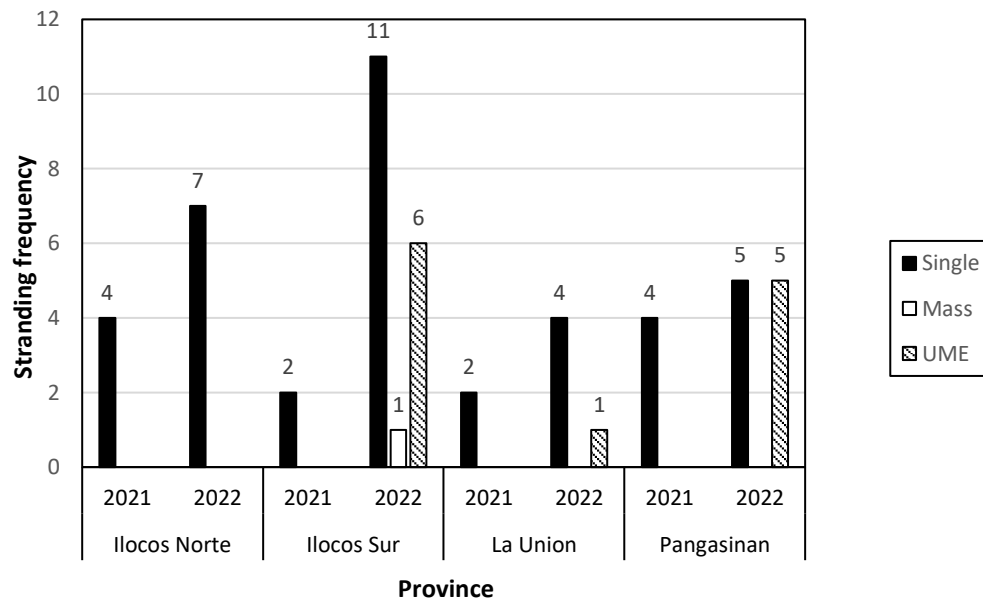


FIGURE 15. STRANDING EVENT CATEGORIES FROM 2021 AND 2022 IN ILOCOS REGION.

REGION 2 (CAGAYAN VALLEY)

The distribution of stranding events in 2021 and 2022 in Region 2 is shown in Figure 16. There was a total of 11 stranding events in the 2-yr period, three stranding events in 2021 and eight stranding events in 2022. Cagayan province had the highest stranding incidences with a total of 10 stranding events (three in 2021 and seven in 2022) (Figure 17). Meanwhile, Batanes had only one incidence which occurred in 2022.

Region 2 had a total of 20 stranding grids and had two municipality/city hotspots (see Table 2 and Figure 16), one of which is classified as the hottest stranding hotspot across the Philippines – Santa Ana with a mean annual stranding rate of 1.2778. The other hotspot was Sanchez Mira-Claveria with a mean annual stranding rate of 0.8333. These two hotspots belong to the very high grid category. There were five medium grids and 13 low grids.

There were only seven months with strandings in Region 2 (Figure 18). Stranding events were the highest in July (n=3). March and October had two stranding events each. January, February, April, June, and December had no strandings in the 2-yr period.

For the seasonality, JJA and SON had the highest stranding incidence, both of which had a total of four strandings (Figure 19). All strandings in the SON season occurred in Cagayan in 2022. Meanwhile, the only one stranding event in Batanes occurred in the JJA season.

There were eight species of marine mammals that stranded along the coast of Region 2 in the 2-yr period (Figure 20). Pantropical spotted dolphin was the most frequent species to strand in Region 2 (n=3). This was followed by the pygmy sperm whale (n=2). The rest of the species had only one stranding event each. Note that Region 2 together with Region 11 have the most diverse assemblage of marine mammals by region (see Table 3).

There were nine single stranding events and two mass strandings recorded in Region 2 (Figure 21). The mass stranding events occurred in Cagayan in 2021 and 2022. The 2021 mass stranding involved three individuals of short-finned pilot whale and the 2022 mass stranding involved six Indo-Pacific bottlenose dolphins. The later mass stranding event was due to fisheries interaction as bycatch (beach seine).

Marine mammal strandings in the Philippines from 2021 to 2022

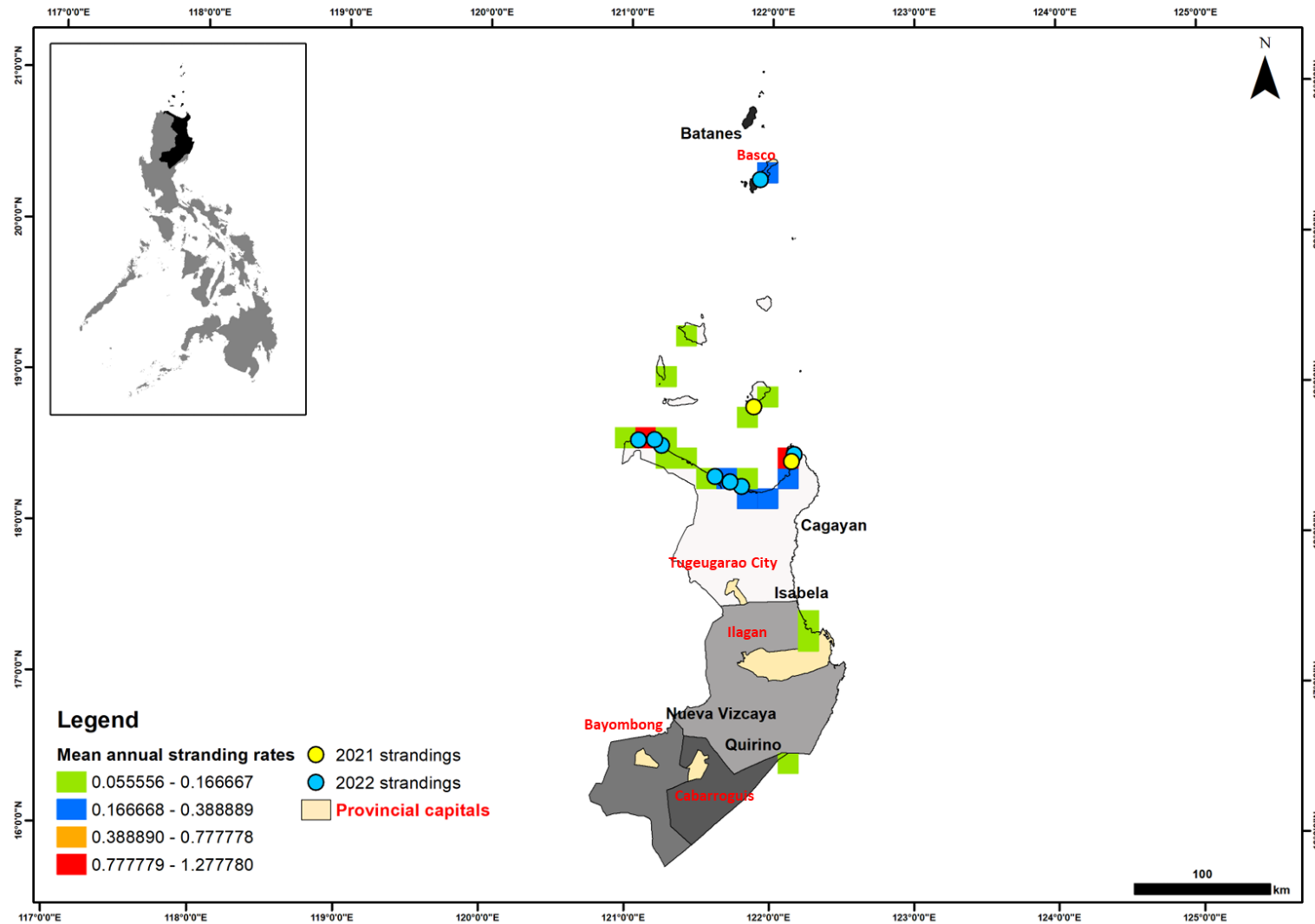


FIGURE 16. MARINE MAMMAL STRANDING STATUS IN REGION 1 (CAGAYAN VALLEY).

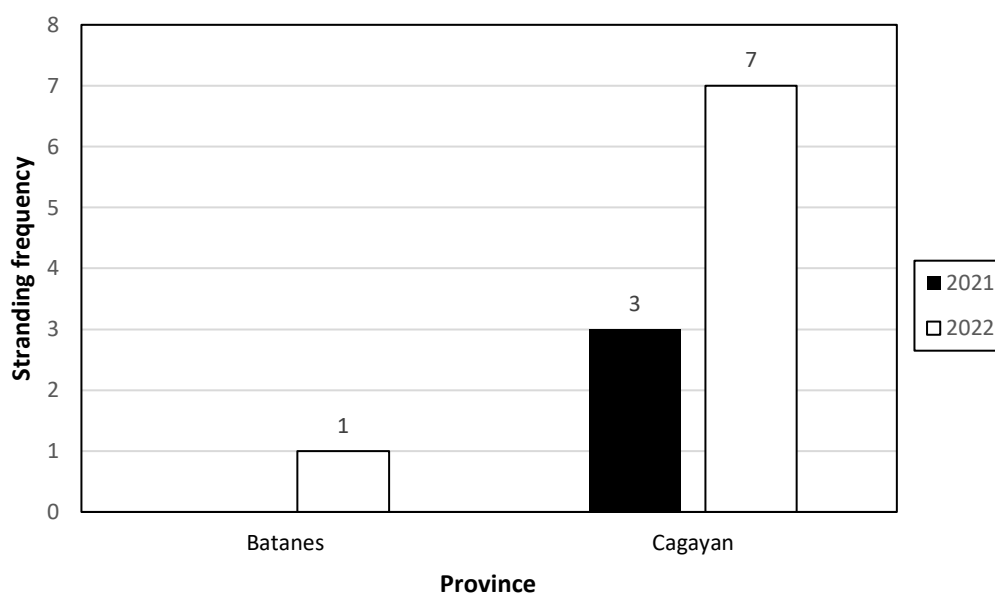


FIGURE 17. STRANDINGS PER PROVINCE FROM 2021 AND 2022 CAGAYAN VALLEY REGION.

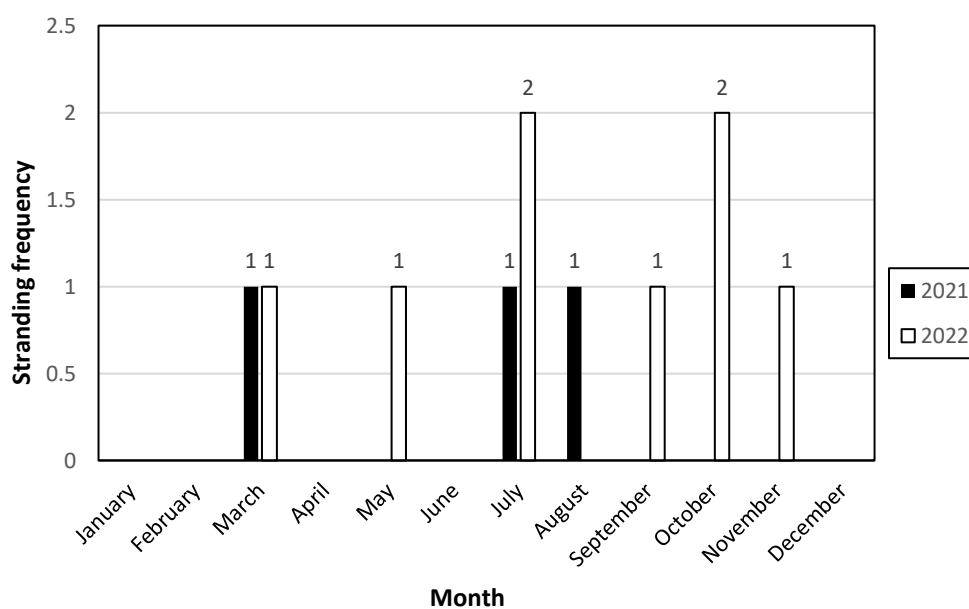


FIGURE 18. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 AND 2022 IN CAGAYAN VALLEY REGION.

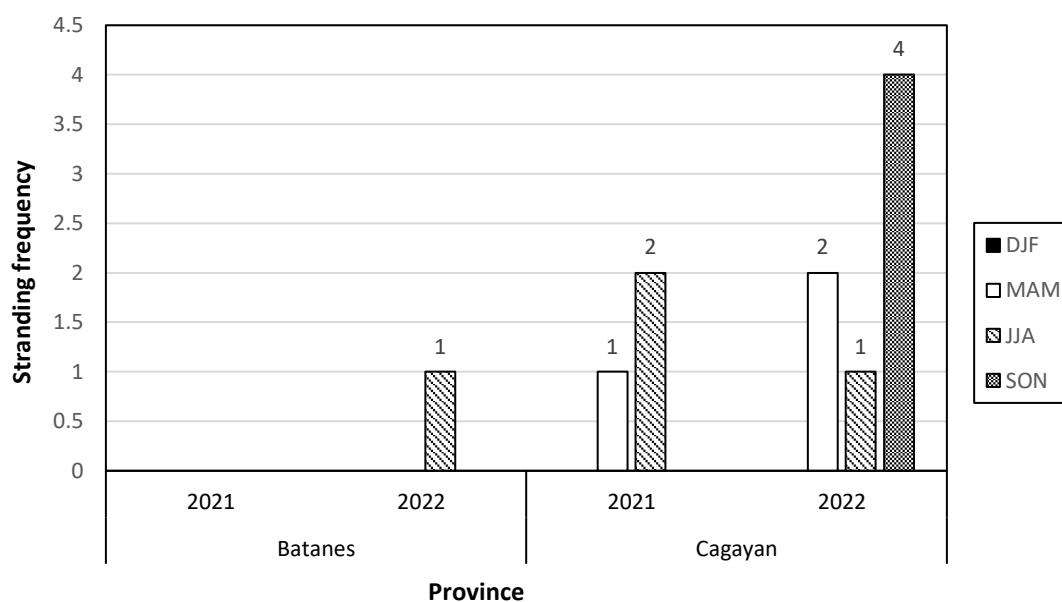


FIGURE 19. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 AND 2022 IN CAGAYAN VALLEY REGION.

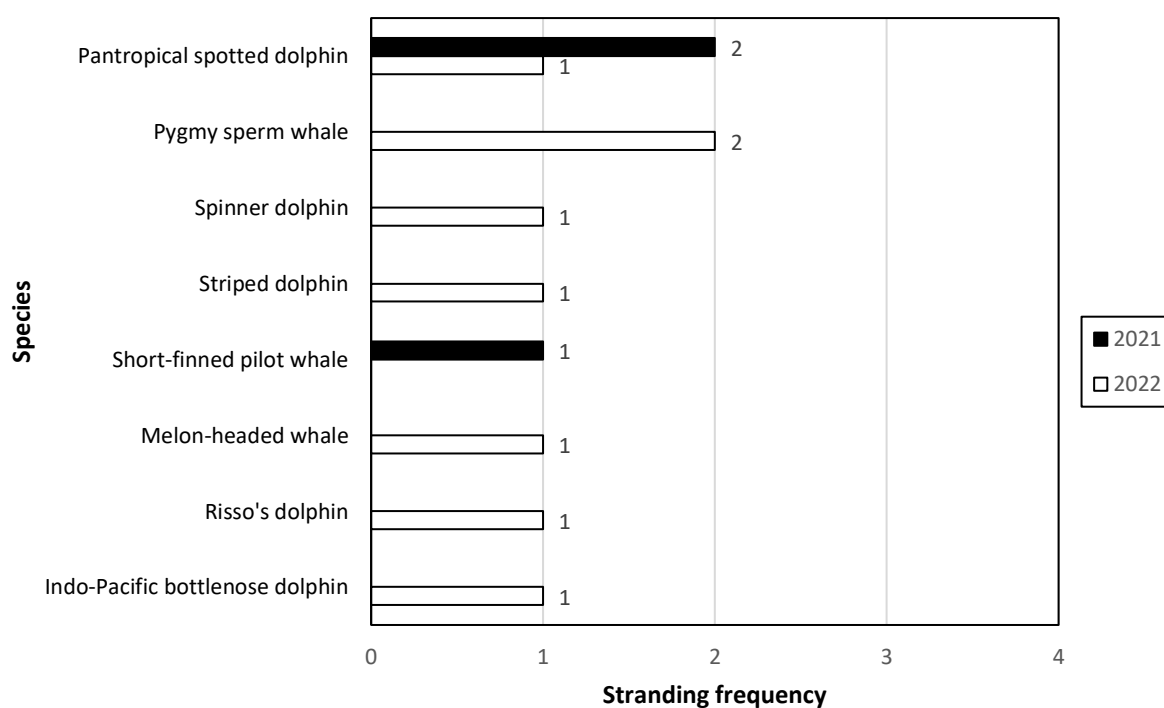


FIGURE 20. STRANDED MARINE MAMMAL SPECIES FROM 2021 AND 2022 IN CAGAYAN VALLEY REGION.

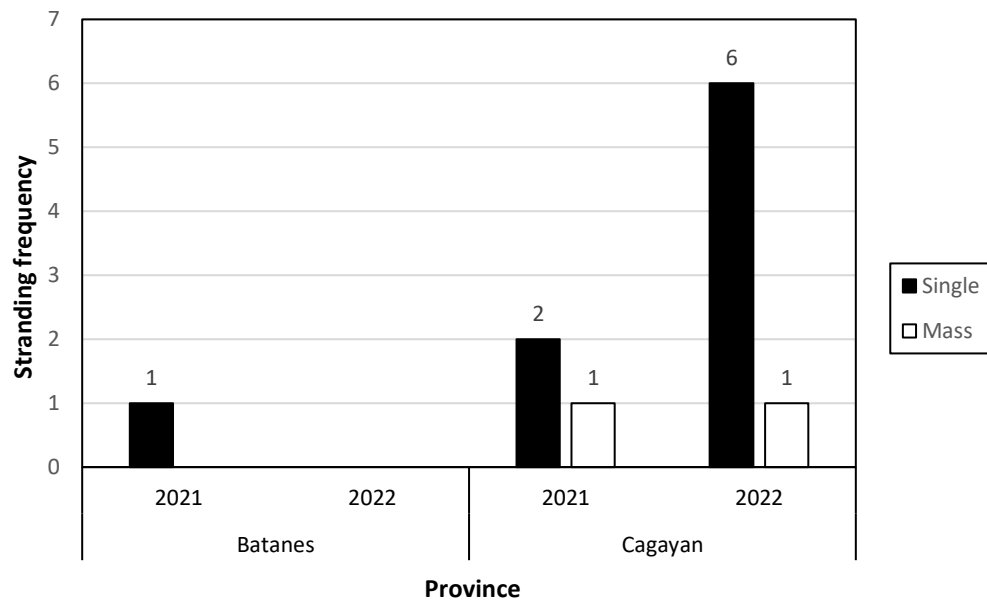


FIGURE 21. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN CAGAYAN VALLEY REGION.

REGION 3 (CENTRAL LUZON)

The distribution of stranding events in 2021 and 2022 in Region 3 is shown in Figure 22. There was a total of six stranding events in the 2-yr period, three stranding events in both 2021 and 2022. Bataan had the highest stranding incidences with a total of four stranding events, two stranding events each in 2021 and 2022 (Figure 23) Aurora and Zambales had only one stranding event each.

Region 3 had a total of 27 stranding grids (see Table 2 and Figure 23). The region had only one stranding hotspot – Morong in Bataan with a mean annual stranding rate of 0.4444. There were 17 low grids and nine medium grids.

There were six months with stranding events in Region 3 (Figure 24). There were two strandings in September, one each in 2021 and 2022. The rest of the months with strandings had one stranding event each. These months were March, May, November, and December.

In terms of seasonality, stranding incidences in Region 3 occurred mostly in the SON season ($n=3$) (Figure 25). Two of which occurred in Bataan and one in Aurora. There were two incidences in the MAM season and one in the DJF season.

There were five marine mammal species that stranded along the coast of Region 2 in the 2-yr period (Figure 26). The top species that was frequently stranded in this region was the striped dolphin ($n=2$). The rest of the species had only one stranding event each – Fraser's dolphin, spinner dolphin, Bryde's whale, and pantropical spotted dolphin. For the stranding category, all stranding events in Region 3 in the 2-yr period involved single stranding events (Figure 27). Note that Region 2 together with Region 11 have the most diverse assemblage of marine mammals by region (see Table 3).

Marine mammal strandings in the Philippines from 2021 to 2022

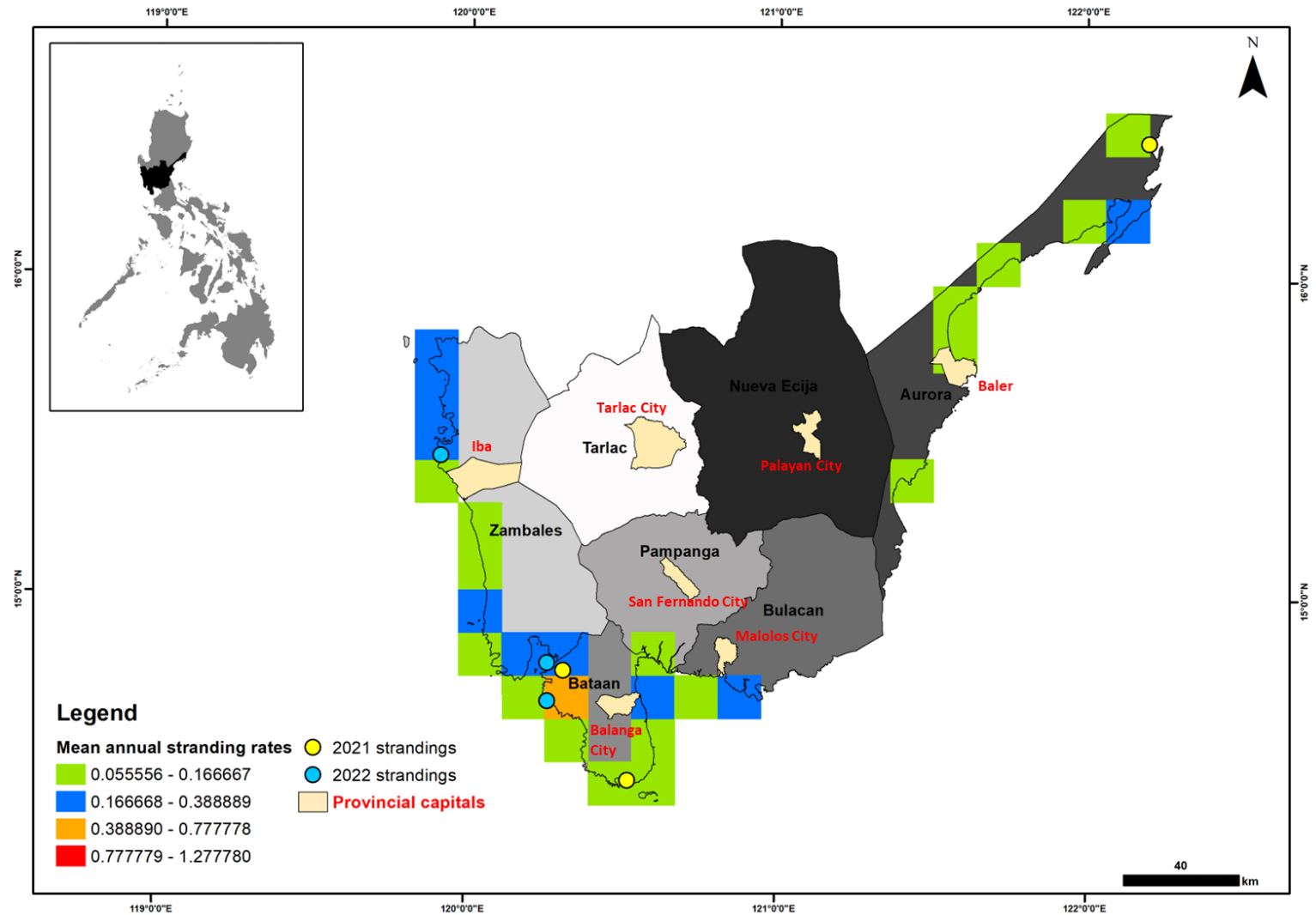


FIGURE 22. MARINE MAMMAL STRANDING STATUS IN REGION 3 (CENTRAL LUZON).

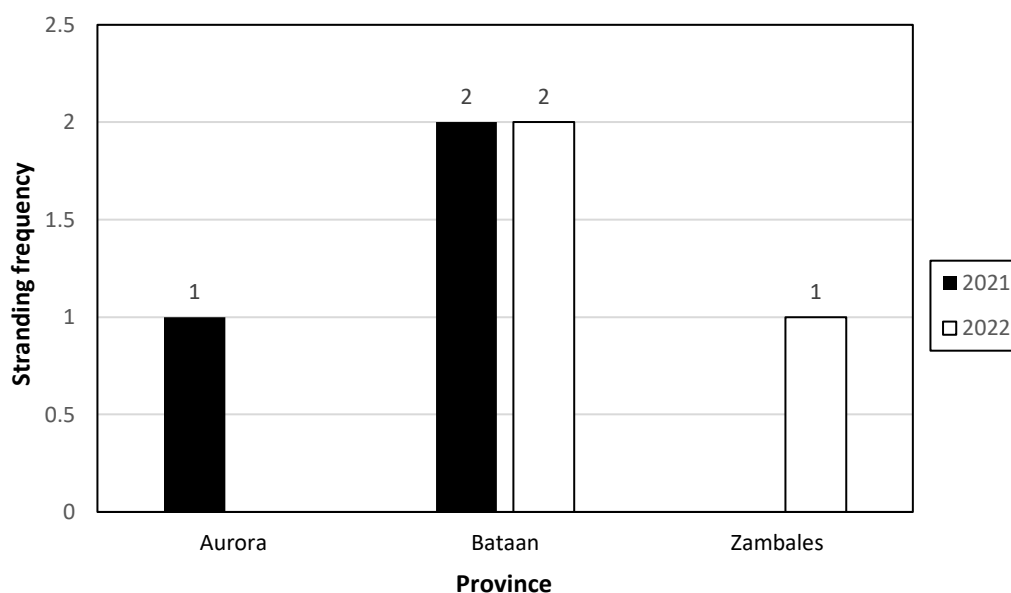


FIGURE 23. STRANDINGS PER PROVINCE FROM 2021 AND 2022 IN REGION 3 (CENTRAL LUZON).

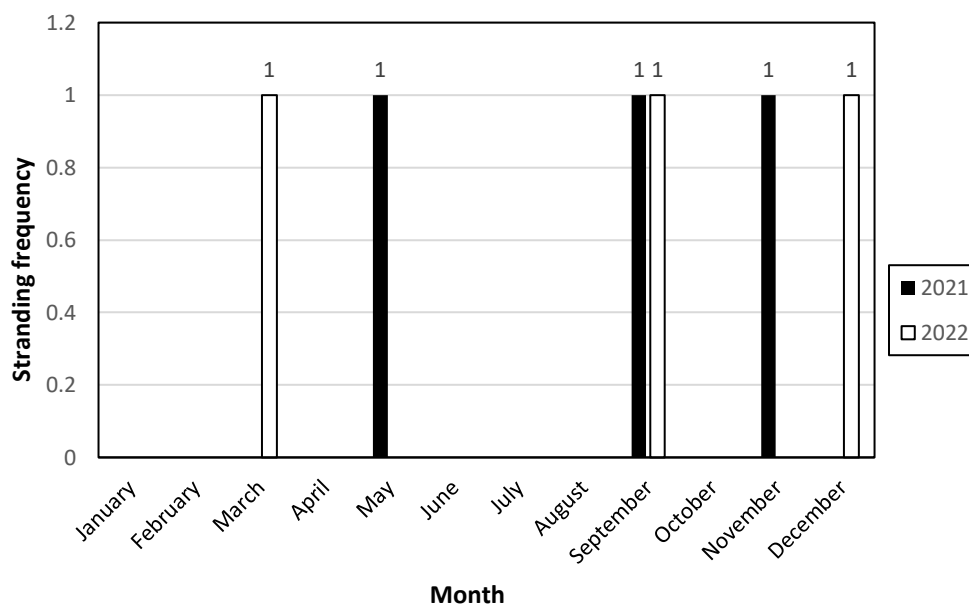


FIGURE 24. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 AND 2022 IN REGION 3 (CENTRAL LUZON).

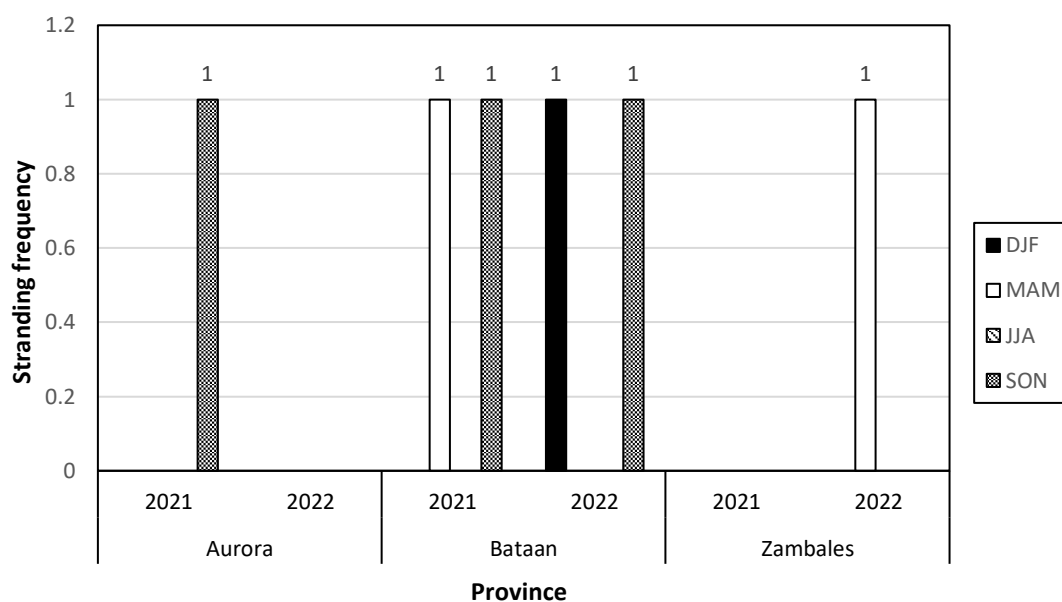


FIGURE 25. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 AND 2022 IN REGION 3 (CENTRAL LUZON).

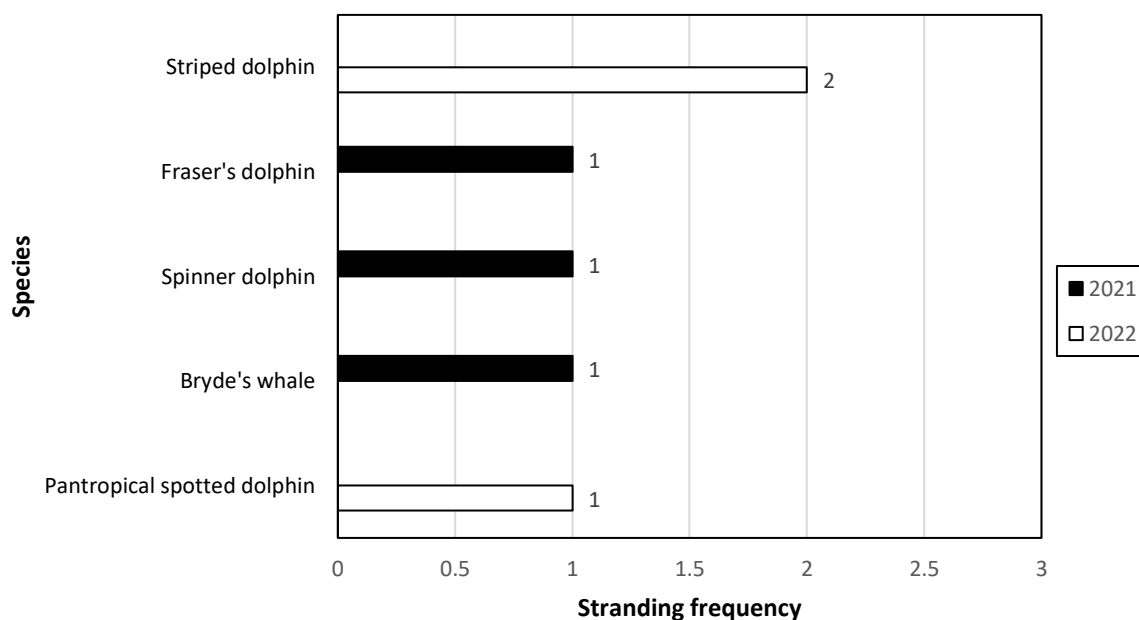


FIGURE 26. STRANDED MARINE MAMMAL SPECIES FROM 2021 AND 2022 IN REGION 3 (CENTRAL LUZON).

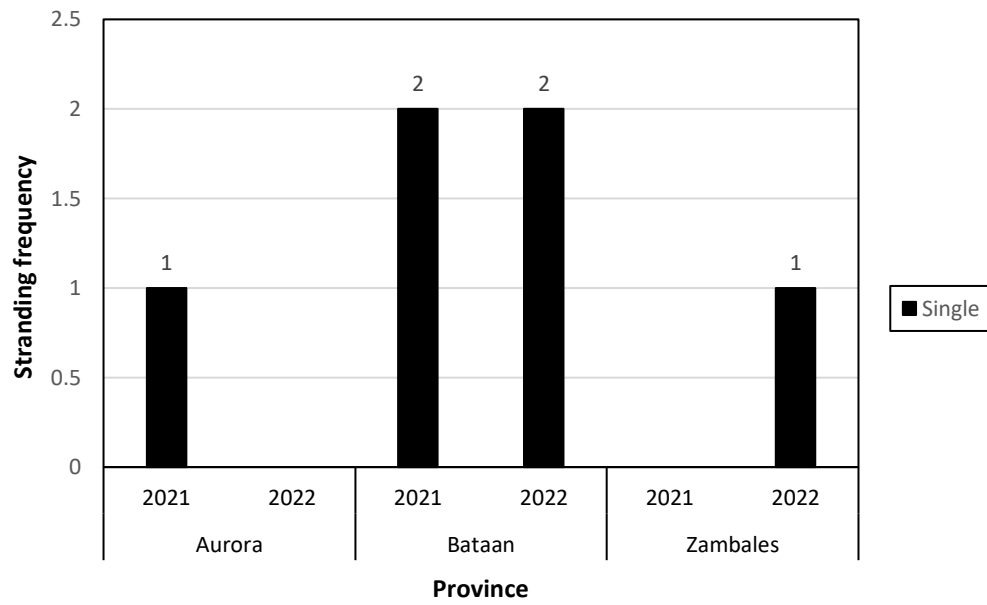


FIGURE 27. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN REGION 3 (CENTRAL LUZON).

REGION 4A (CALABARZON)

The distribution of stranding events in 2021 and 2022 in Region 4A is shown in Figure 28. There was a total of nine stranding events in the 2-yr period in this region, six events in 2021 and three in 2022. Quezon province had the most stranding incidences with a total of eight stranding events (six in 2021 and two in 2022) (Figure 29). Batangas had only one stranding event which occurred in 2022.

Region 4A had a total of 35 stranding grids. The region had one stranding hotspot classified as a high grid – Padre Burgos-Agdangan in Quezon with a mean annual stranding rate of 0.5000 (see Table 2 and Figure 28). There were 30 low grids and four medium grids.

There were only six months with strandings in Region 4A (Figure 30). Stranding events of 2021 occurred in January (n=1), March (n=1), April (n=2), June (n=1), and July (n=1). Meanwhile, all strandings of 2022 occurred only in one month – November (n=3).

Stranding events in Region 4A occurred across all seasons (Figure 31). There were three stranding events each during the MAM and SON season. All strandings in the MAM season occurred in Quezon in 2021. There were two stranding events in the JJA season and one in DJF.

There were eight species of marine mammals that were stranded along the coast of Region 4A in the 2-yr period (Figure 32). Risso's dolphin was the most frequent species that stranded in the region (n=2). The rest of the species had only one stranding – spinner dolphin, unidentified balaenopterid, Blainville's beaked whale, Fraser's dolphin, dwarf sperm whale, pygmy sperm whale, and pantropical spotted dolphin. For the stranding category, all stranding events involved single strandings (Figure 33).

Marine mammal strandings in the Philippines from 2021 to 2022

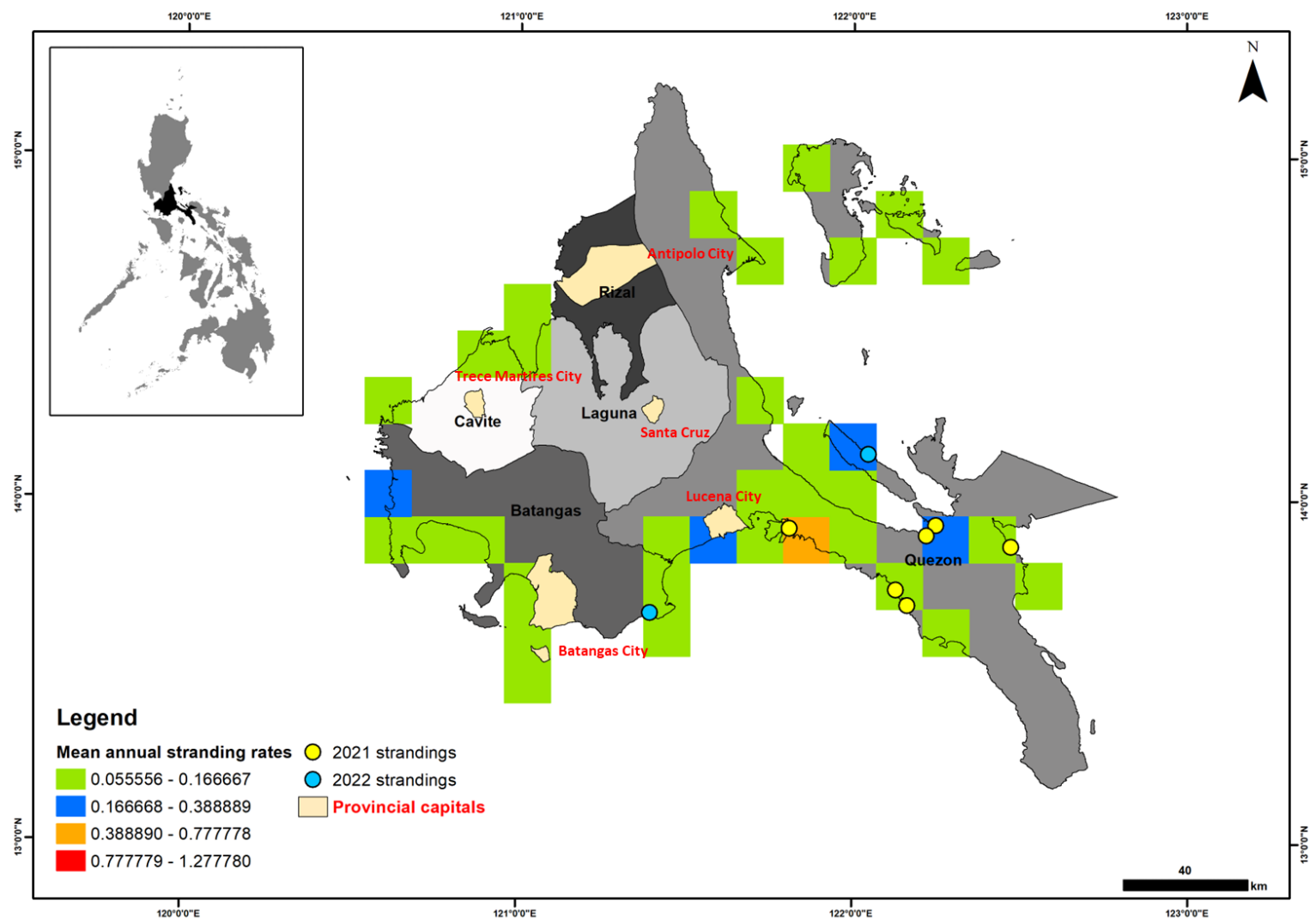


FIGURE 28. MARINE MAMMAL STRANDING STATUS IN REGION 4A (CALABARZON).

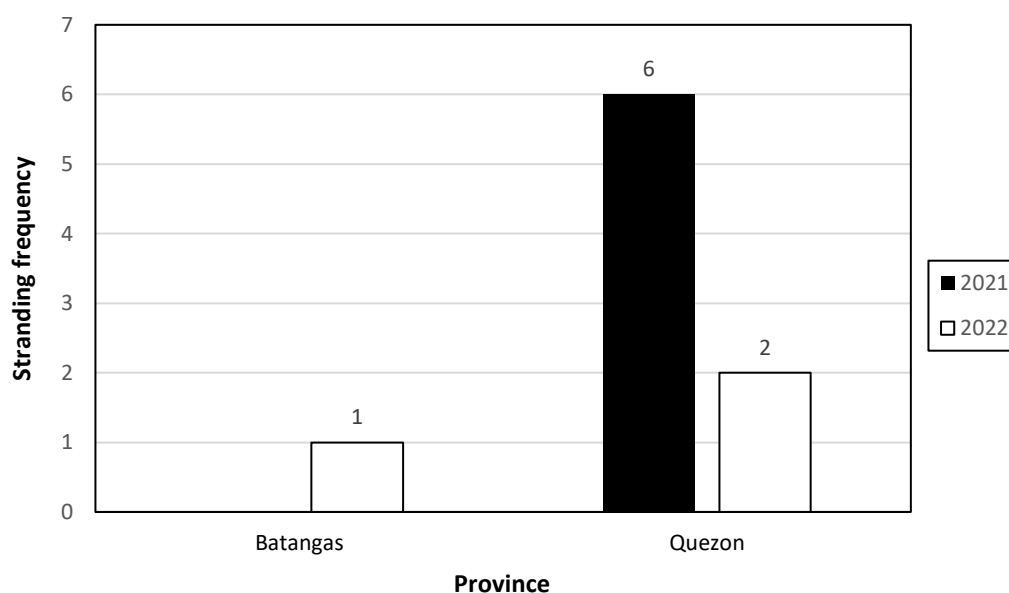


FIGURE 29. STRANDINGS PER PROVINCE FROM 2021 AND 2022 IN REGION 4A (CALABARZON).

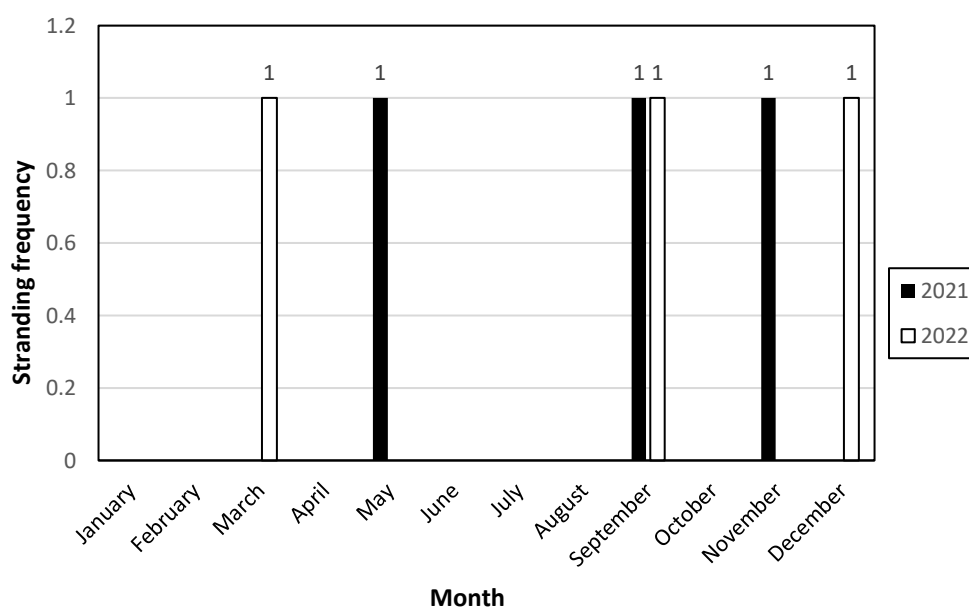


FIGURE 30. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN REGION 4A (CALABARZON).

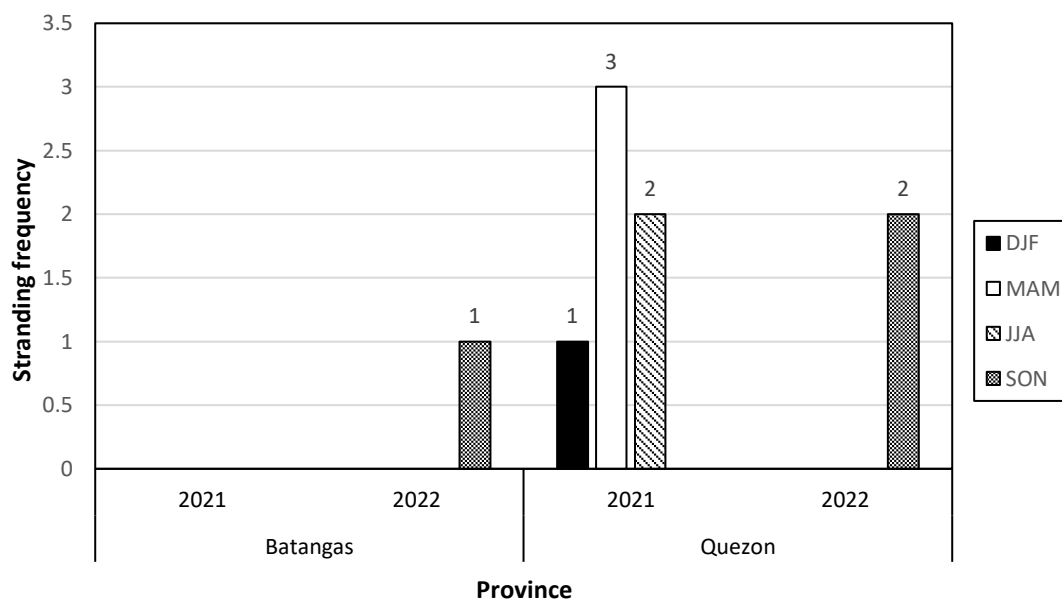


FIGURE 31. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN REGION 4A (CALABARZON).

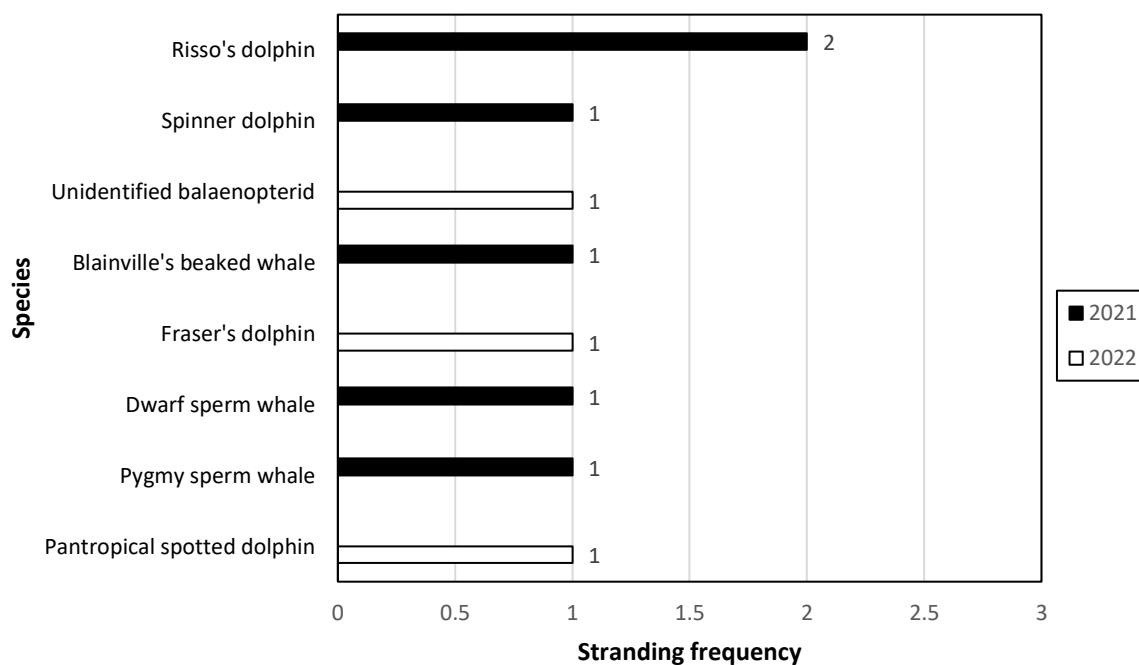


FIGURE 32. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN REGION 4A (CALABARZON).

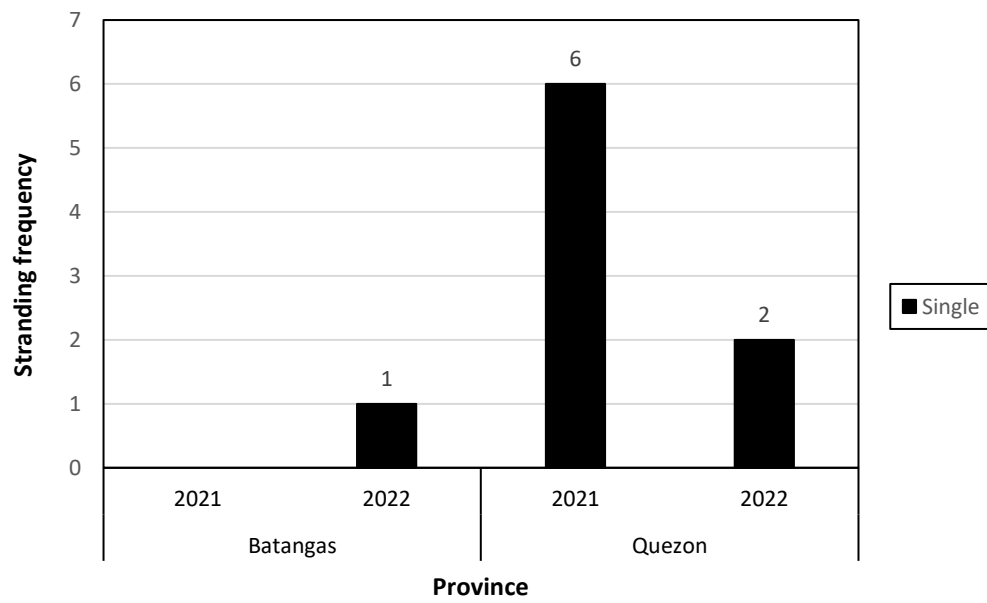


FIGURE 33. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN REGION 4A (CALABARZON).

REGION 4B (MIMAROPA)

The distribution of stranding events in 2021 and 2022 in Region 4B is shown in Figure 34. There was a total of 18 stranding events in the 2-yr period in this region, 14 events in 2021 and four events in 2022. Most of these stranding events occurred in the provinces of Palawan (n=7) and Oriental Mindoro (n=6) (Figure 35). Romblon had two stranding incidences and the rest of the provinces had one stranding event each which occurred all in 2021.

Region 4B had a total of 46 stranding grids. The region had one stranding hotspot, classified as a high grid, located in Odiongan, Romblon with a mean annual stranding rate of 0.4444 (see Table 2 and Figure 34). There were 5 medium grids and 40 low grids.

Stranding events in Region 4B occurred in almost every month except on February and July (Figure 36). The highest incidences occurred in the months of April, May, and November, all of which had three stranding events each. The rest of the months with strandings had one to two strandings.

Figure 28 shows the seasonal distribution of strandings per province in Region 4B in the 2-yr period (Figure 37). Stranding incidences occurred the highest during the MAM season (n=7), followed by the SON season (n=5). JJA had four stranding events and DJF had two. About 43% of the strandings in the MAM season occurred in Oriental Mindoro in 2021. Meanwhile, all seasons in Palawan had stranding incidences.

There were nine marine mammal species that stranded along the coast of Region 4B in the 2-yr period (Figure 38). The dugong and Risso's dolphin were the top species that frequently stranded in the region with four strandings each. The dugong had two strandings in 2021 as well in 2022. On the other hand, all strandings of Risso's dolphin occurred only in 2021. The other species that stranded in this region were: dwarf sperm whale (n=2), short-finned pilot whale (n=2), Indo-Pacific bottlenose dolphin (n=2), false killer whale (n=1), spinner dolphin (n=1), Bryde's whale (n=1), and Fraser's dolphin (n=1). All stranding events in this region involved single strandings (Figure 39).

Marine mammal strandings in the Philippines from 2021 to 2022

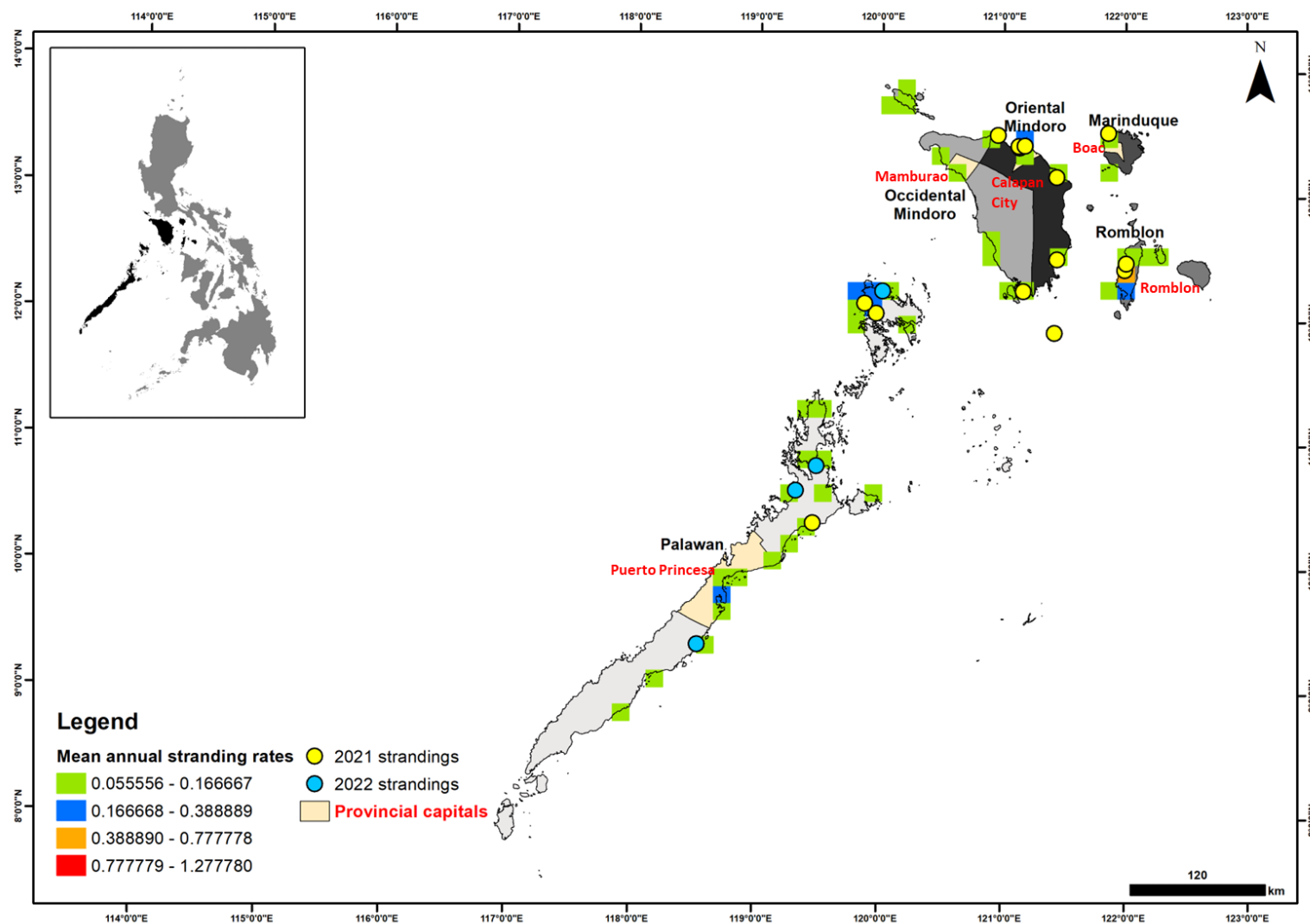


FIGURE 34. MARINE MAMMAL STRANDING STATUS IN REGION 4B (MIMAROPA).

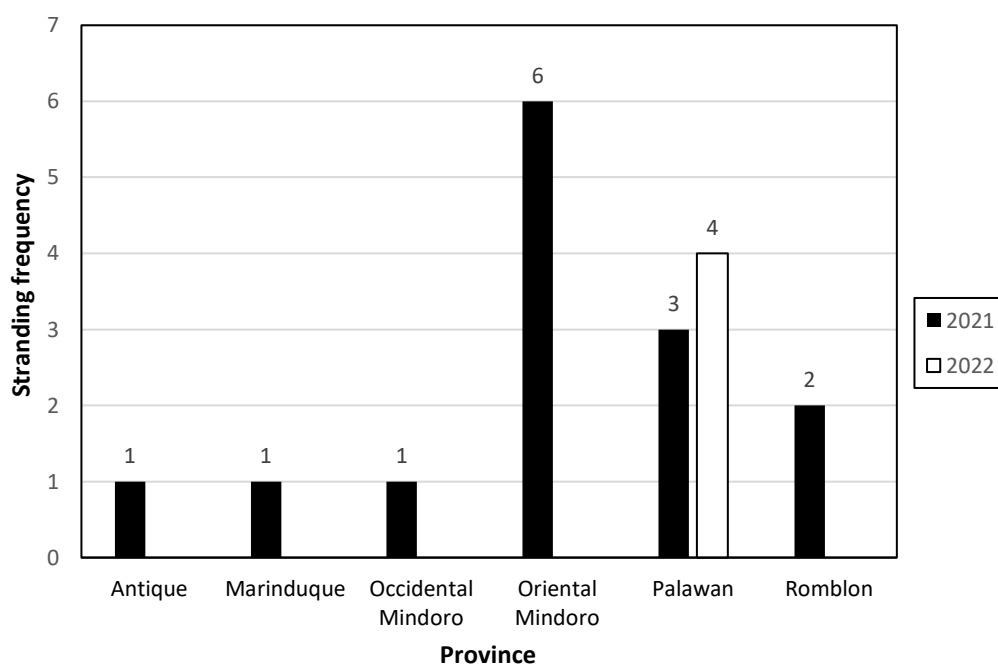


FIGURE 35. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN MIMAROPA REGION.

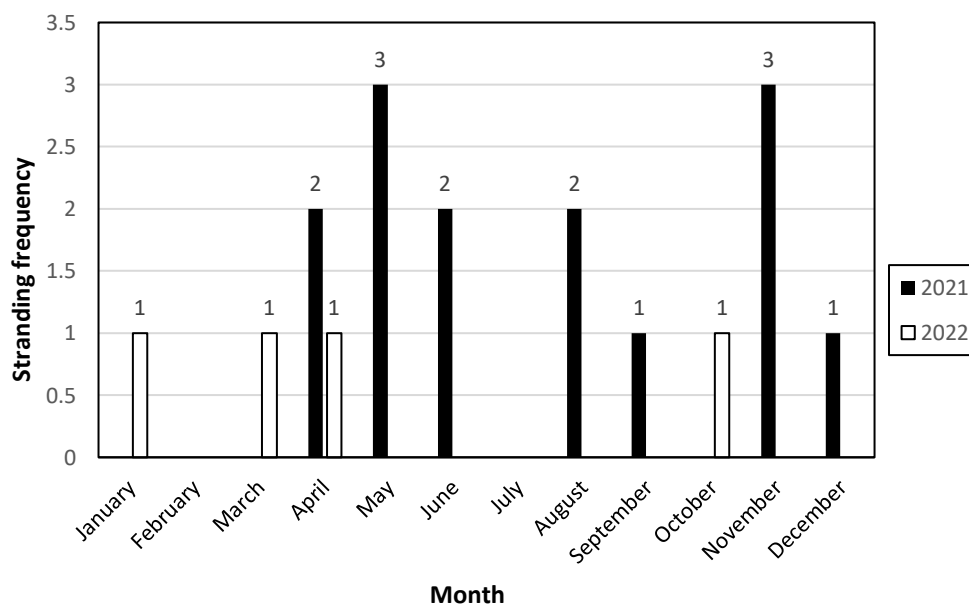


FIGURE 36. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN MIMAROPA REGION.

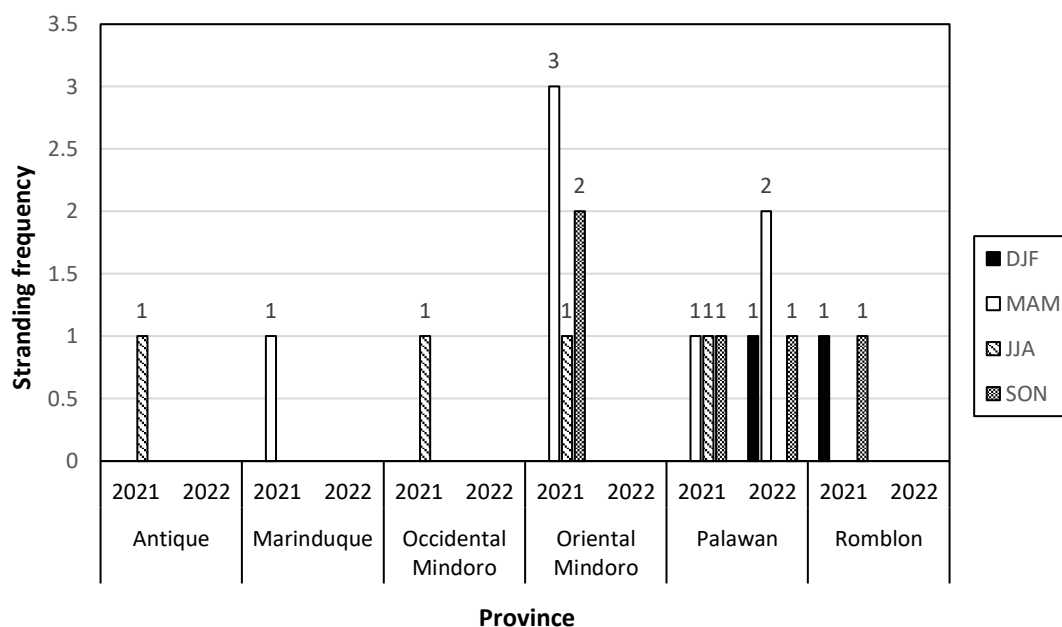


FIGURE 37. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN MIMAROPA REGION.

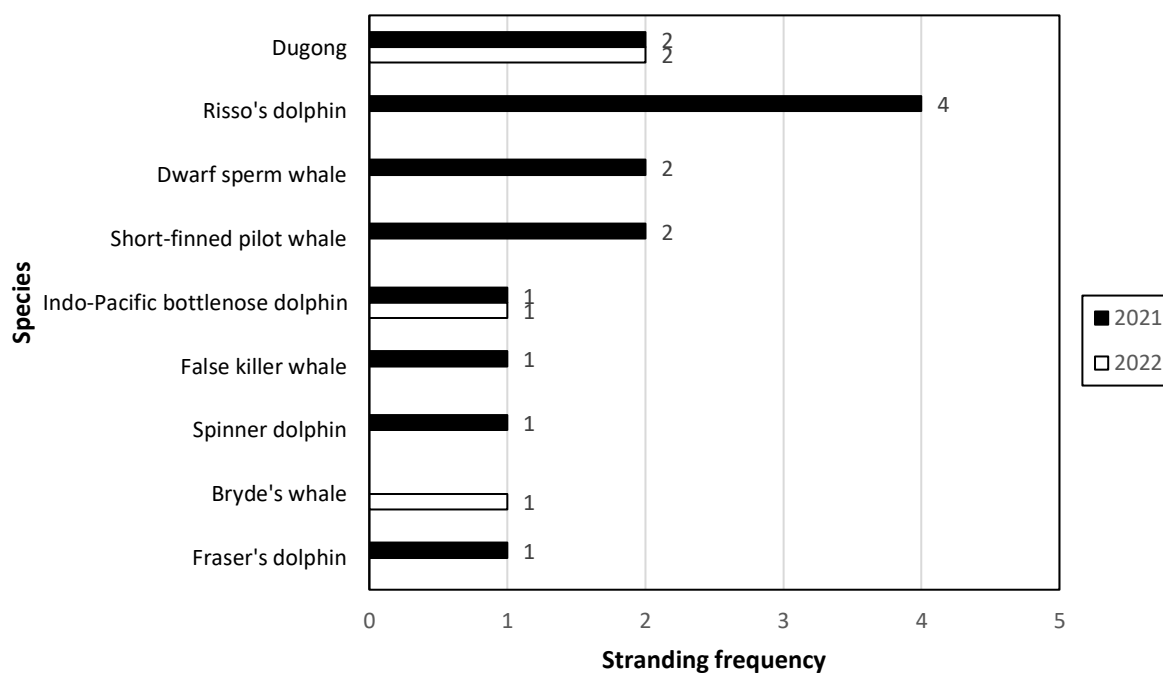


FIGURE 38. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN MIMAROPA REGION.

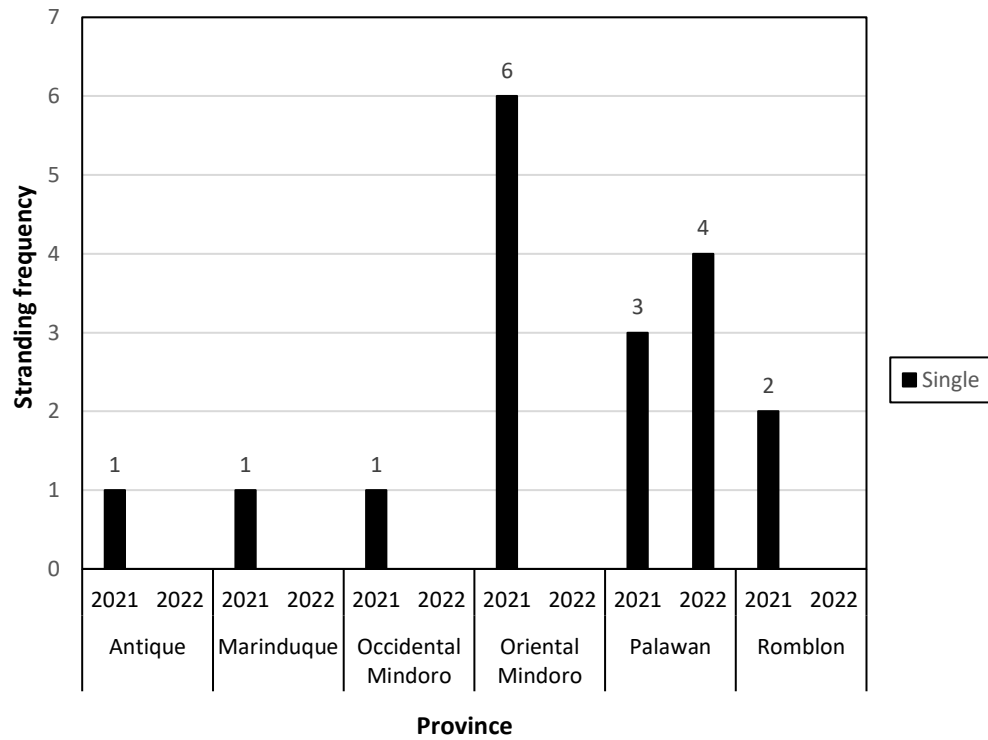


FIGURE 39. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN MIMAROPA REGION.

REGION V (BICOL REGION)

The distribution of stranding events in 2021 and 2022 in Region 5 is shown in Figure 40. Region 5 was the top three region with the highest stranding events (see Table 2). There was a total of 24 stranding events in the 2-yr period in this region, 18 events in 2021 and six events in 2022. Most of these stranding events occurred in the provinces of Masbate ($n=8$) and Camarines Sur ($n=7$) in which 75-86% of its strandings occurred in 2021 (Figure 41) Sorsogon had three stranding events, Catanduanes and Albay had two stranding events each, and Camarines Norte had one stranding event.

Region 5 had a total of 73 stranding grids, the highest number of stranding grids across all Philippine regions. The region had four stranding hotspots that were classified as high grids (see Table 2 and Figure 40). The stranding hotspots were Del Gallego, Camarines Sur (0.7778), Legazpi City, Albay (0.4444), Gubat, Sorsogon (0.4444), and Barcelona, Sorsogon (0.4444). There were nine medium grids and 60 low grids.

Stranding events in Region 5 occurred in almost every month except on April, July, and December (Figure 42). The highest incidences occurred in May with seven strandings, six in 2021 and one in 2022. The rest of the months with strandings had three to one strandings each.

Figure 43 shows the seasonal distribution of strandings per province in Region 5 in the 2-yr period. Stranding incidences occurred the highest during the MAM season ($n=8$), followed by the JJA season ($n=6$). DJF and SON had five strandings each. About 80% of the strandings in the DJF season occurred in Camarines Sur in 2021. Strandings during the MAM season occurred in every province of Region 5 except in Albay.

There were 11 marine mammal species that stranded along the coast of Region 5 in the 2-yr period (Figure 44). Spinner dolphin was the top species that frequently stranded in the region ($n=7$). Short-finned pilot whale followed the list with five stranding incidences. Risso's dolphin, Fraser's dolphin, and dwarf sperm whale had two stranding events each. The rest of species had one stranding incidence – pygmy sperm whale, Indo-Pacific bottlenose dolphin, pantropical spotted dolphin, sperm whale, Irrawaddy dolphin, and pygmy killer whale.

In terms of stranding category, 20 were single stranding events, two mass strandings, and two UMEs (Figure 45). One of the mass stranding events involved 25 Fraser's dolphin in Del Gallego, Camarines Sur. There were 12 individuals released and 13 dead upon initial sighting. The other mass stranding event involved two spinner dolphins in Placer, Masbate which were eventually released. The two UMEs involved short-finned pilot whales that stranded in Virac, Catanduanes. The cause of stranding of UME were not clearly determined.

Marine mammal strandings in the Philippines from 2021 to 2022

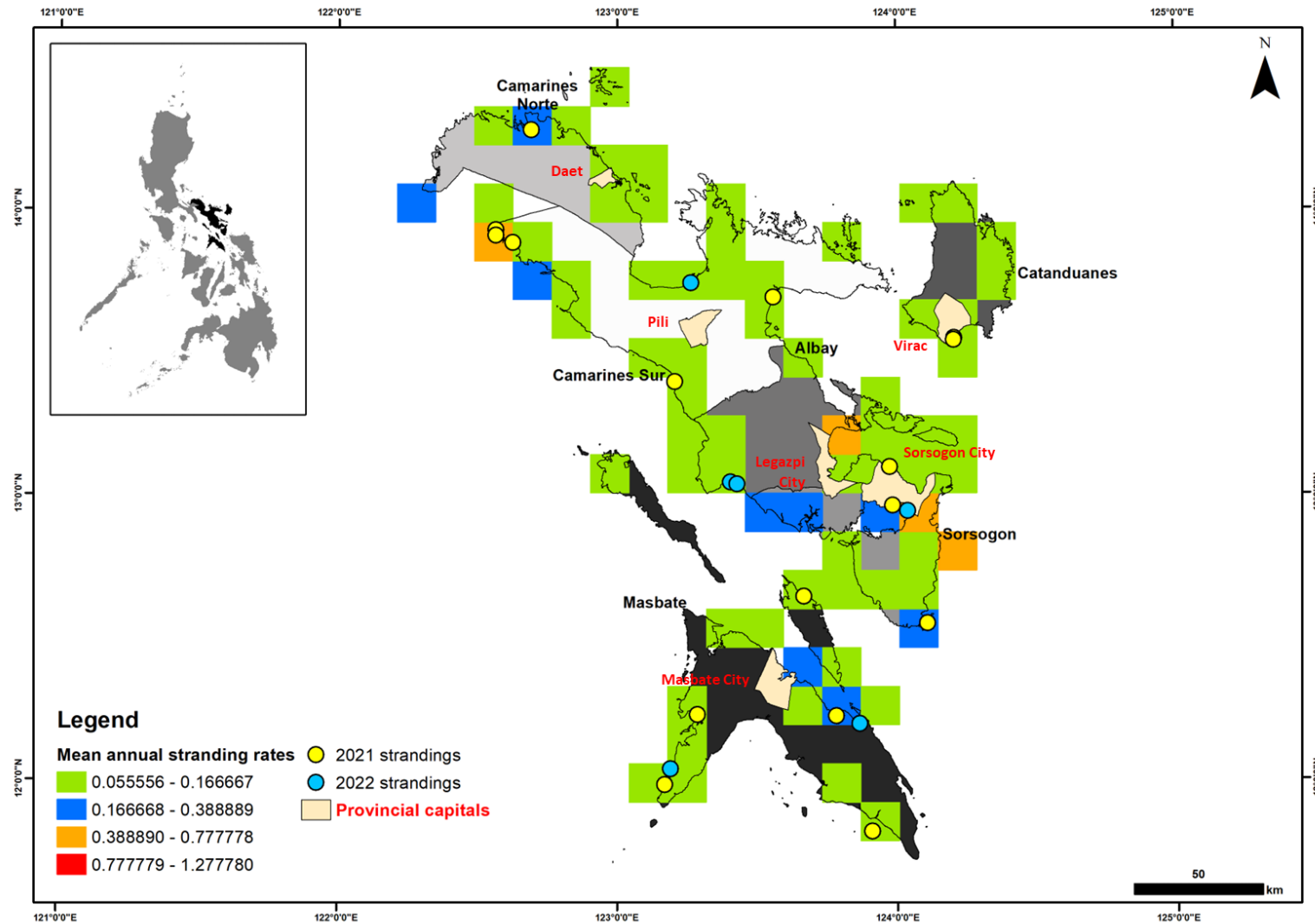


FIGURE 40. MARINE MAMMAL STRANDING STATUS IN REGION 5 (BICOL REGION).

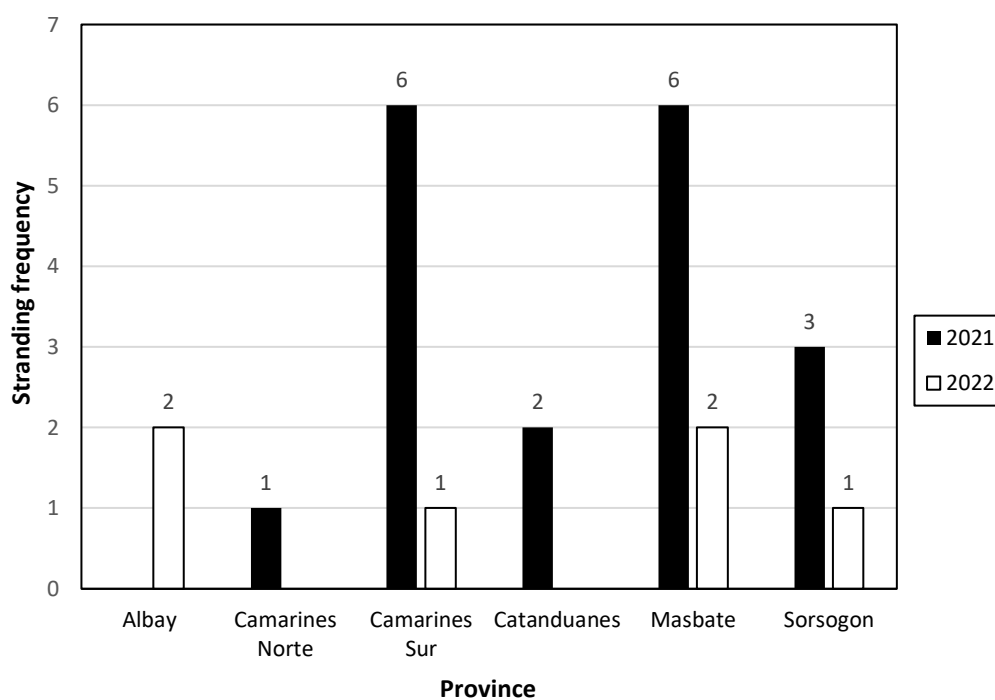


FIGURE 41. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN BICOL REGION.

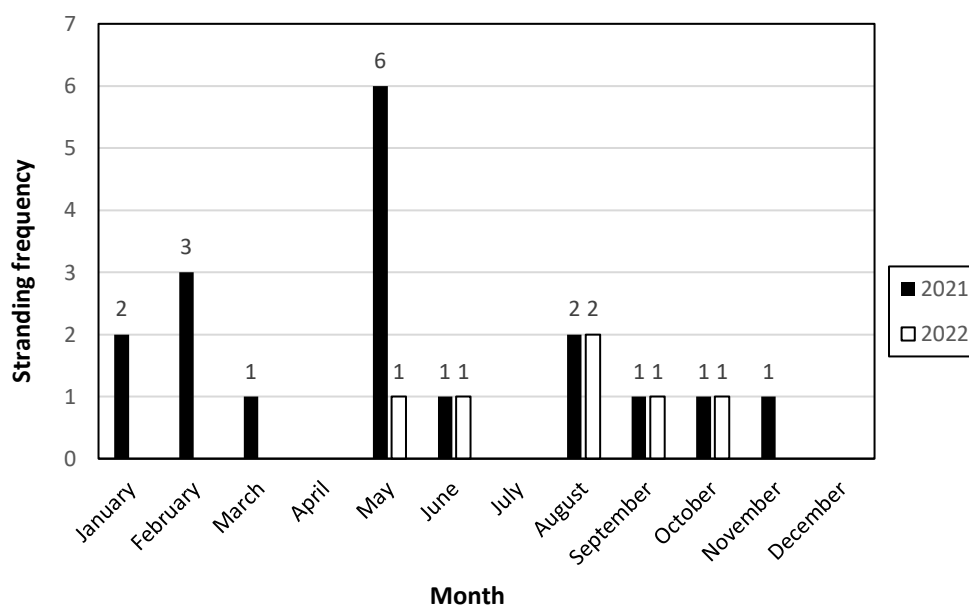


FIGURE 42. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN BICOL REGION.

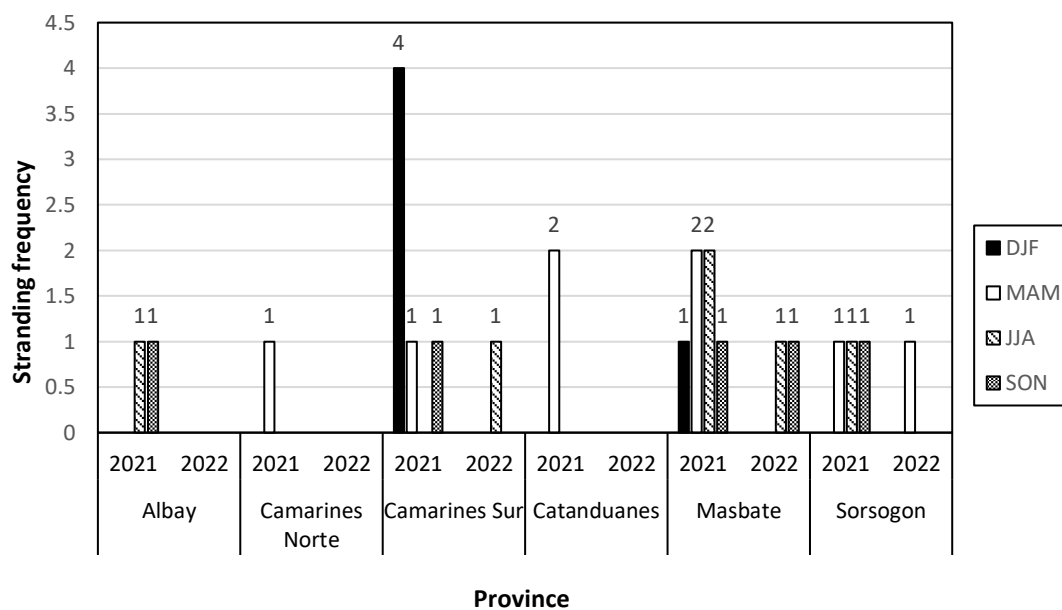


FIGURE 43. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN BICOL REGION.

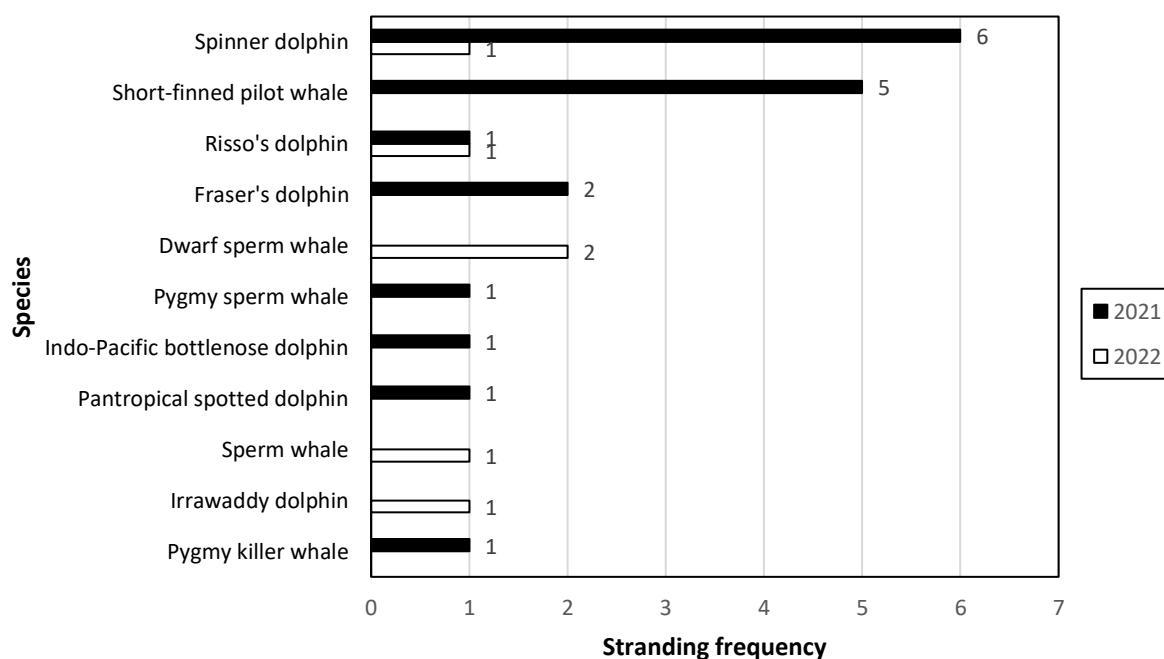


FIGURE 44. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN BICOL REGION.

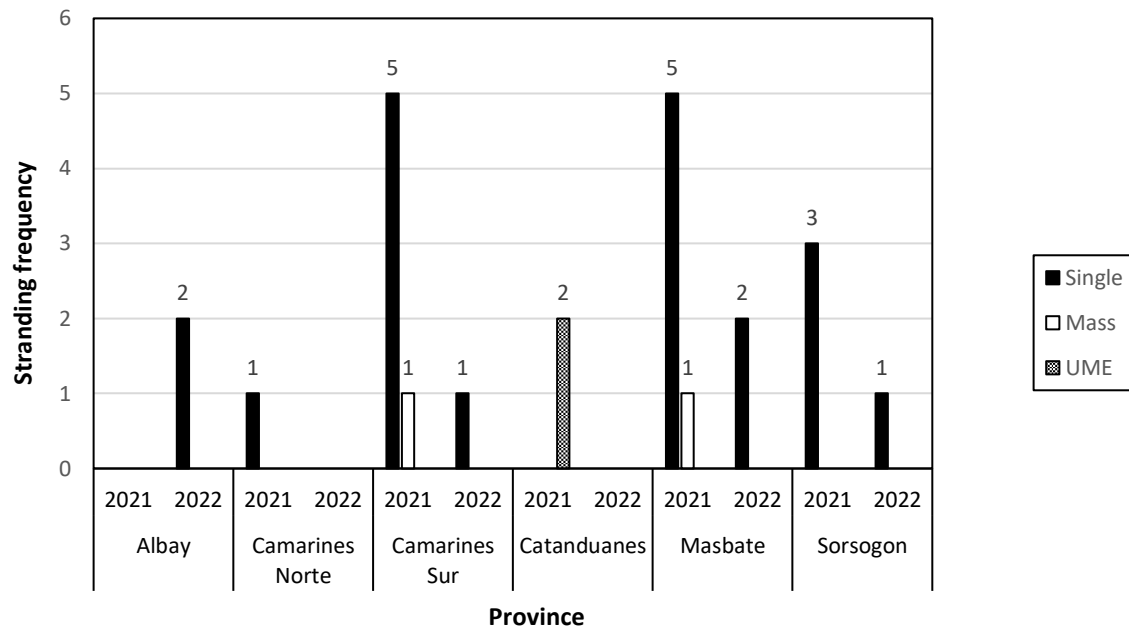


FIGURE 45. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN BICOL REGION.

REGION 6 (WESTERN VISAYAS)

The distribution of stranding events in 2021 and 2022 in Region 6 is shown in Figure 46. There was a total of 24 stranding events in the 2-yr period in this region, 13 events in 2021 and 10 events in 2022. Most of these stranding events occurred in the provinces of Negros Occidental (n=7) and Antique (n=5) (Figure 47). Aklan and Guimaras had four stranding events each, Iloilo had two stranding events, and Capiz had one stranding event.

Region 6 had a total of 45 stranding grids. The region had one stranding hotspot that was classified as high grid – Pulupandan and Bago City, Negros Occidental with a mean annual stranding rate of 0.6111 (see Table 2 and Figure 46). There were seven medium grids and 37 low grids.

Stranding events in Region 6 occurred in every month in the 2-yr period (Figure 48). The highest incidences occurred in March and July with five strandings each. The rest of the months with strandings had two to one strandings each.

Figure 49 shows the seasonal distribution of strandings per province in Region 6 in the 2-yr period. Stranding incidences occurred the highest during the JJA season (n=8), followed by the MAM season (n=7). DJF and SON had four strandings each. Fifty percent of the stranding events in the JJA occurred in Negros Occidental. MAM strandings occurred in almost all provinces except in Capiz.

There were 11 marine mammals that were stranded along the coast of Region 6 in the 2-yr period (Figure 50). The dugong was the top species that frequently stranded in the region (n=6). Short-finned pilot whale followed the list with four stranding incidences. Spinner dolphin had three stranding events. Fraser's dolphin and dwarf sperm whale had two strandings each. The rest of species had one stranding incidence – Risso's dolphin, sperm whale, Irrawaddy dolphin, pygmy killer whale, common bottlenose dolphin, Omura's whale. All stranding events that occurred in this region were classified as single stranding events (Figure 51).

Marine mammal strandings in the Philippines from 2021 to 2022

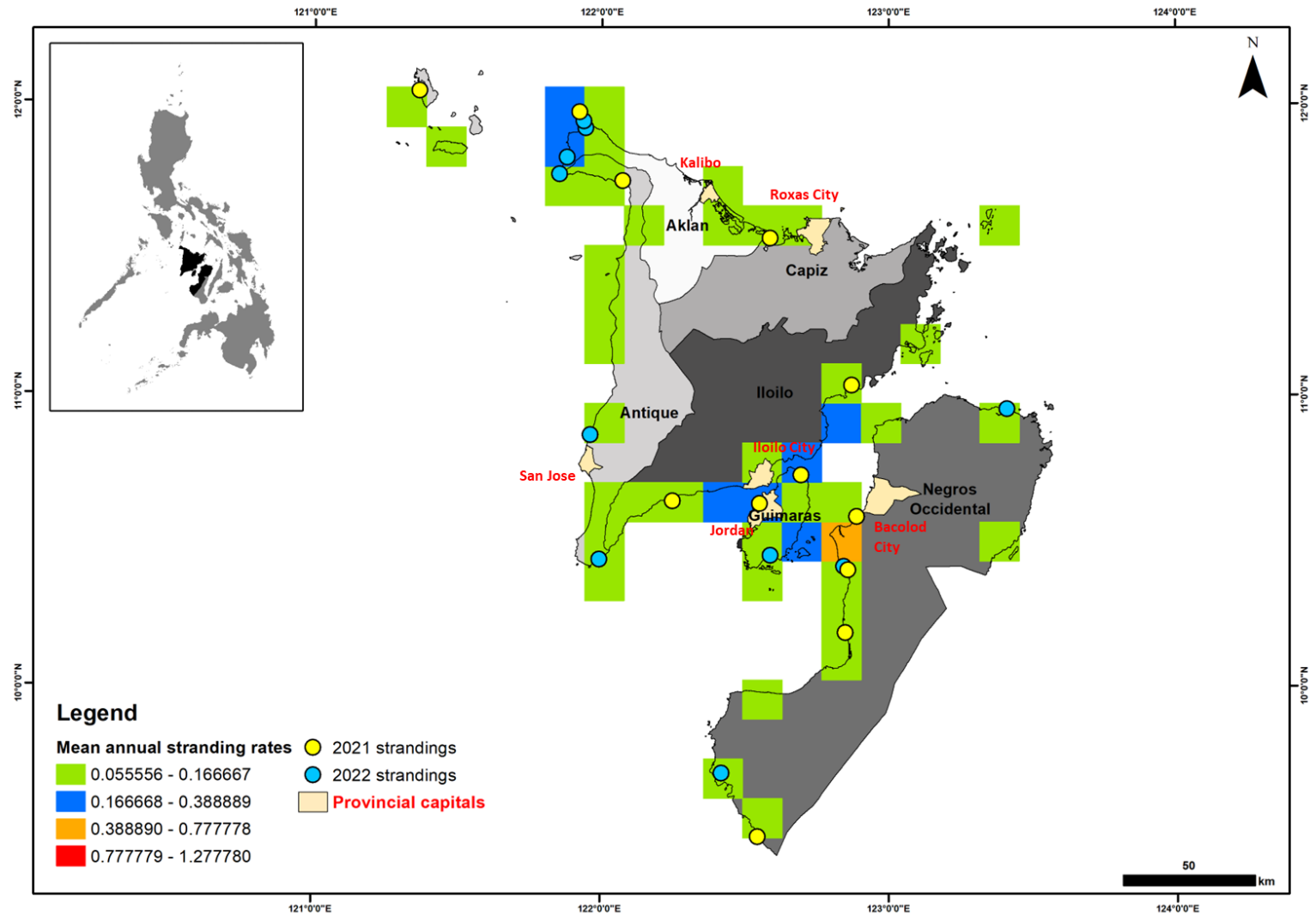


FIGURE 46. MARINE MAMMAL STRANDING STATUS IN REGION 6 (WESTERN VISAYAS).

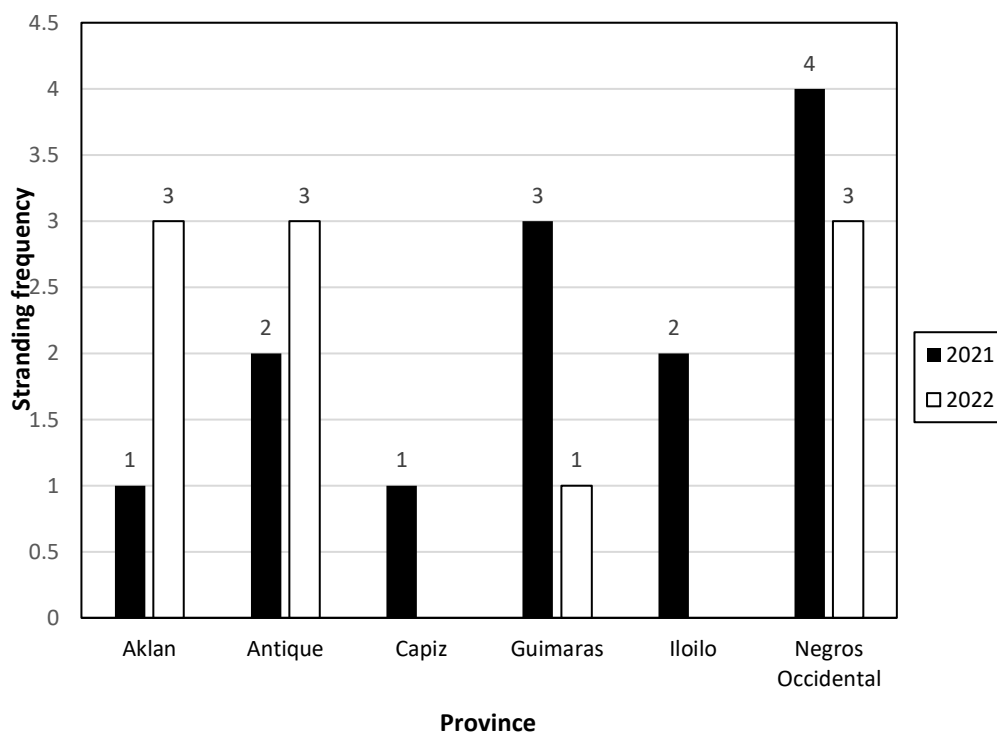


FIGURE 47. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN WESTERN VISAYAS REGION.

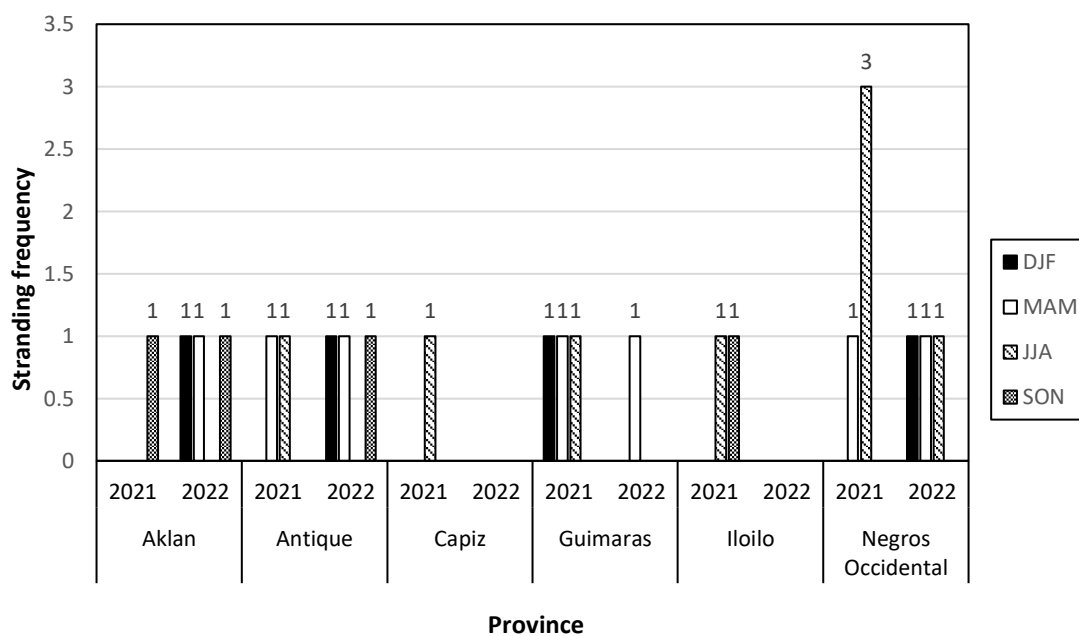


FIGURE 48. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN WESTERN VISAYAS REGION.

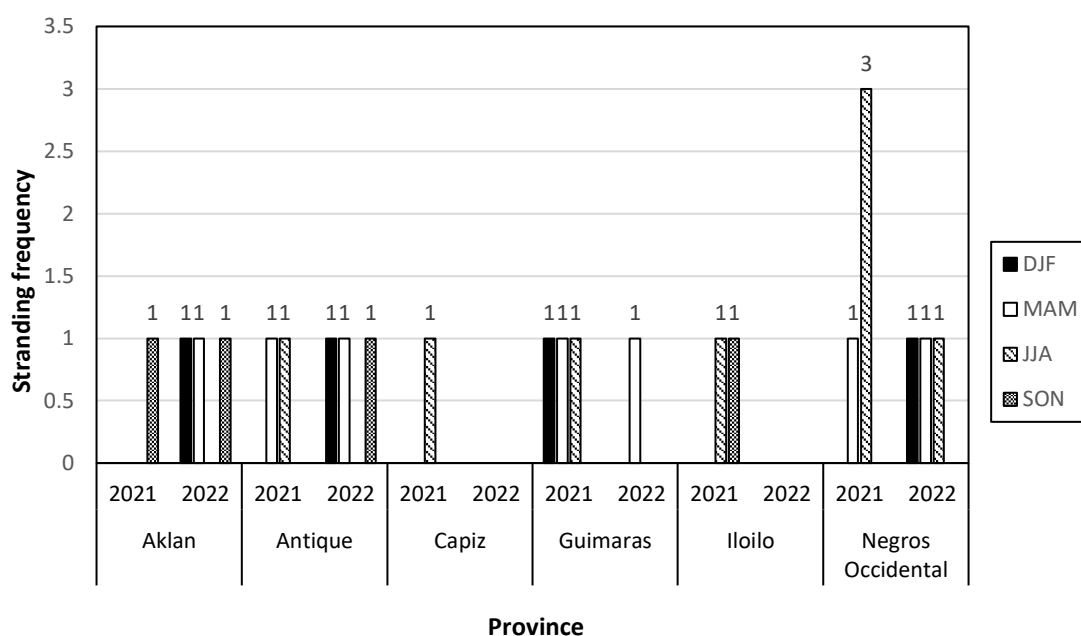


FIGURE 49. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN WESTERN VISAYAS REGION.

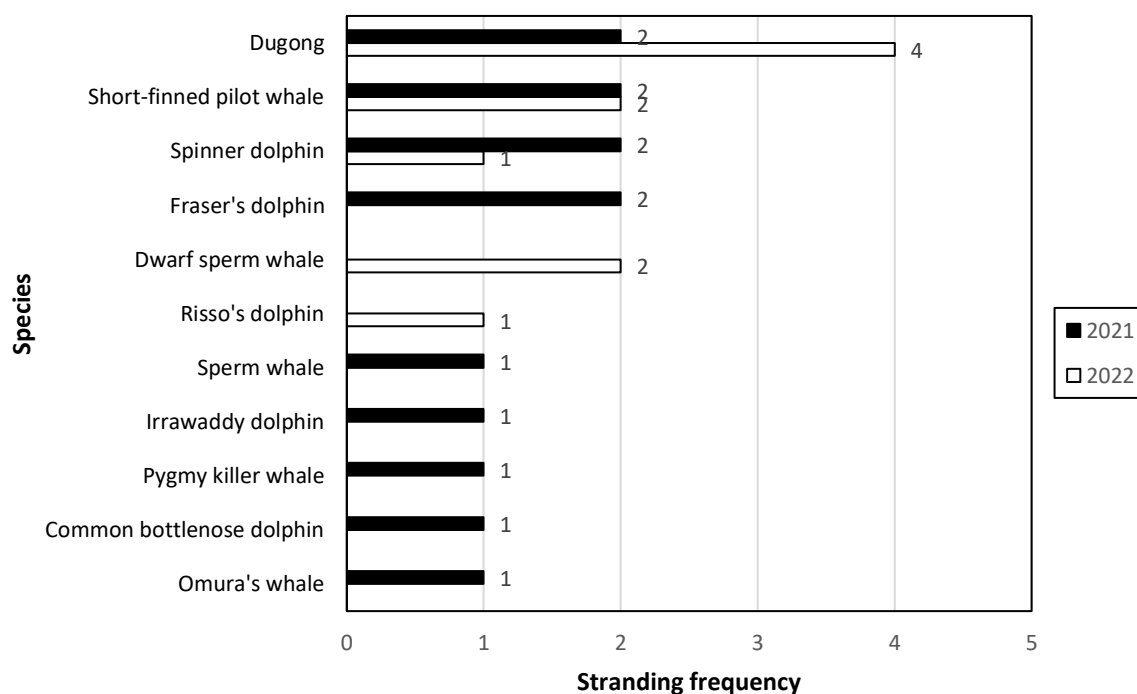


FIGURE 50. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN WESTERN VISAYAS REGION.

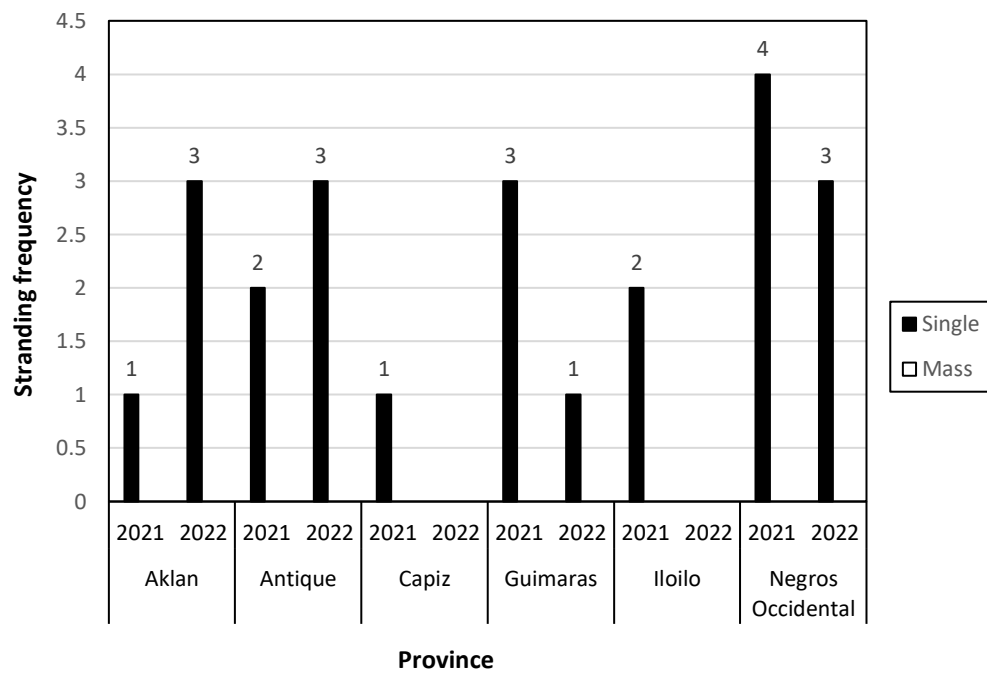


FIGURE 51. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN WESTERN VISAYAS REGION.

REGION 7 (CENTRAL VISAYAS)

The distribution of stranding events in 2021 and 2022 in Region 7 is shown in Figure 52. There was a total of eight stranding events in the 2-yr period in this region, seven events in 2021 and only one event in 2022. The only stranding event in 2022 occurred in Negros Oriental (Figure 53). The province also had two stranding events in 2021, with a total of three events ($n=3$). Cebu had three stranding events as well. While, Siquijor had one stranding event.

Region 7 had a total of 45 stranding grids (see Figure 52). The region had no stranding hotspot. There were 12 medium grids and 33 low grids in this region.

Stranding events in Region 7 occurred in five months – January ($n=2$), March ($n=2$), April ($n=1$), May ($n=1$), and July ($n=1$) (Figure 54). There was one stranding each in January of 2021 and 2022. Meanwhile, the two stranding events in March all occurred in 2021.

Figure 55 shows the seasonal distribution of strandings per province in Region 7 in the 2-yr period. Fifty percent of the stranding events in the region occurred during the MAM season ($n=4$). There were two events that occurred during the DJF season, all of which were recorded in Negros Oriental. There was one incidence that occurred in the JJA season which was recorded in Cebu. No stranding event occurred during the SON season.

There were six species of marine mammals that were stranded along the coast of Region 7 in the 2-yr period (Figure 56). Indo-Pacific bottlenose dolphin topped the list of stranded marine mammals in the region ($n=2$). The rest of the species had one stranding each – Risso's dolphin, spinner dolphin, Cuvier's beaked whale, Fraser's dolphin, short-finned pilot whale.

Figure 57 showed the categories of stranding events in Region 7. Seven stranding events were classified as single strandings and one as a mass stranding event. The mass stranding event occurred in Siquijor in 2021. It involved two Fraser's dolphin that were already found dead upon sighting.

Marine mammal strandings in the Philippines from 2021 to 2022

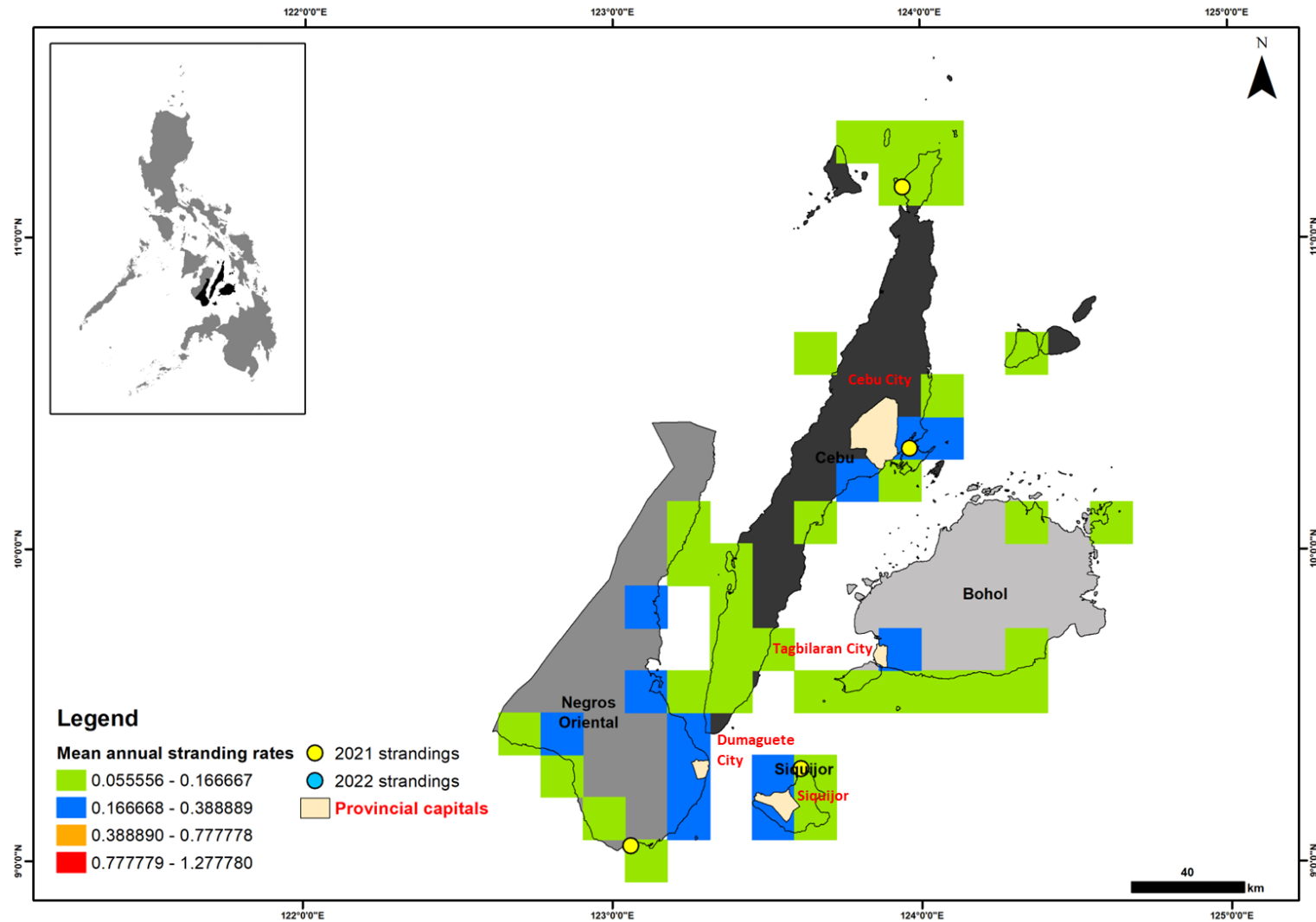


FIGURE 52. MARINE MAMMAL STRANDING STATUS IN REGION 7 (CENTRAL VISAYAS).

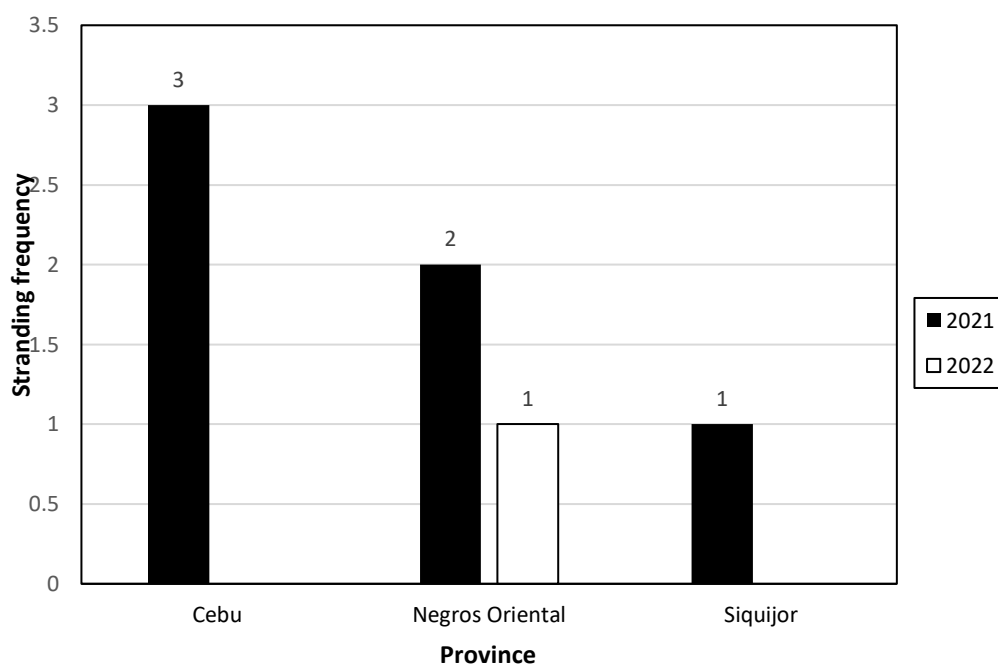


FIGURE 53. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN CENTRAL VISAYAS REGION.

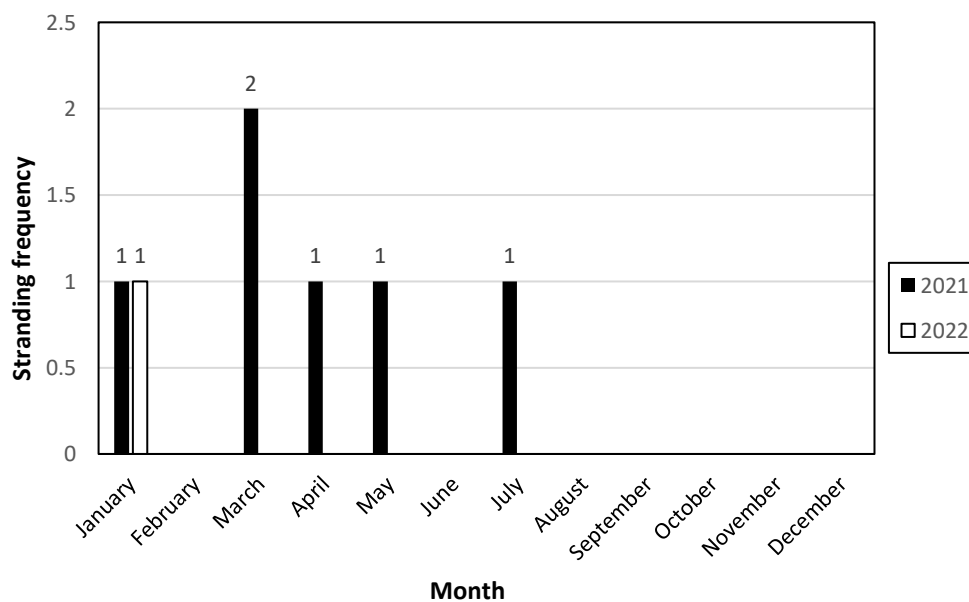


FIGURE 54. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN CENTRAL VISAYAS REGION.

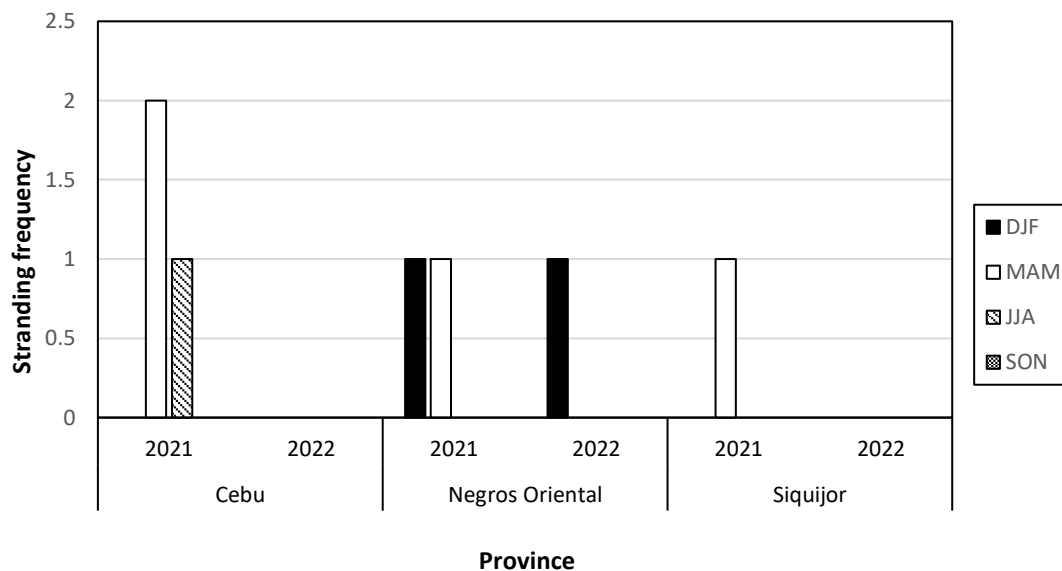


FIGURE 55. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN CENTRAL VISAYAS REGION.

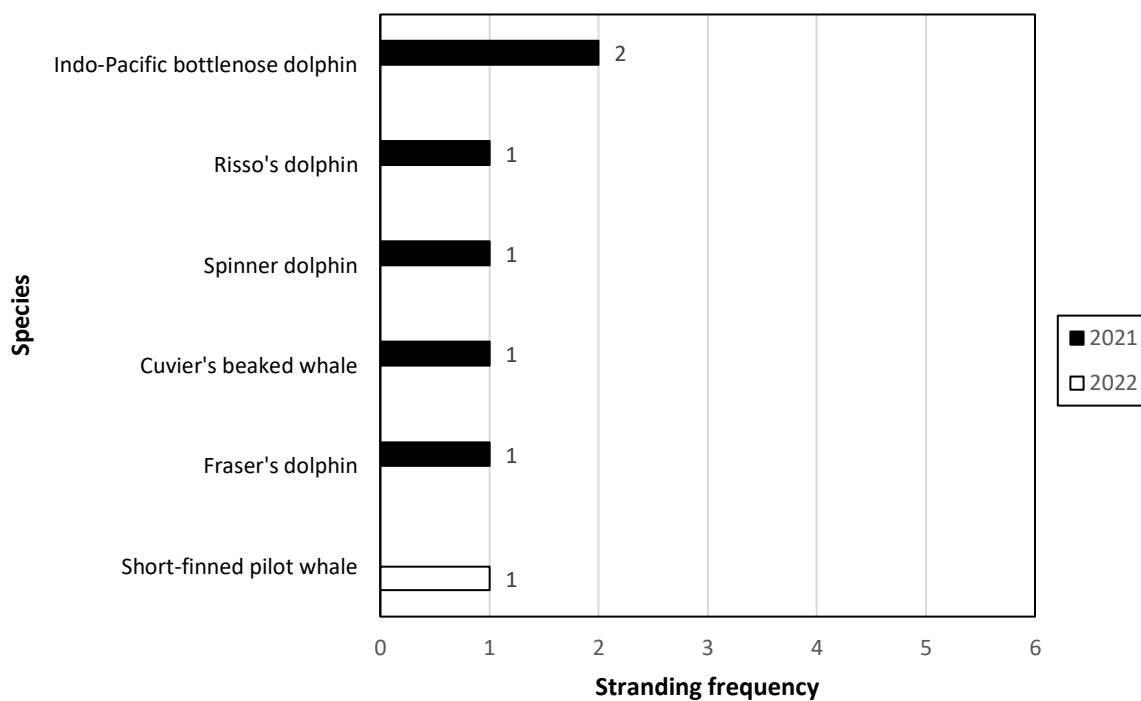


FIGURE 56. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN CENTRAL VISAYAS REGION.

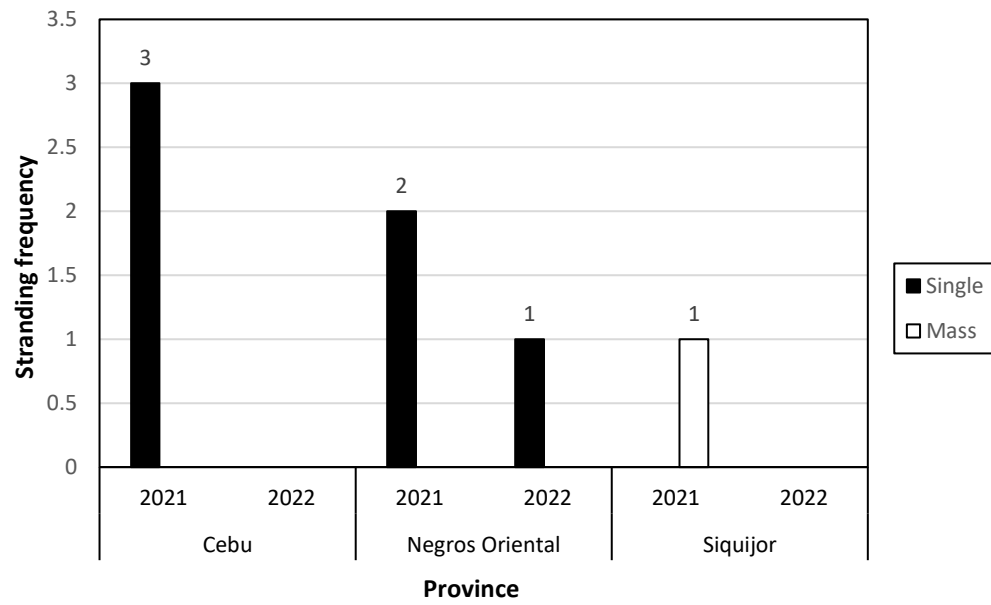


FIGURE 57. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN CENTRAL VISAYAS REGION.

REGION 8 (EASTERN VISAYAS)

The distribution of stranding events in 2021 and 2022 in Region 8 is shown in Figure 58. There was a total of 11 stranding events in the 2-yr period in this region, eight events in 2021 and three events in 2022. Eastern Samar and Leyte were the top provinces with the most strandings in this region ($n=3$) (Figure 59). Samar had two events, while Biliran, Northern Samar, and Southern Leyte had one stranding event each.

Region 8 had a total of 38 stranding grids (see Figure 58). The region had no stranding hotspot. There were three medium grids and 35 low grids in this region.

Stranding events in Region 8 occurred in eight months (Figure 60). There were two stranding events each in May, July, and October. The rest of the months had only one stranding each – January, April, June, August, December.

Figure 61 shows the seasonal distribution of strandings per province in Region 8 in the 2-yr period. About 36% percent of the stranding events in the region occurred during the JJA season ($n=4$). These occurred in the provinces of Eastern Samar, Northern Samar, and Samar. Twenty-seven percent of the incidents occurred during the MAM season ($n=3$). DJF and SON had two stranding events each.

There were nine marine mammal species that stranded along the coast of Region 8 in the 2-yr period (Figure 62). Spinner dolphin topped the list of stranded marine mammals in the region ($n=3$). The rest of the species had one stranding each – Indo-Pacific bottlenose dolphin, unidentified balaenopterid, dwarf sperm whale, sperm whale, Fraser's dolphin, Risso's dolphin, Bryde's whale, and pygmy killer whale. All stranding events in the region were classified as single stranding events (Figure 63).

Marine mammal strandings in the Philippines from 2021 to 2022

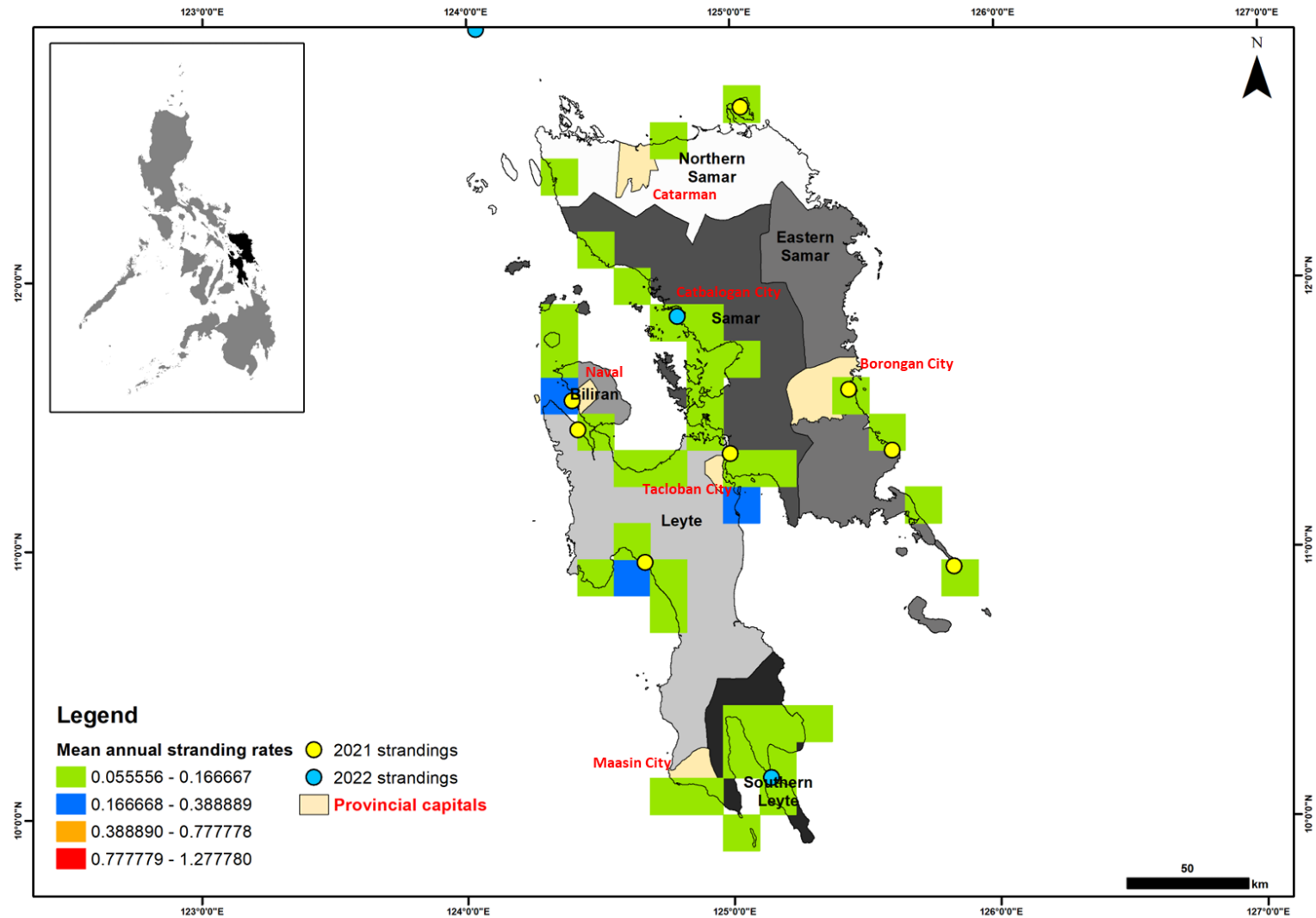


FIGURE 58. MARINE MAMMAL STRANDING STATUS IN REGION 8 (EASTERN VISAYAS).

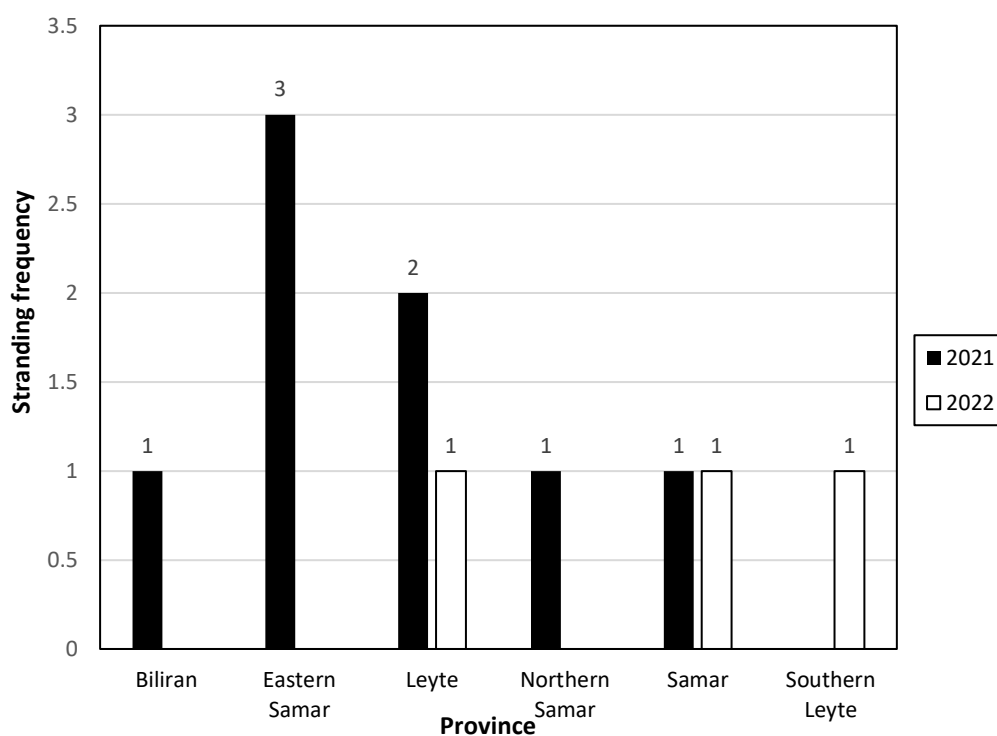


FIGURE 59. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN EASTERN VISAYAS REGION.

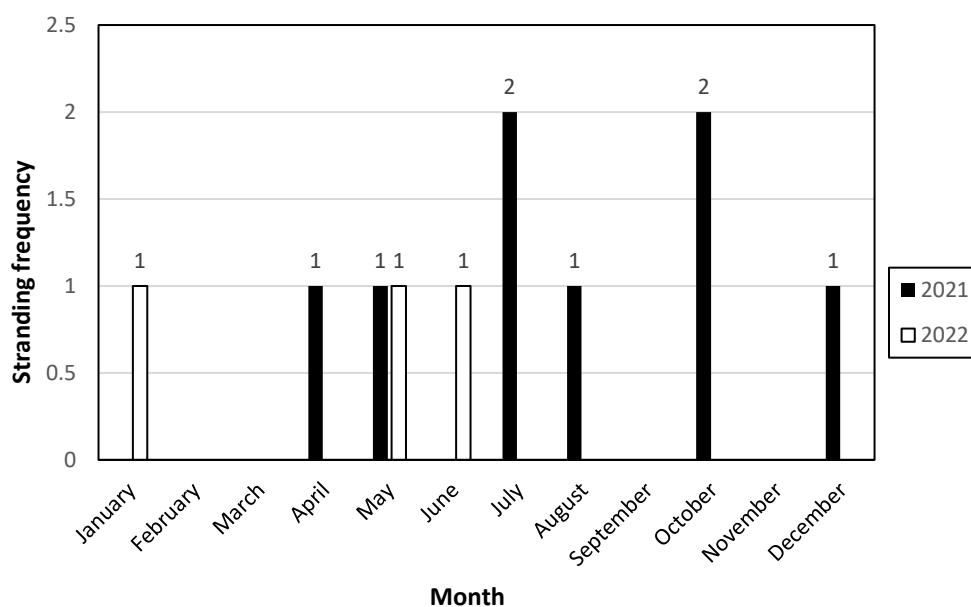


FIGURE 60. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN EASTERN VISAYAS REGION.

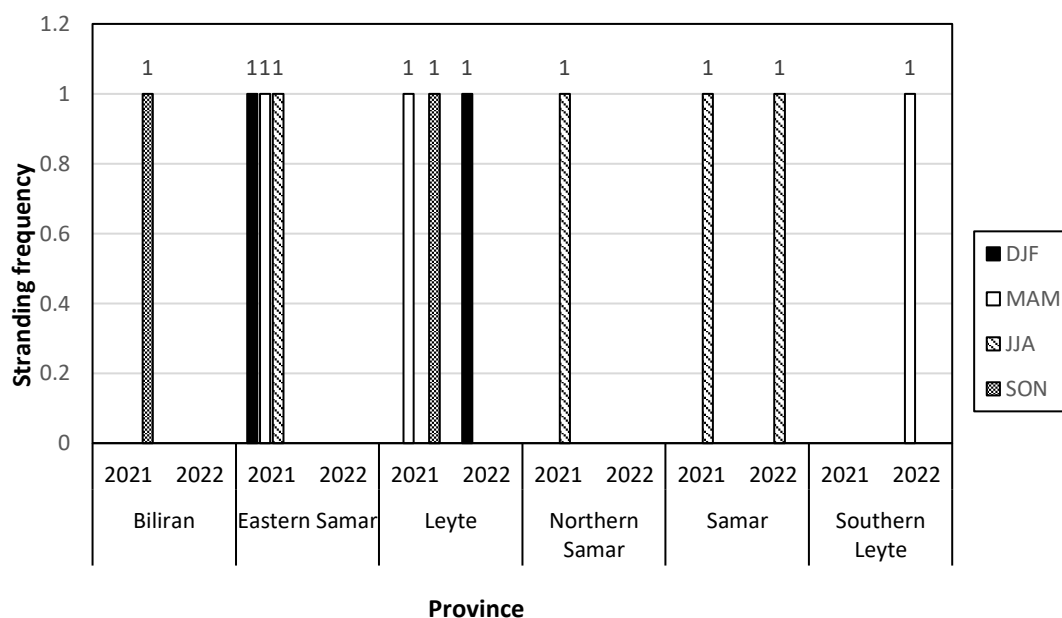


FIGURE 61. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN EASTERN VISAYAS REGION.

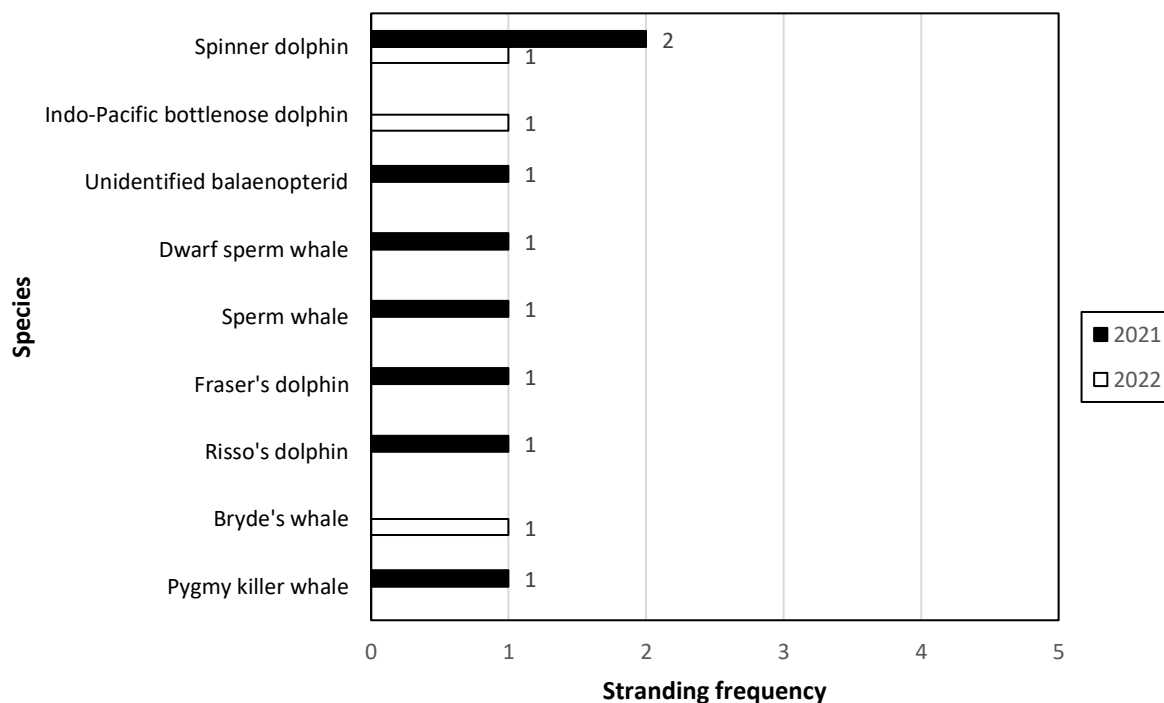


FIGURE 62. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN EASTERN VISAYAS REGION.

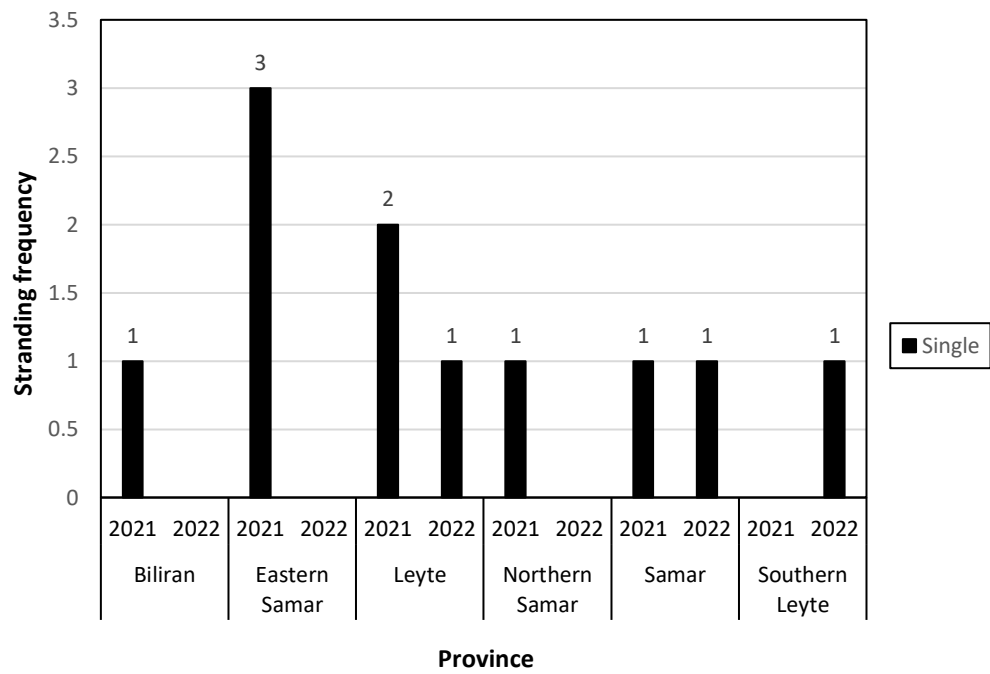


FIGURE 63. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN EASTERN VISAYAS REGION.

REGION 9 (ZAMBOANGA PENINSULA)

The distribution of stranding events in 2021 and 2022 in Region 9 is shown in Figure 64. There was a total of nine stranding events in the 2-yr period in this region, six events in 2021 and two events in 2022. Zamboanga del Sur was the top province with the most strandings in this region ($n=5$) (Figure 65). Zamboanga Sibugay had two strandings and Zamboanga del Norte had one stranding.

Region 9 had a total of 24 stranding grids. There was one stranding hotspot in this region and was classified as a high grid – Zamboanga City in Zamboanga del Sur with a mean annual stranding rate of 0.5000 (see Table 2 and Figure 64). There were three medium grids and 20 low grids.

Stranding events in Region 9 occurred in seven months (Figure 66). There were two stranding events in June. The rest of the months had only one stranding each – January, February, March, April, July, and November.

Figure 67 shows the seasonal distribution of strandings per province in Region 9 in the 2-yr period. Stranding events occurred mostly during the JJA season in the region ($n=3$) and it all occurred in Zamboanga del Sur in 2021. DJF and MAM season had two stranding events each. There was only one stranding event in the SON season, and it occurred in Zamboanga Sibugay in 2021.

There were eight marine mammal species that stranded along the coast of Region 9 in the 2-yr period (Figure 68). All species that were stranded had one incidence each. The species were an unidentified balaenopterid, pygmy killer whale, spinner dolphin, false killer whale, sperm whale, Indo-Pacific bottlenose dolphin, short-finned pilot whale, and Risso's dolphin. All stranding events in the region were classified as single stranding events (Figure 69).

Marine mammal strandings in the Philippines from 2021 to 2022

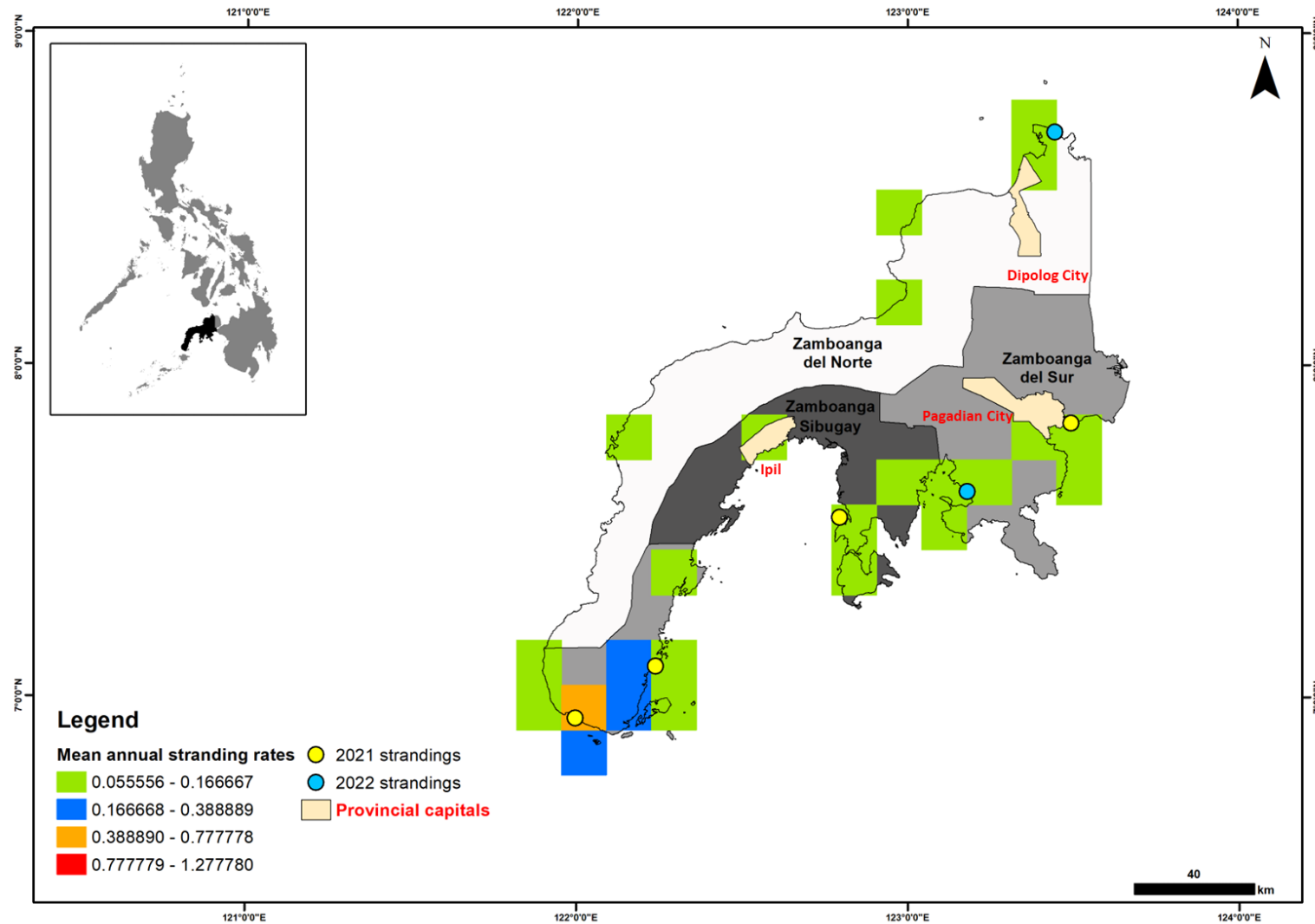


FIGURE 64. MARINE MAMMAL STRANDING STATUS IN REGION 9 (ZAMBOANGA PENINSULA).

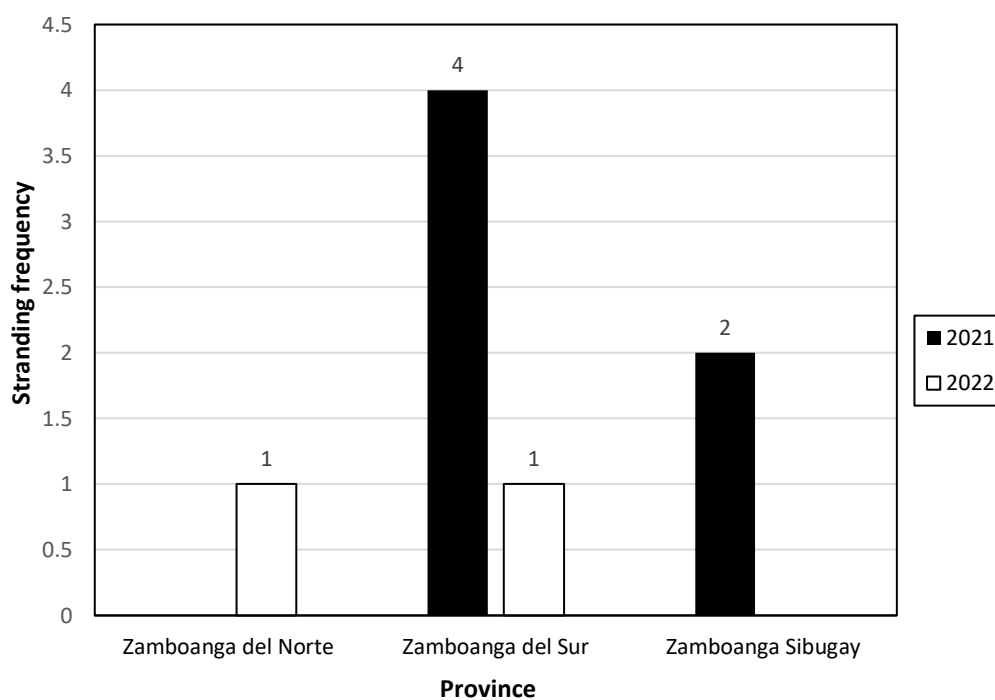


FIGURE 65. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN ZAMBOANGA PENINSULA.

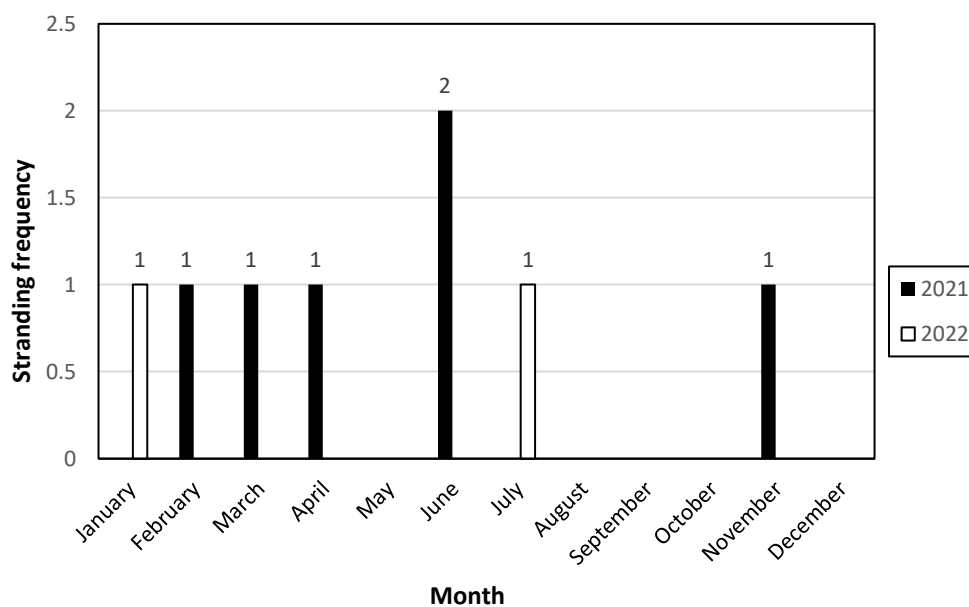


FIGURE 66. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN ZAMBOANGA PENINSULA.

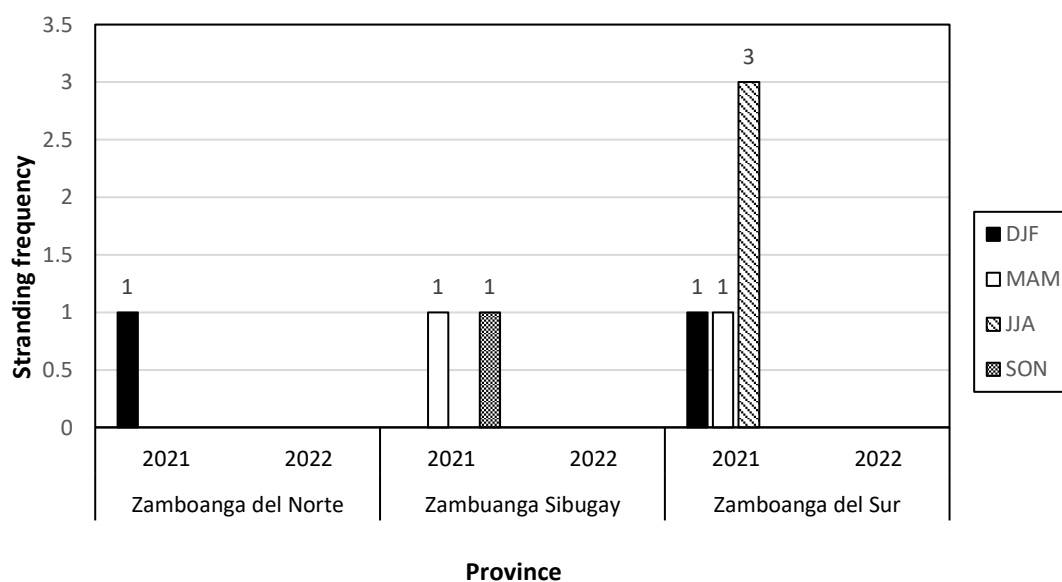


FIGURE 67. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN ZAMBOANGA PENINSULA REGION.

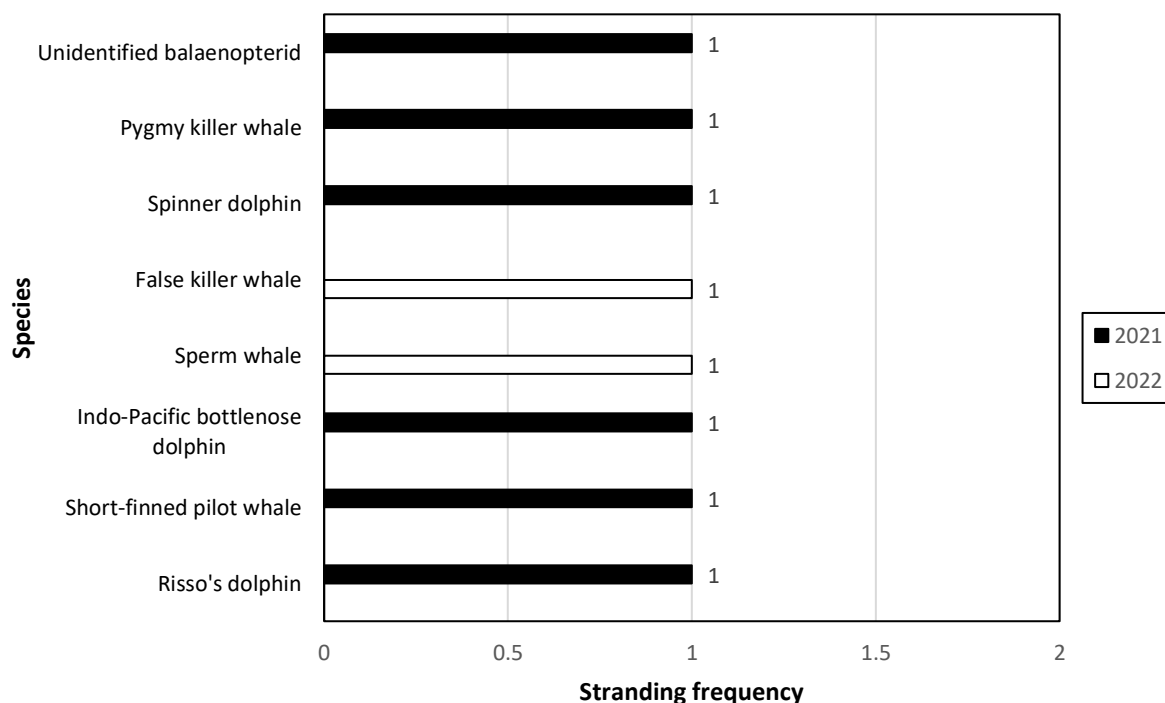


FIGURE 68. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN ZAMBOANGA PENINSULA REGION.

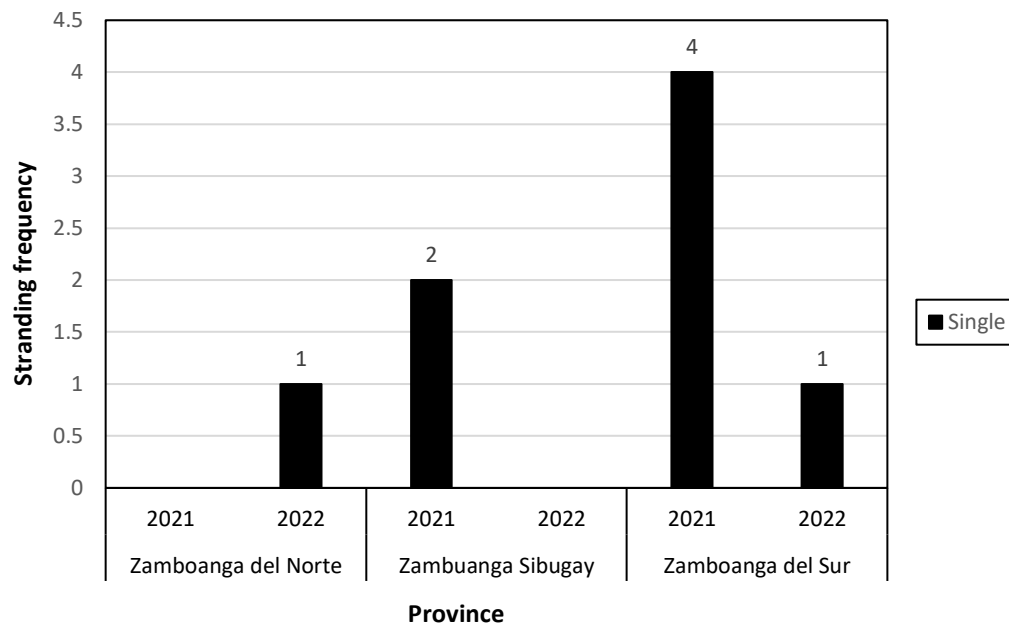


FIGURE 69. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN ZAMBOANGA PENINSULA REGION.

REGION 10 (NORTHERN MINDANAO)

The distribution of stranding events in 2021 and 2022 in Region 10 is shown in Figure 70. There was a total of seven stranding events in the 2-yr period in this region, four events in 2021 and three events in 2022. Misamis Occidental was the top province with the most strandings in this region (n=4) (Figure 71). Misamis Oriental had two strandings and Camiguin had one stranding.

Region 10 had a total of 19 stranding grids (Figure 70). There was no stranding hotspot in this region. It had three medium grids and 16 low grids.

Stranding events in Region 10 occurred in five months (Figure 72). There were two stranding events in both January and April. The rest of the months had only one stranding each – February, July, and August.

Figure 73 shows the seasonal distribution of strandings per province in Region 10 in the 2-yr period. Stranding events occurred mostly during the DJF season in the region (n=3) and occurred in Misamis Occidental and Misamis Oriental. MAM and JJA season had two strandings each. There was no recorded stranding in the SON season.

There were five marine mammal species that stranded along the coast of Region 10 in the 2-yr period (Figure 74). Fraser's dolphin and Risso's dolphin were the top species that frequently stranded in the region (n=2). The rest of the species had one stranding event each – spinner dolphin, false killer whale, and pantropical spotted dolphin. All stranding events in the region were classified as single stranding events (Figure 75).

Marine mammal strandings in the Philippines from 2021 to 2022

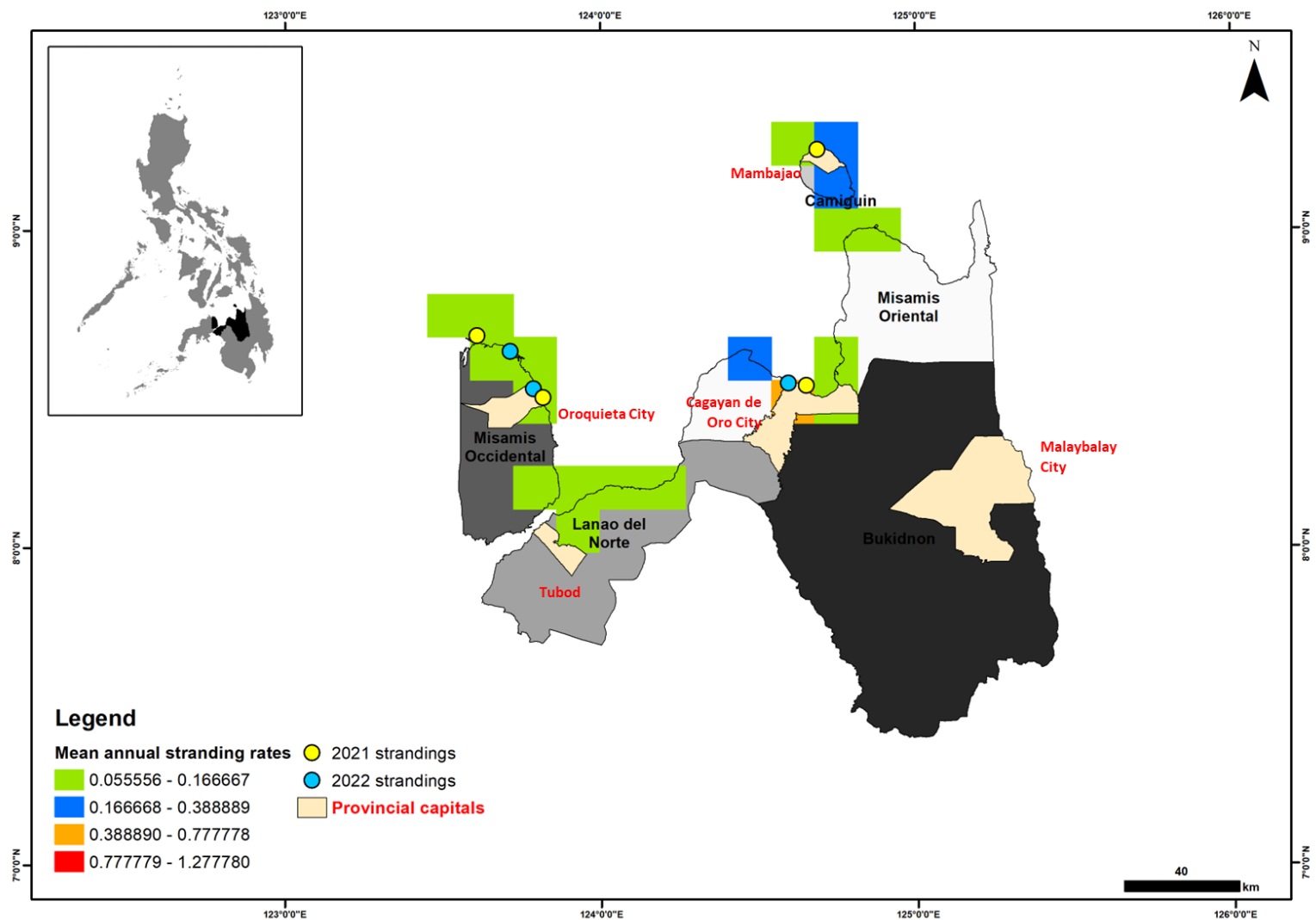


FIGURE 70. MARINE MAMMAL STRANDING STATUS IN REGION 10 (NORTHERN MINDANAO).

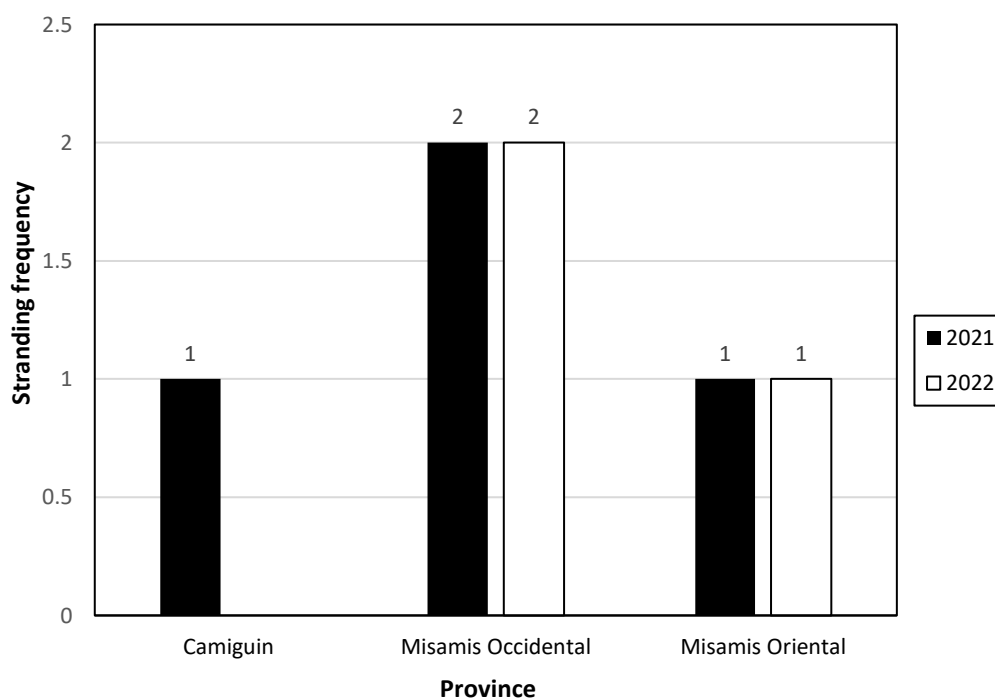


FIGURE 71. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN NORTHERN MINDANAO.

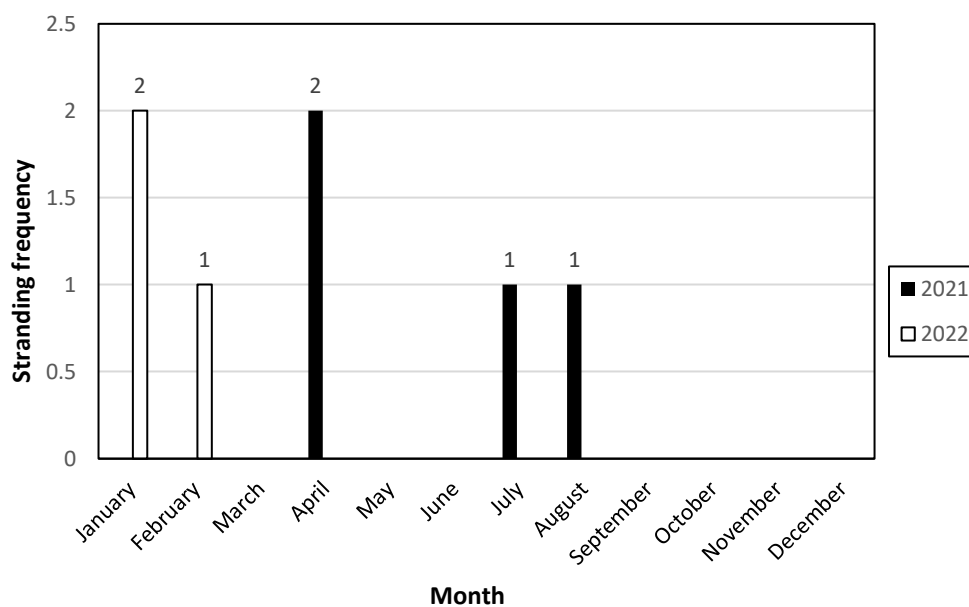


FIGURE 72. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN NORTHERN MINDANAO REGION.

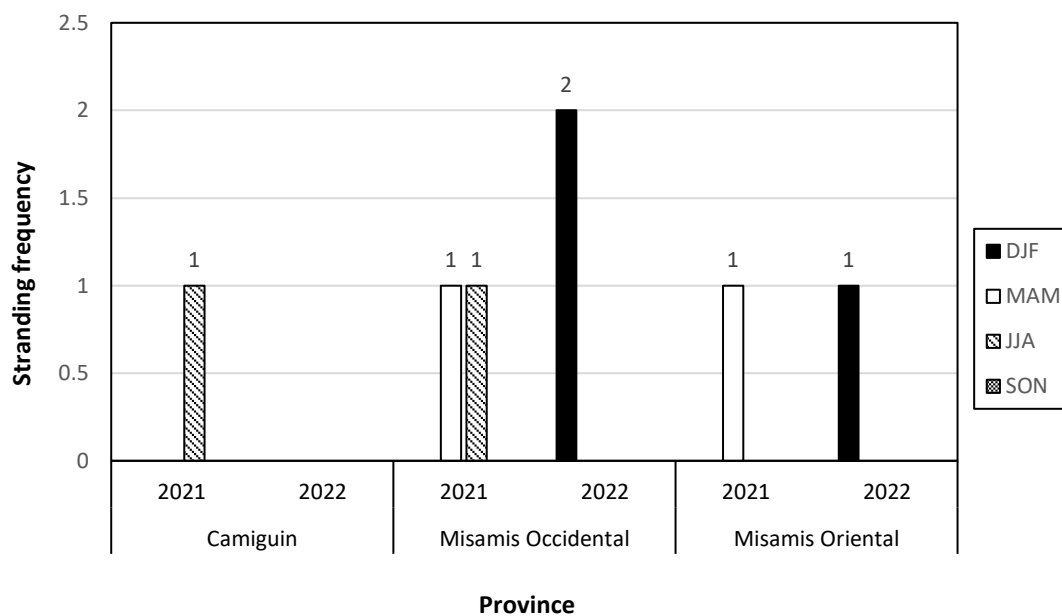


FIGURE 73. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN NORTHERN MINDANAO REGION.

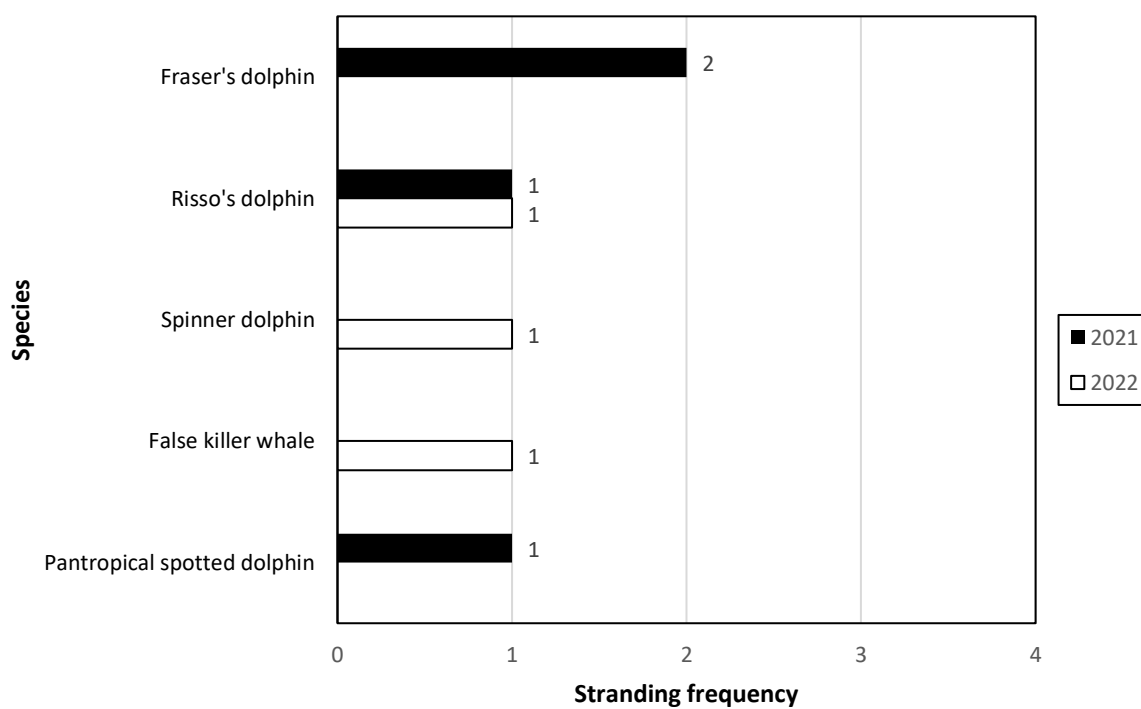


FIGURE 74. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN NORTHERN MINDANAO.

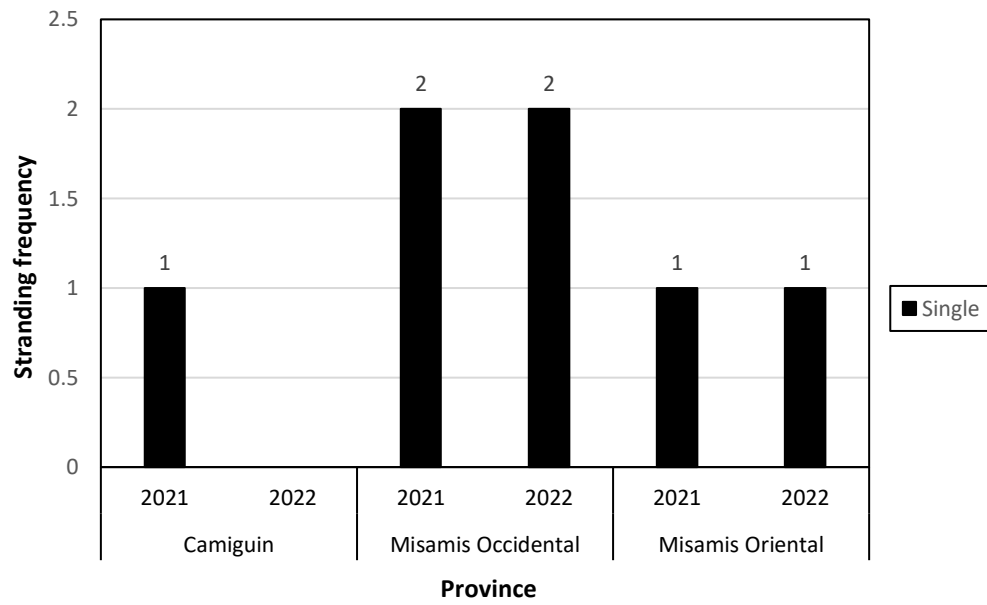


FIGURE 75. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN NORTHERN MINDANAO.

REGION 11 (DAVAO REGION)

The distribution of stranding events in 2021 and 2022 in Region 11 is shown in Figure 76. There was a total of six stranding events in the 2-yr period in this region, three events each in 2021 and 2022. Davao Oriental was the top province with the most strandings in this region ($n=4$) (Figure 77). Davao Occidental had two strandings and all these events occurred in 2022.

Region 11 had a total of 27 stranding grids and had four stranding hotspots (see Table 2 and Figure 76). The four hotspots were Mati City in Davao Oriental (0.7222), Southern Davao City in Davao del Sur (0.6667), Maco-Mabini-Tagum City in Compostela Valley and Davao del Norte (0.6111), and Northern Davao City (0.5000). There was one medium grid which was located in Samal Island and 21 low grids.

Stranding events in Region 11 occurred in four months (Figure 78). Both May and December had two stranding events. Meanwhile, April and July had one stranding event each.

Figure 79 shows the seasonal distribution of strandings per province in Region 11 in the 2-yr period. Stranding events occurred mostly during the MAM season in the region ($n=3$) and both provinces, and these strandings were recorded in both Davao Oriental and Davao Occidental. DJF season had two strandings and JJA had one event. There was no recorded stranding in the SON season.

There were five marine mammal species that stranded along the coast of Region 11 in the 2-yr period (Figure 80). The dugong was the top species that frequently stranded in the region ($n=2$). The rest of the species had one stranding event each – Cuvier's beaked whale, sperm whale, Bryde's whale, and Deranayigala's beaked whale. All stranding events in the region were classified as single stranding events (Figure 81). Note that Region 11 together with Region 2 have the most diverse assemblage of marine mammals by region (see Table 3).

Marine mammal strandings in the Philippines from 2021 to 2022

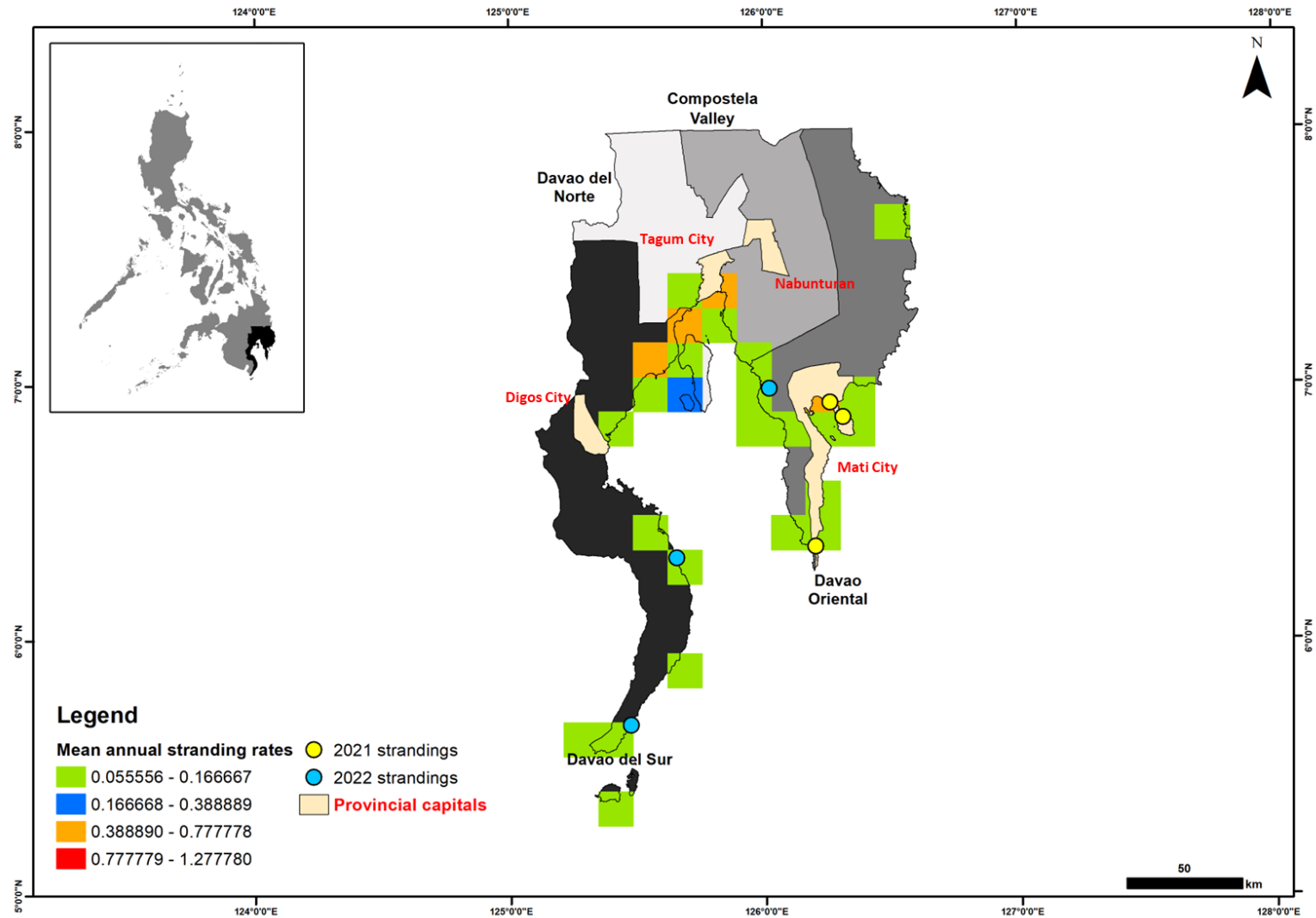


FIGURE 76. MARINE MAMMAL STRANDING STATUS IN REGION 11 (DAVAO).

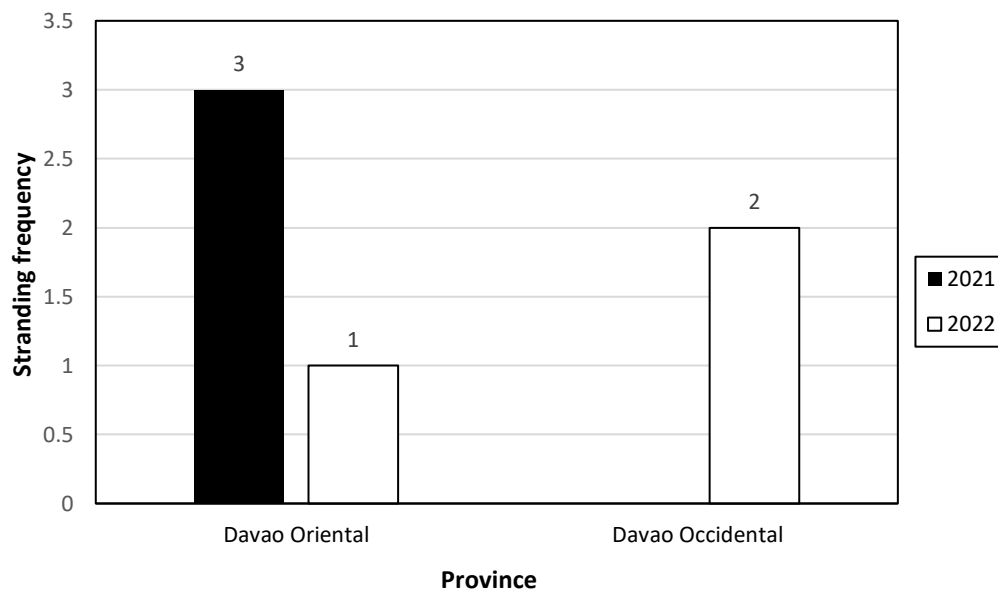


FIGURE 77. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN DAVAO REGION.

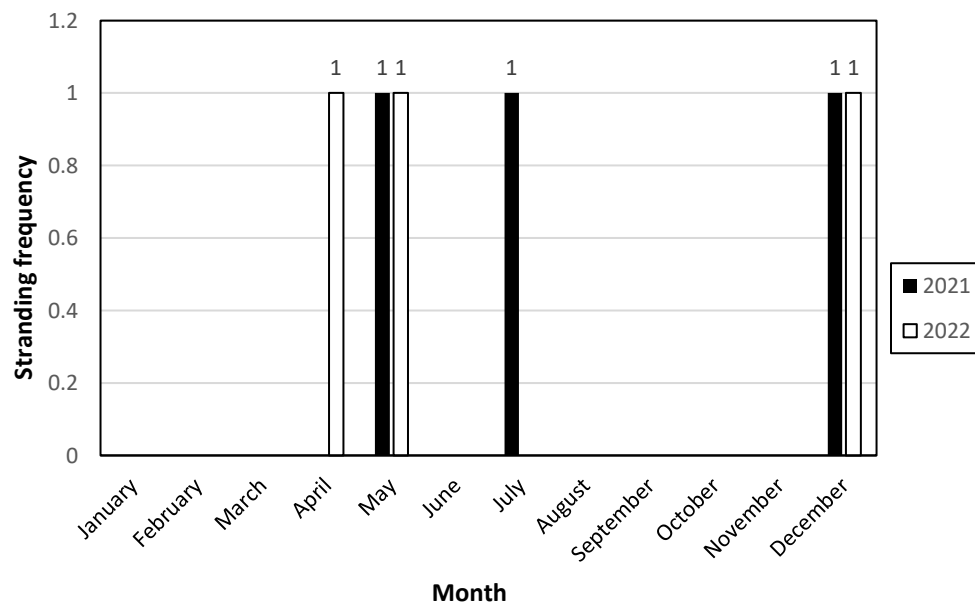


FIGURE 78. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN DAVAO REGION.

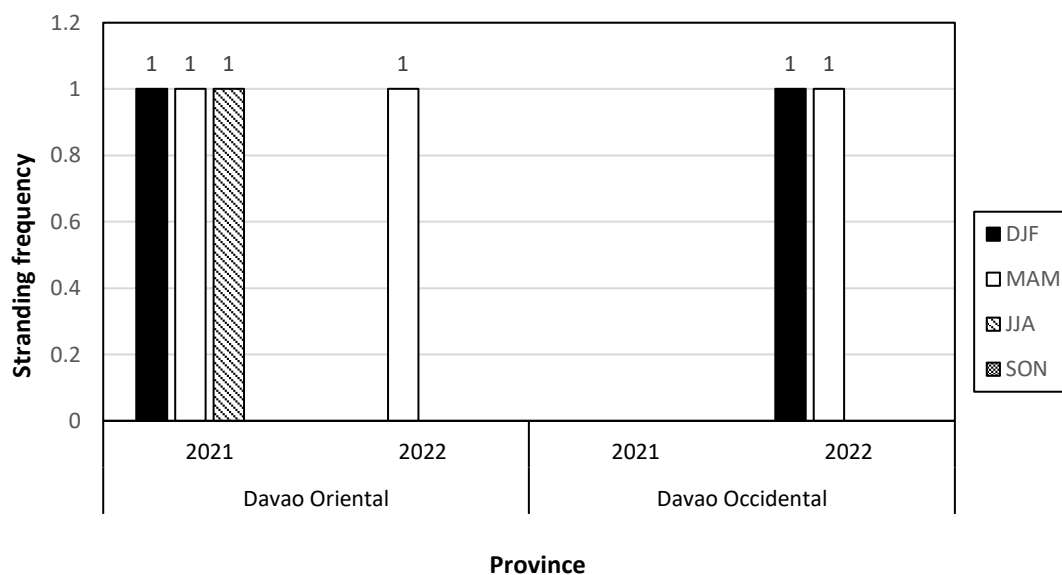


FIGURE 79. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN DAVAO REGION.

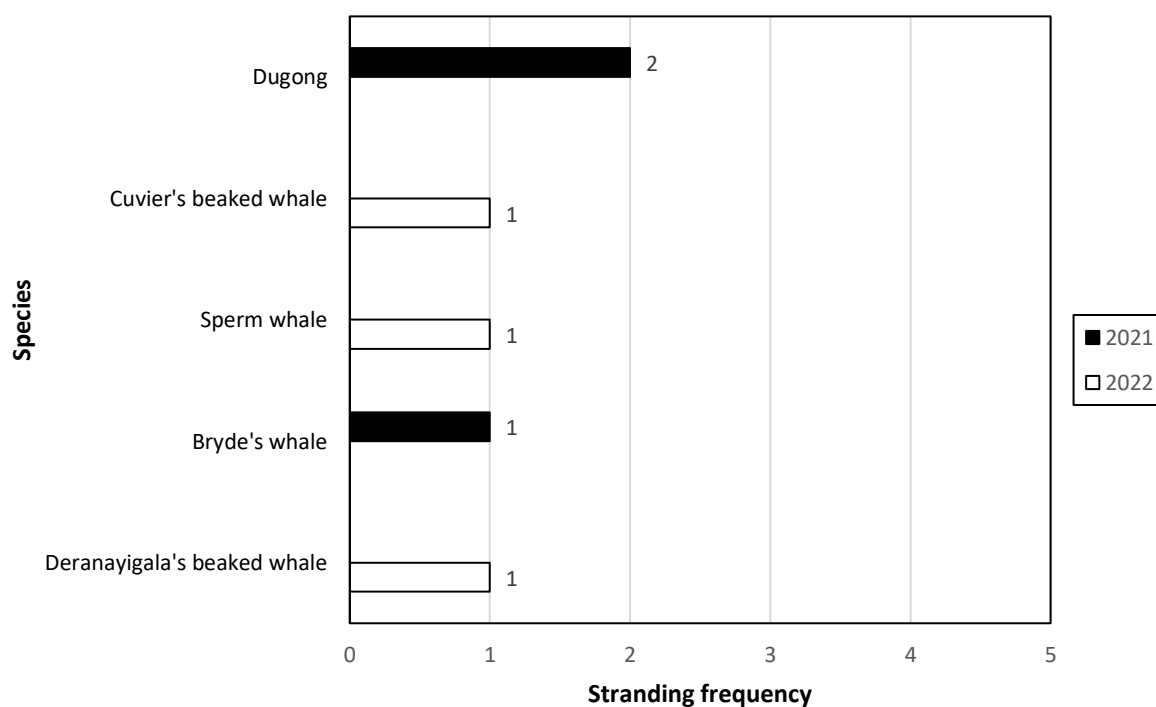


FIGURE 80. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN DAVAO REGION.

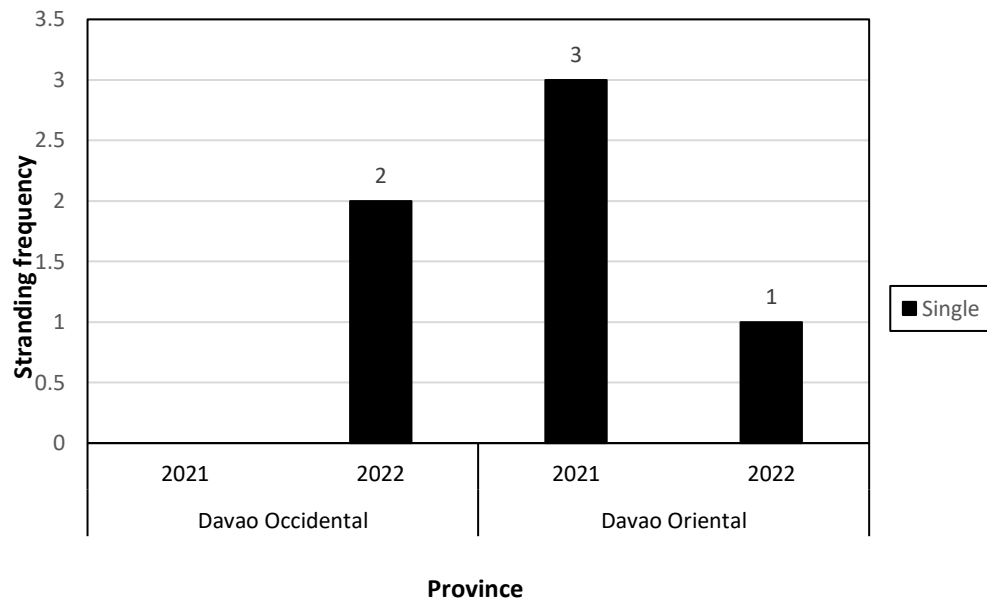


FIGURE 81. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN DAVAO REGION.

REGION 12 (SOCCSKSARGEN)

The distribution of stranding events in 2021 and 2022 in Region 12 is shown in Figure 82. Region 12 was the top two province with highest stranding events in total in the 2-yr period next to Region 1. There was a total of 25 stranding events in the 2-yr period in this region. There were 11 stranding events in 2021 and 14 events in 2022. Sarangani contributed 88% of strandings to the total stranding events in the region ($n=22$) (Figure 83). There were equal number of stranding events in Sarangani in 2021 and 2022 ($n=11$ each). Sultan Kudarat had two stranding events and South Cotabato had one incidence, and all strandings in these provinces occurred in 2022.

Region 12 had a total of 17 stranding grids and had four stranding hotspots classified as high grids (see Table 2 and Figure 82). The four hotspots were Malapatan-Alabel in Sarangani (0.7222), Glan in Sarangani (0.5556), Maasim in Sarangani (0.5000), and General Santos City in South Cotabato (0.4444). There were nine medium grids and only four low grids.

Stranding events in Region 12 occurred almost every month except in September (Figure 84). June and November had the highest stranding incidences with five and four incidences, respectively. February and August had three stranding events each. The rest of the other months had one to two stranding events.

Figure 85 shows the seasonal distribution of strandings per province in Region 12 in the 2-yr period. Stranding events occurred mostly during the JJA season in the region ($n=10$) and were all recorded in Sarangani. There were seven JJA strandings in 2021 and three in 2022. The rest of the seasons, MAM, JJA, and SON had five stranding events each. The two stranding events in Sultan Kudarat occurred in the DJF and MAM season. Meanwhile, the only stranding event in South Cotabato occurred in the DJF season.

There were 11 marine mammal species that stranded along the coast of Region 12 in the 2-yr period (Figure 86). The dugong was the top species that frequently stranded in the region ($n=7$). This was followed by the short-finned pilot whale ($n=4$). Sperm whale and spinner dolphin had three stranding events each. Melon-headed whale had two events. The rest of the species had one stranding events – pantropical spotted dolphin, rough-toothed dolphin, striped dolphin, Indo-Pacific bottlenose dolphin, and pygmy sperm whale.

All stranding events in the region were classified as single stranding events except for one which was classified as out of habitat (Figure 87). The out of habitat event involved a short-finned pilot whale in 2021. The event was recorded to have occurred in the waters of Alabel, Sarangani.

Marine mammal strandings in the Philippines from 2021 to 2022

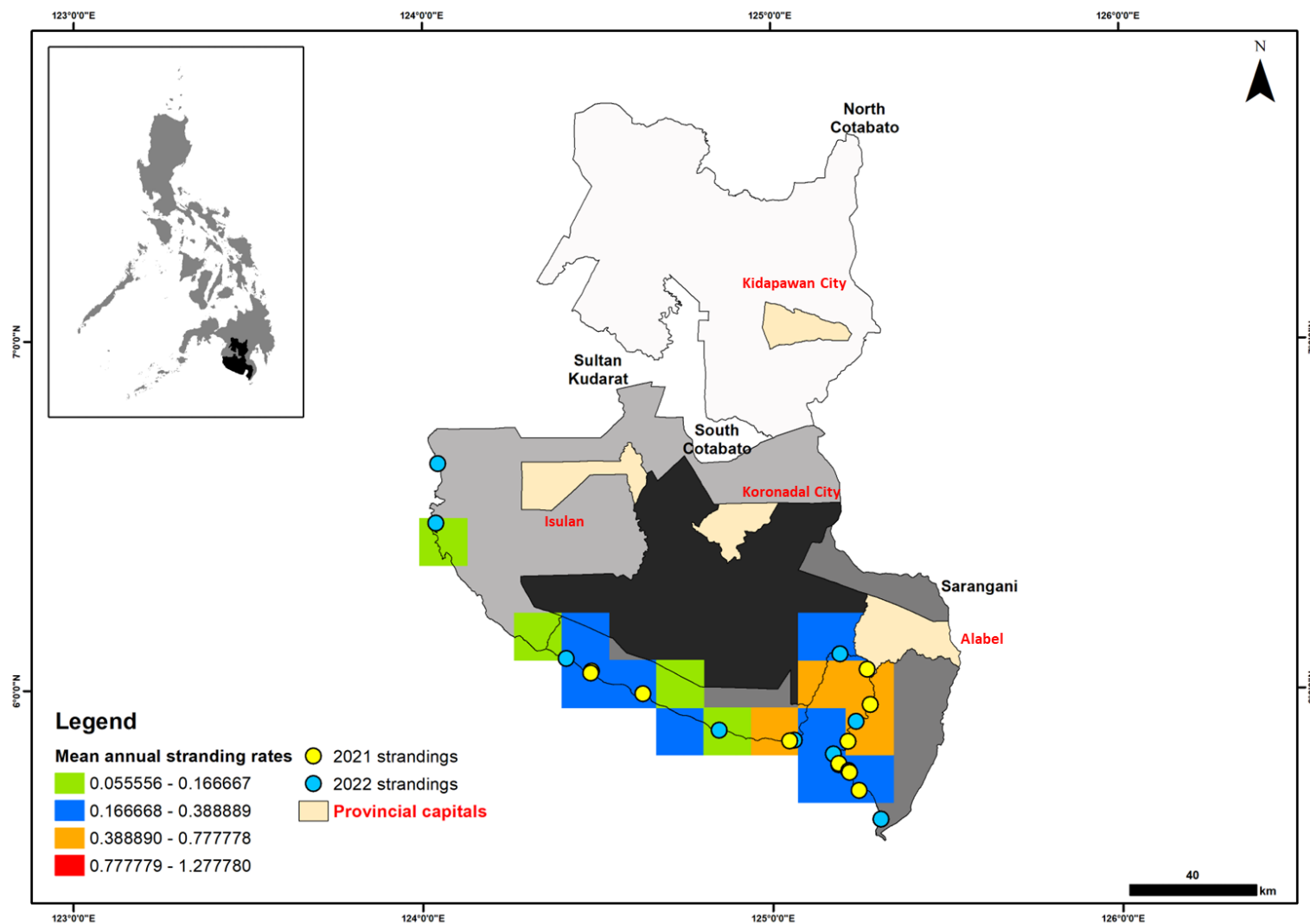


FIGURE 82. MARINE MAMMAL STRANDING STATUS IN REGION 12 (SOCCSKSARGEN).

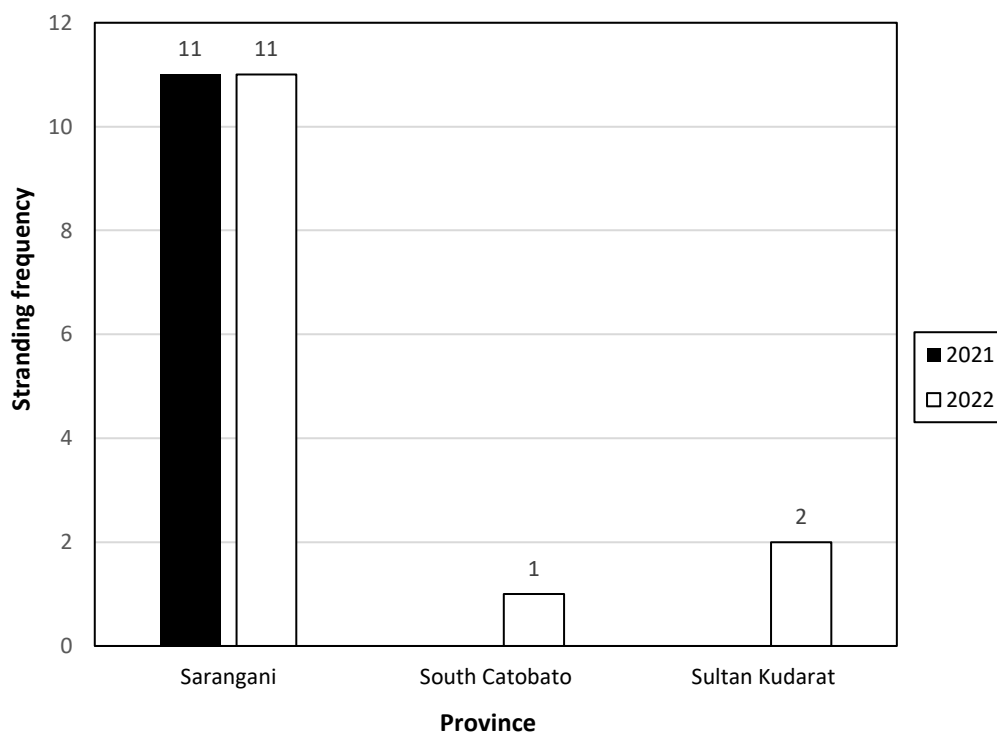


FIGURE 83. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN SOCCSKSARGEN REGION.

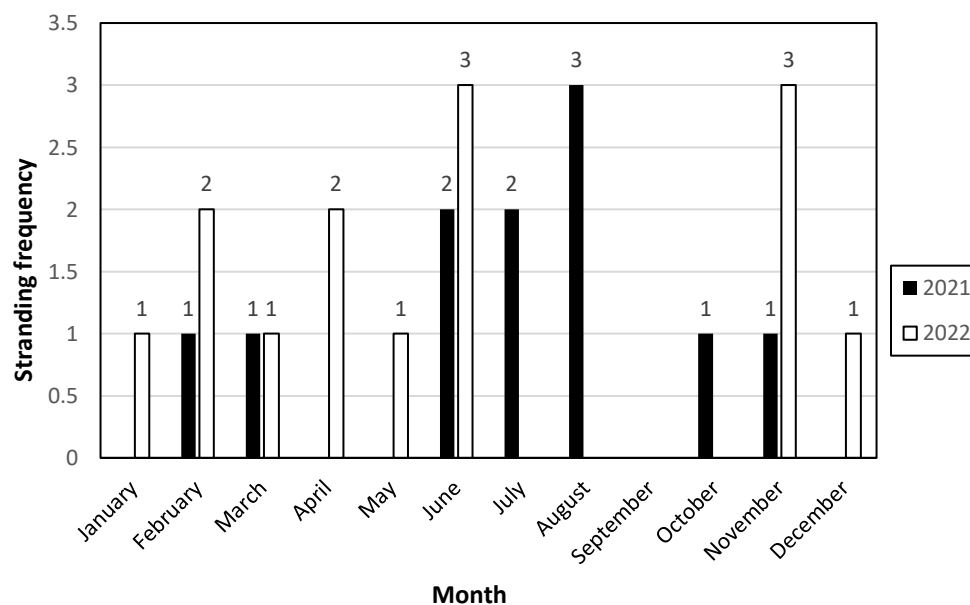


FIGURE 84. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN SOCCSKSARGEN REGION.

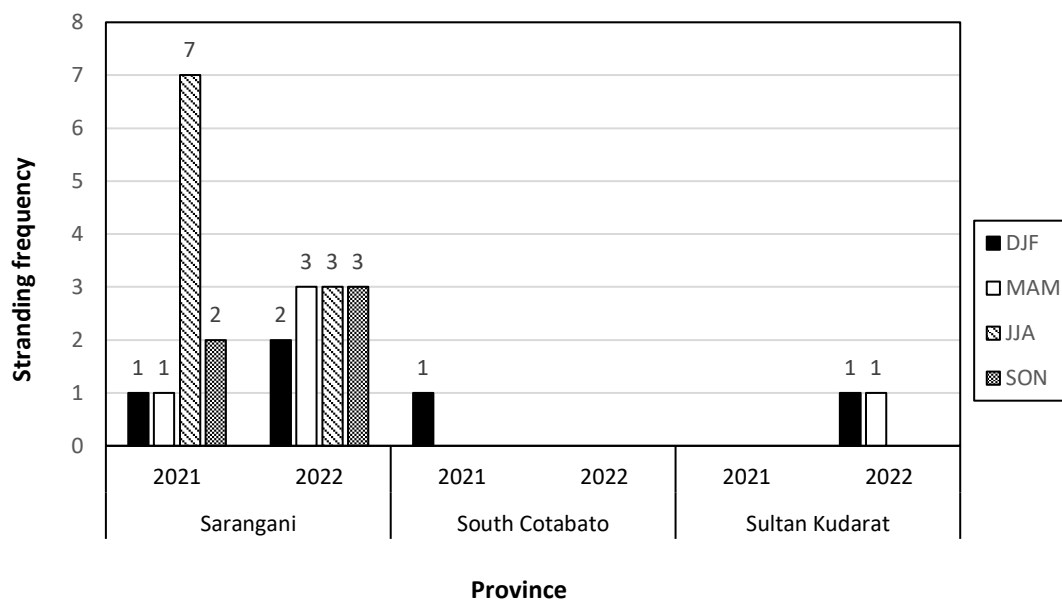


FIGURE 85. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN SOCCSKSARGEN REGION.

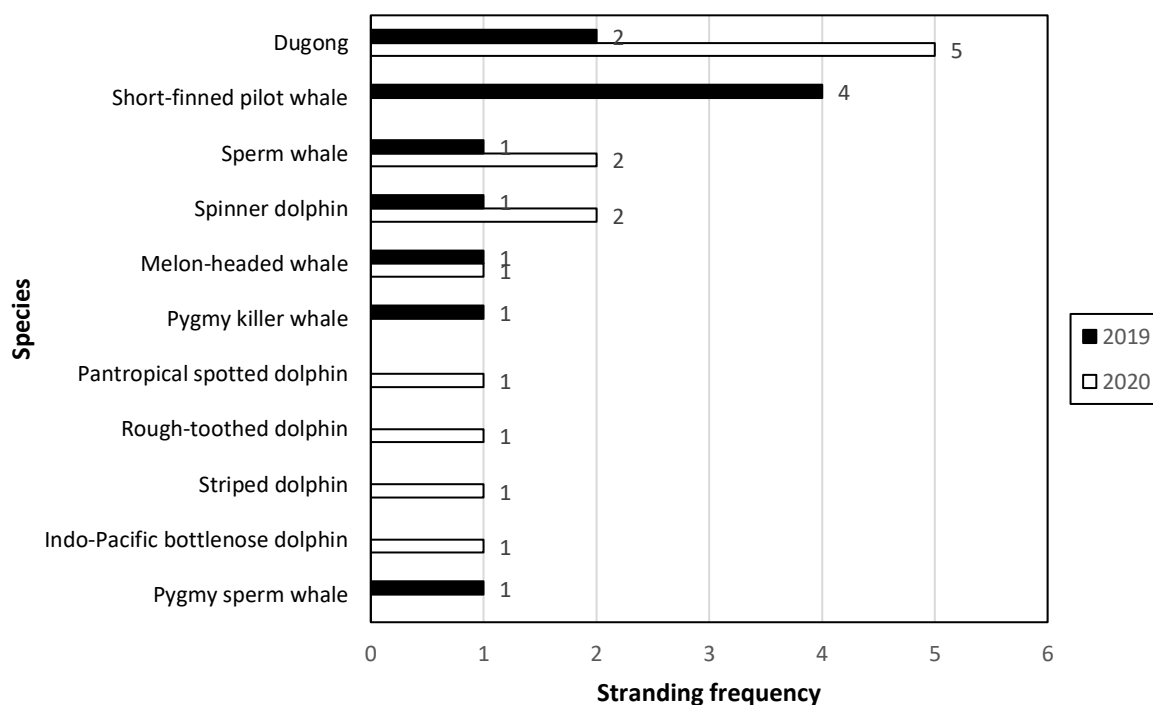


FIGURE 86. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN SOCCSKSARGEN REGION.

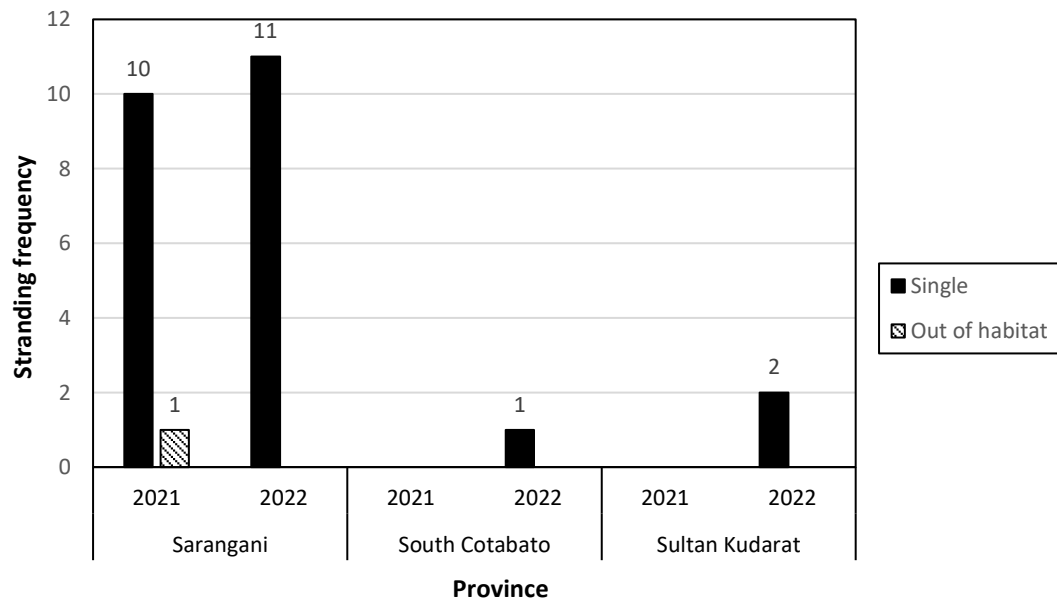


FIGURE 87. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN SOCCSKSARGEN REGION.

REGION 13 (CARAGA REGION)

The distribution of stranding events in 2021 and 2022 in Region 13 is shown in Figure 88. There was a total of eight stranding events in the 2-yr period in this region. There were six stranding events in 2021 and two events in 2022. Surigao del Sur had the highest stranding events among provinces ($n=4$) (Figure 89). Surigao del Norte had three stranding events and Dinagat had one.

Region 12 had a total of 26 stranding grids (see Figure 89). There was no stranding hotspot in the region. There was one medium grid and 25 low grids. The single medium grid occurred in Dapa in Surigao del Norte.

Stranding events in Region 12 occurred in six months (Figure 90). There were two stranding events each in February and December. The rest of the months had one stranding event each – March, April, May, and June. The only two 2022 stranding events occurred in the months of May and December.

Figure 91 shows the seasonal distribution of strandings per province in Region 13 in the 2-yr period. Stranding events occurred mostly during the DJF season in the region ($n=4$) and were recorded in all provinces with strandings. There were three stranding events in the MAM season. One event was recorded in the JJA season which occurred in Surigao del Sur in 2021.

There were four marine mammal species that stranded along the coast of Region 13 in the 2-yr period (Figure 92). The striped dolphin was the top species that frequently stranded in the region ($n=4$). Sperm whale had two stranding events. The dugong and rough-toothed dolphin had one stranding event each. All stranding events in the region were classified as single stranding events (Figure 93).

Marine mammal strandings in the Philippines from 2021 to 2022

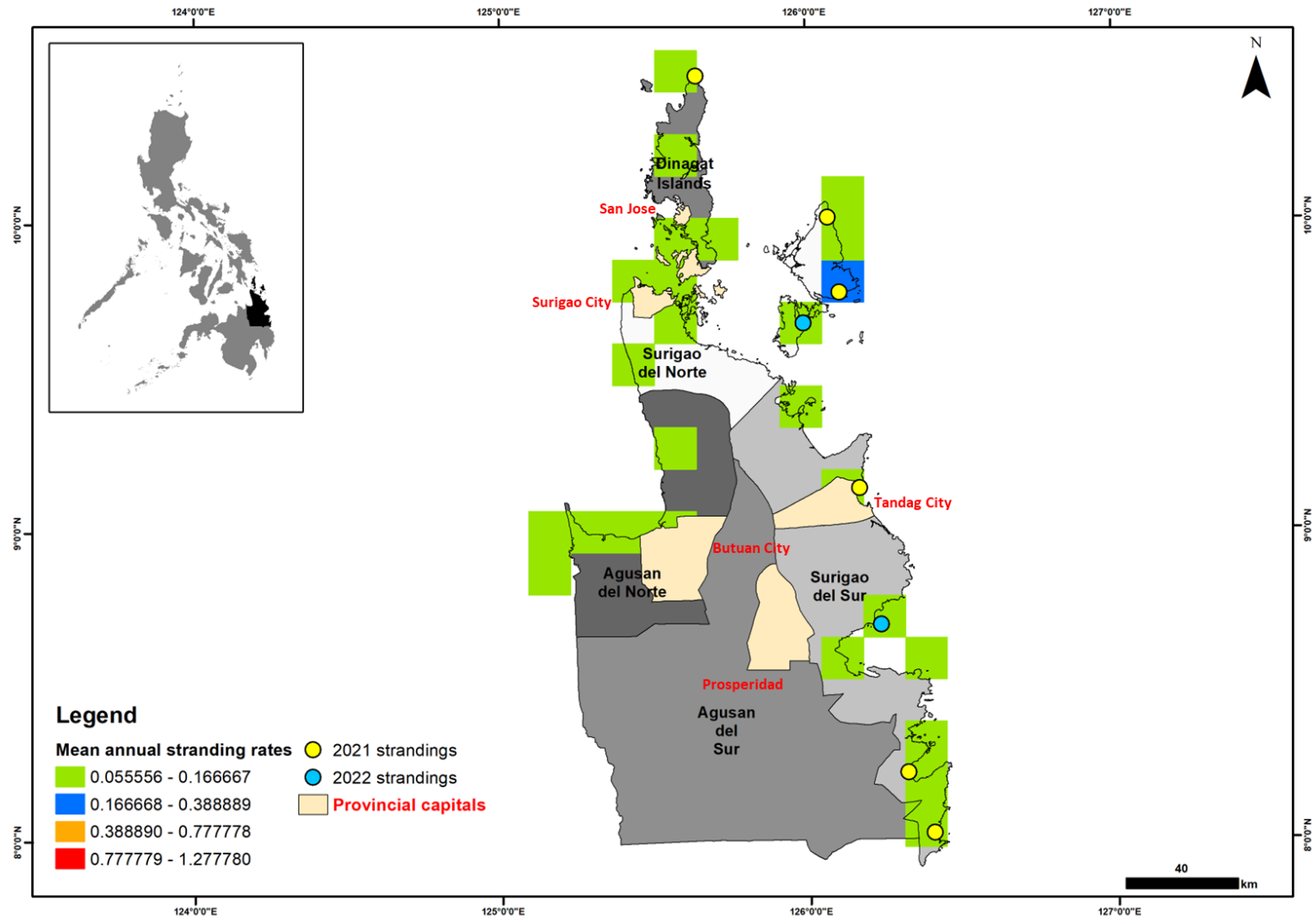


FIGURE 88. MARINE MAMMAL STRANDING STATUS IN REGION 13 (CARAGA).

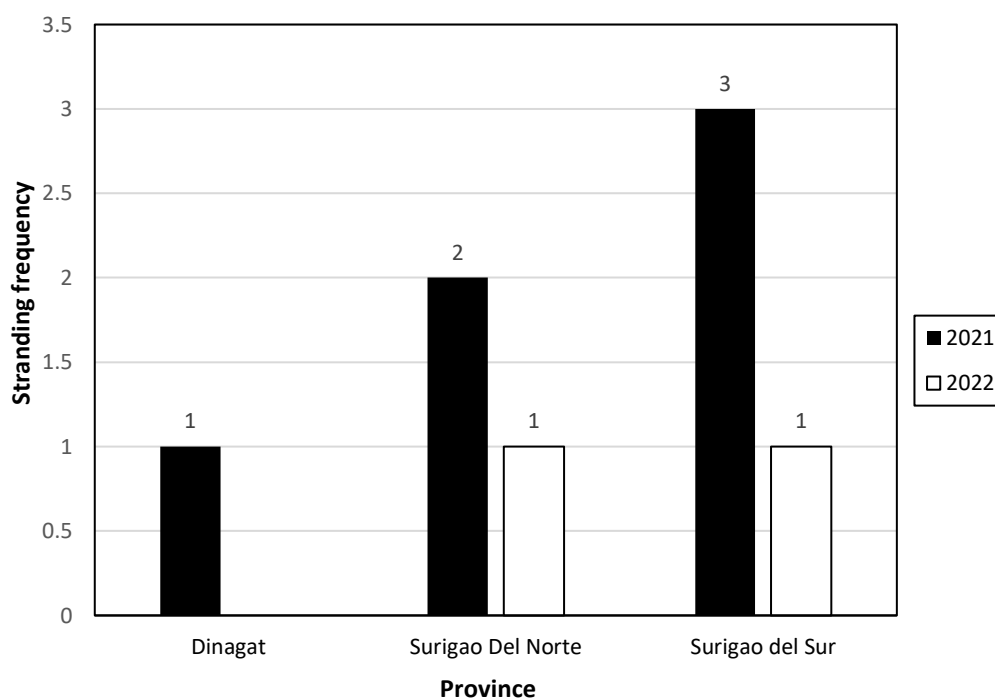


FIGURE 89. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN CARAGA REGION.

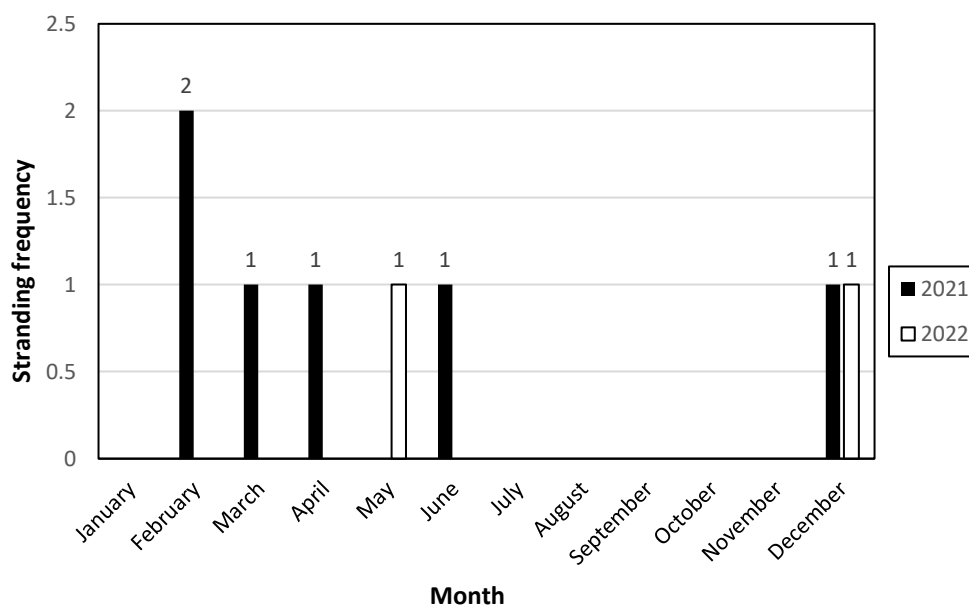


FIGURE 90. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN CARAGA REGION.

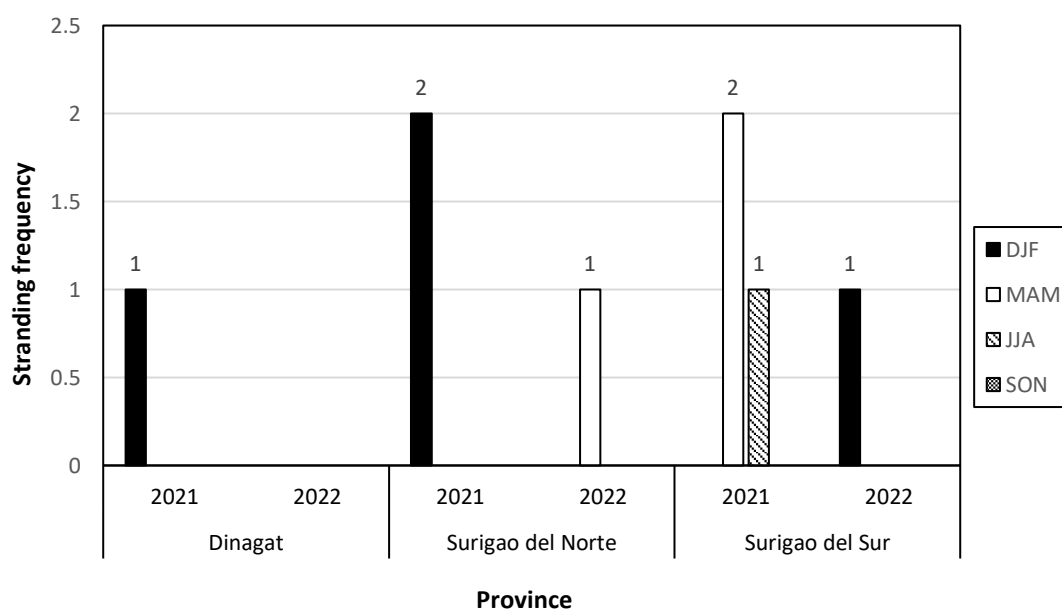


FIGURE 91. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN CARAGA REGION.

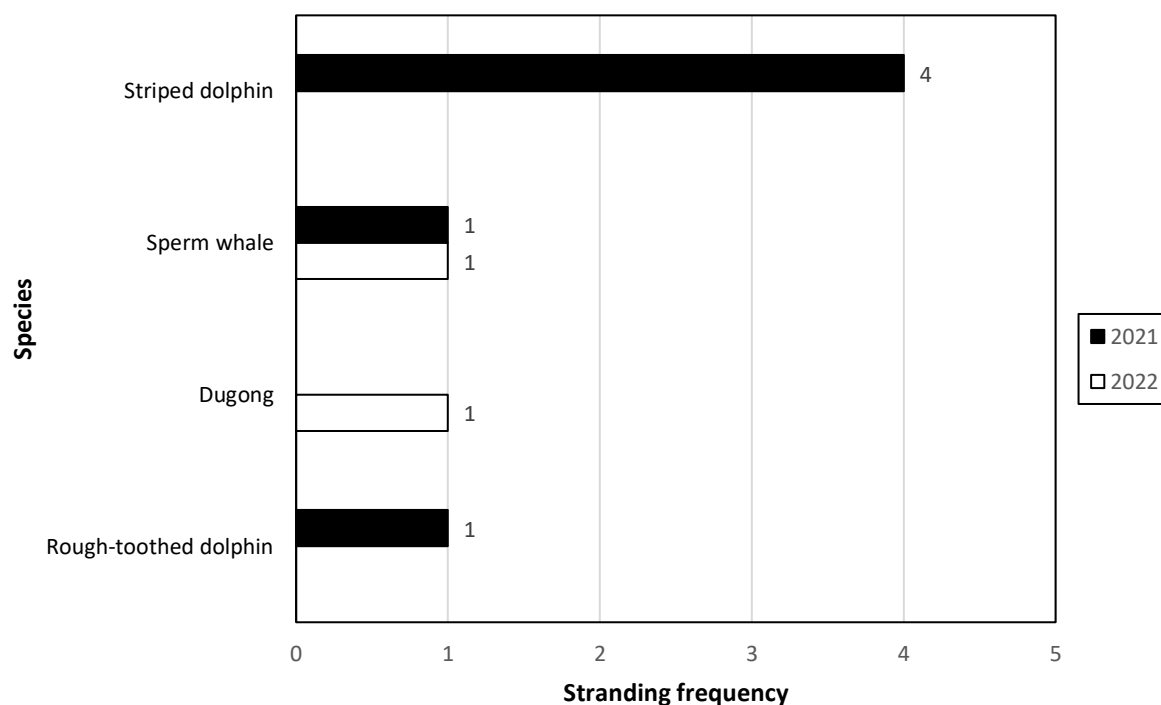


FIGURE 92. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN CARAGA REGION.

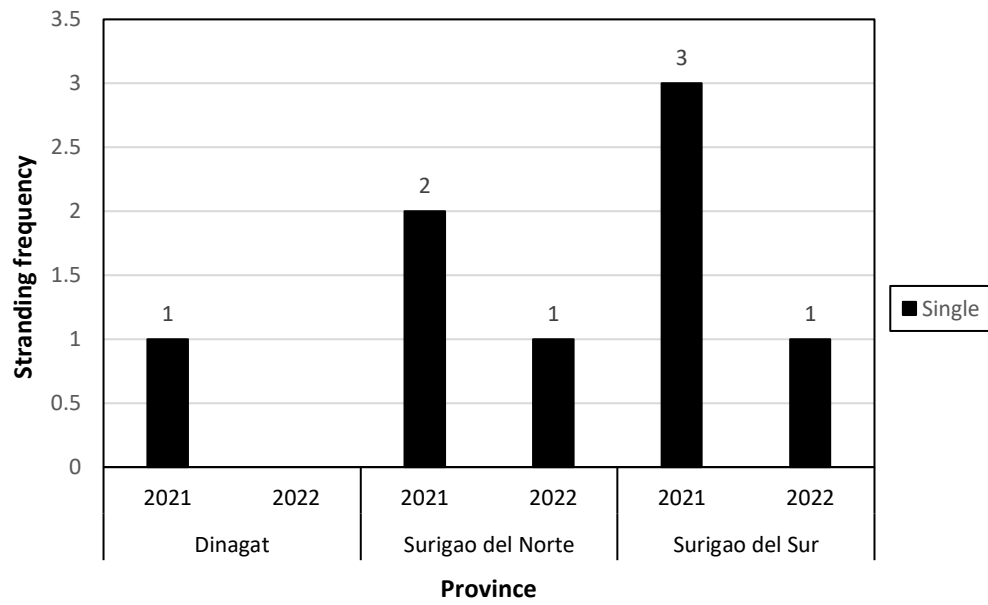


FIGURE 93. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN CARAGA REGION.

BARMM (BANGSAMORO AUTONOMOUS REGION IN MUSLIM MINDANAO)

The distribution of stranding events in 2021 and 2022 in BARMM is shown in Figure 94. There was a total of seven stranding events in the 2-yr period in this region. There were three stranding events in 2021 and four events in 2022. There were two provinces with strandings in the 2-yr period (Figure 95). Tawi-Tawi had the highest stranding events ($n=5$), three in 2021 and two in 2022. Sulu, on the other hand, had two incidents which all occurred in 2022.

BARMM had a total of 18 stranding grids (see Figure 94). All of which were classified as low grids only. Fifty percent of the low grids were recorded in Tawi-Tawi ($n=9$). About 22% were recorded in Sulu ($n=4$), 11% each in Basilan and Maguindanao ($n=2$), and 5.5% in Lanao del Sur ($n=1$).

Stranding events in Region 12 occurred in four months (Figure 96). There were two stranding events each in June, August, and October. There was one stranding event in May.

Figure 97 shows the seasonal distribution of strandings per province in BARMM in the 2-yr period. Stranding events occurred mostly during the JJA season in the region ($n=4$) and were recorded in both provinces with strandings. There were two stranding events in the SON season. One event was recorded in the MAM season which occurred in Tawi-Tawi in 2021. No stranding event occurred in the DJF season.

There were four marine mammal species that were stranded along the coast of BARMM in the 2-yr period (Figure 98). The sperm whale was the most frequent species that stranded in the region ($n=4$). A melon-headed whale, an unidentified balaenopterid, and rough-toothed dolphin had one stranding event each.

All stranding events in the region were classified as single stranding events except for one which was classified as out of habitat (Figure 99). The out of habitat event involved melon-headed whales with a pod size of 50-75 individuals. The event occurred in the waters of Tandubas, Tawi-Tawi.

Marine mammal strandings in the Philippines from 2021 to 2022

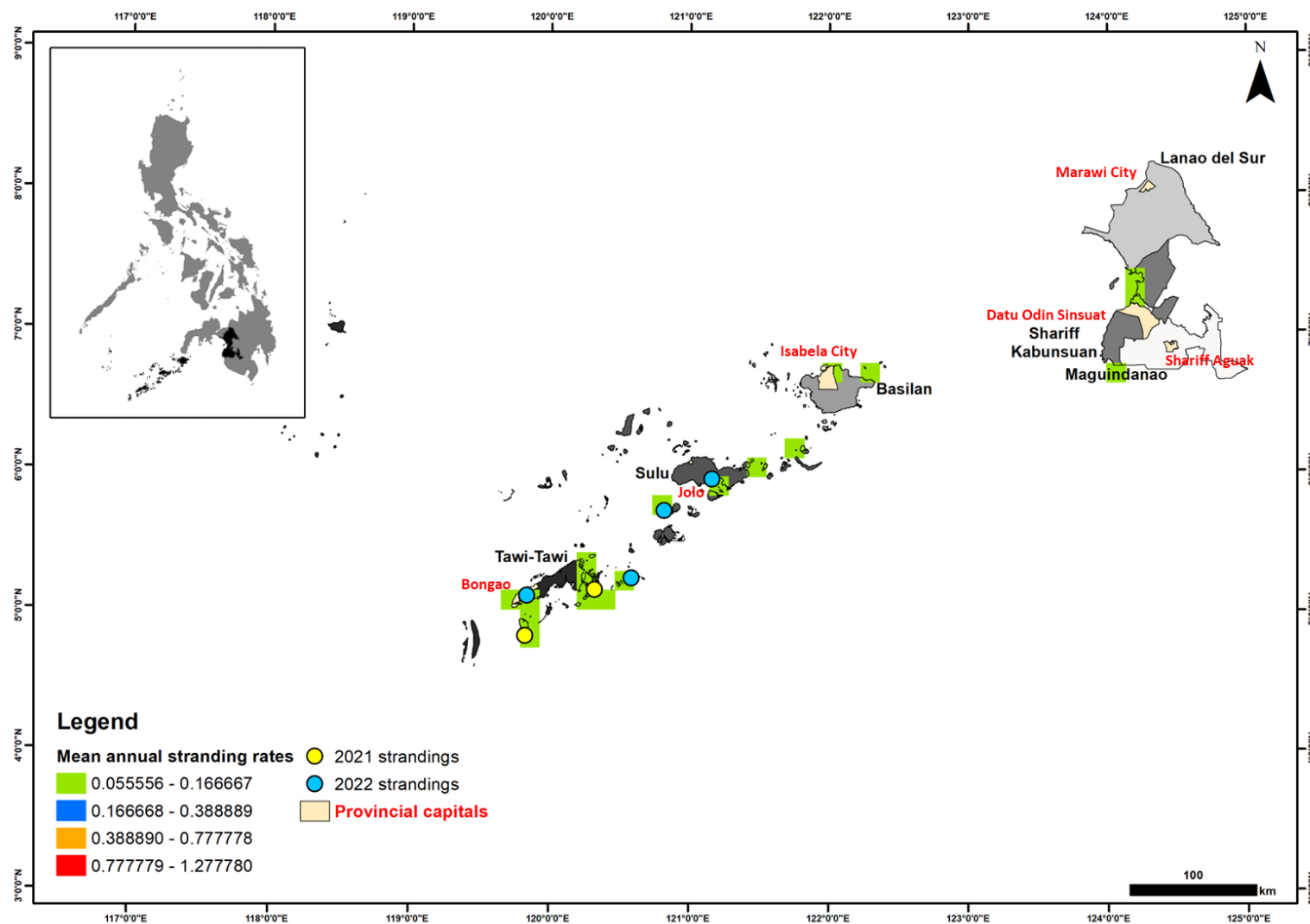


FIGURE 94. MARINE MAMMAL STRANDING STATUS IN BARMM.

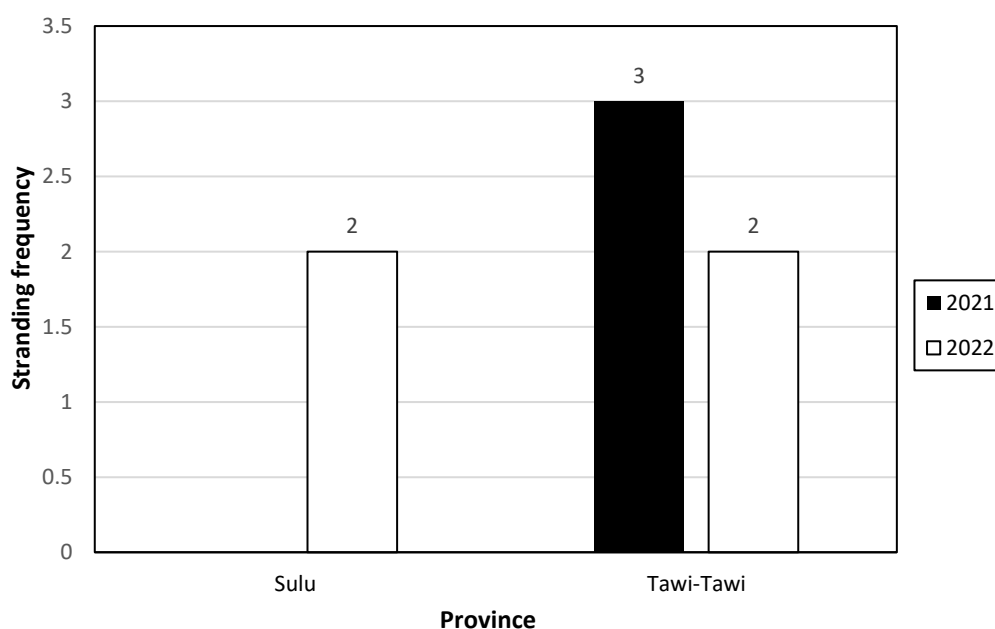


FIGURE 95. STRANDINGS PER PROVINCE FROM 2021 TO 2022 IN BARMM REGION.

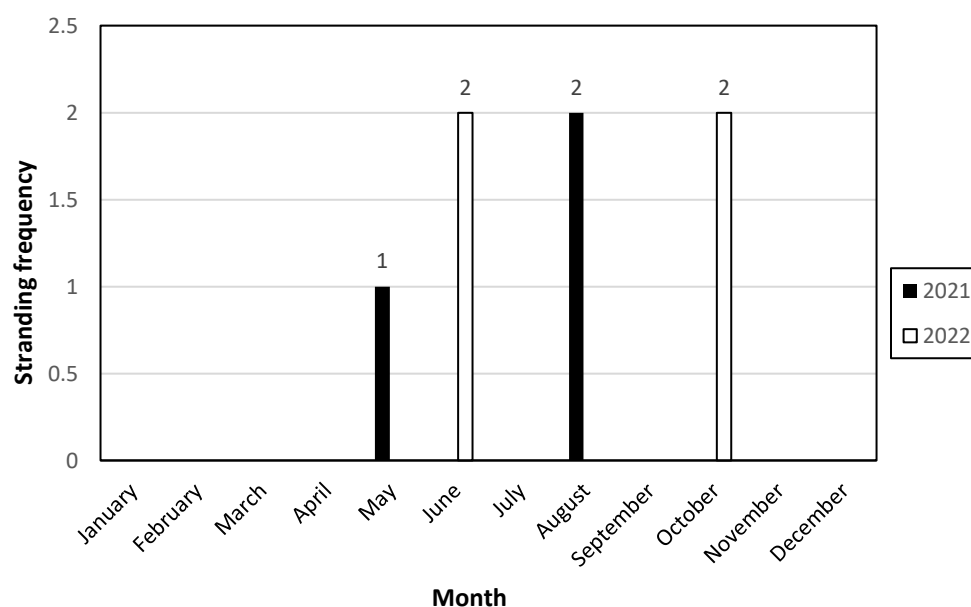


FIGURE 96. MONTHLY DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN BARMM REGION.

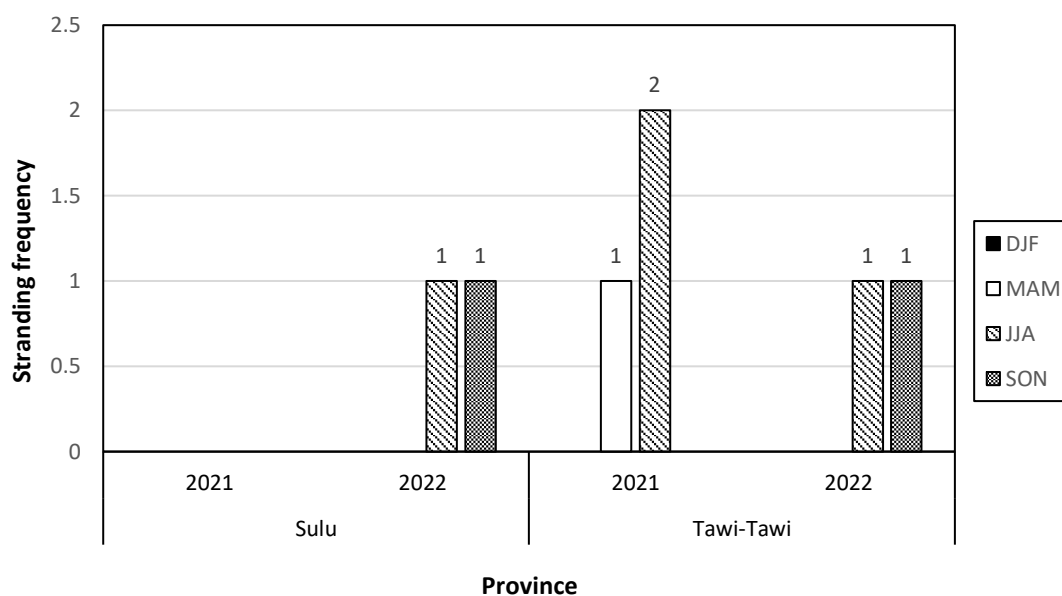


FIGURE 97. SEASONAL DISTRIBUTION OF STRANDINGS FROM 2021 TO 2022 IN BARMM REGION.

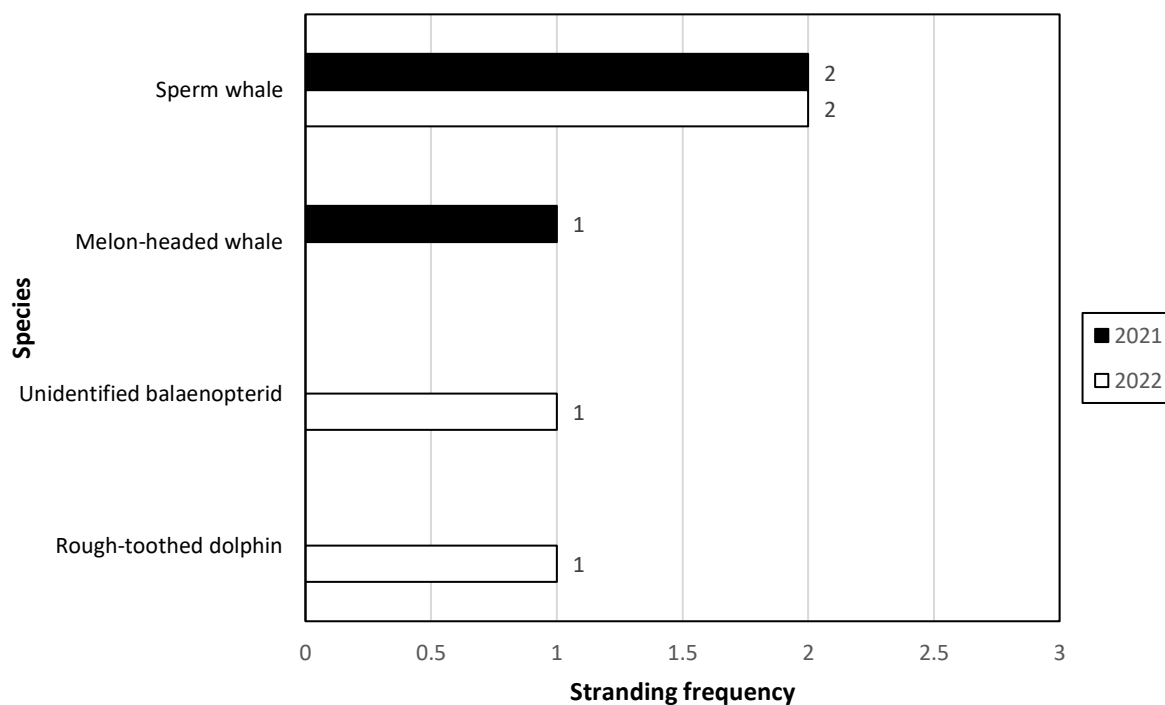


FIGURE 98. STRANDED MARINE MAMMAL SPECIES FROM 2021 TO 2022 IN BARMM REGION.

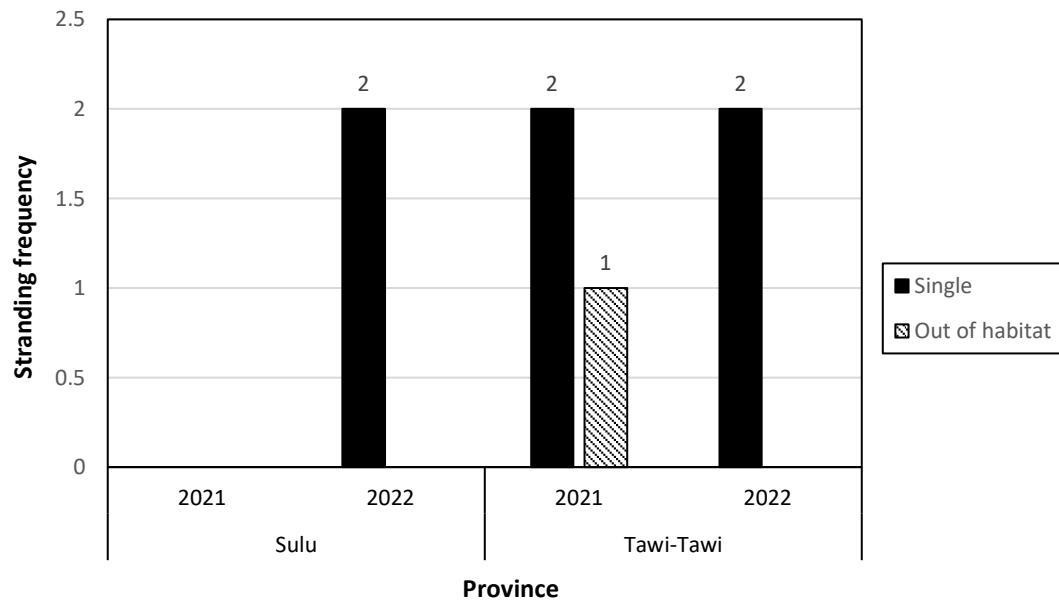


FIGURE 99. STRANDING EVENT CATEGORIES FROM 2021 TO 2022 IN BARMM REGION.

NCR (NATIONAL CAPITAL REGION) OR METROPOLITAN MANILA

The distribution of stranding events in 2021 and 2022 in NCR is shown in Figure 100. There was only one stranding event in NCR that occurred in the 2-yr period. The stranding event occurred in September and the SON season of 2021. In this event, a single stranding event of striped dolphin was involved which was recorded specifically in Navotas City.

NCR had only one stranding grid since the region had the shortest coastline among all regions (see Figure 100). The only grid was located in Manila City and was classified as a low grid. The mean annual stranding rate in this area was 0.1111.

Marine mammal strandings in the Philippines from 2021 to 2022

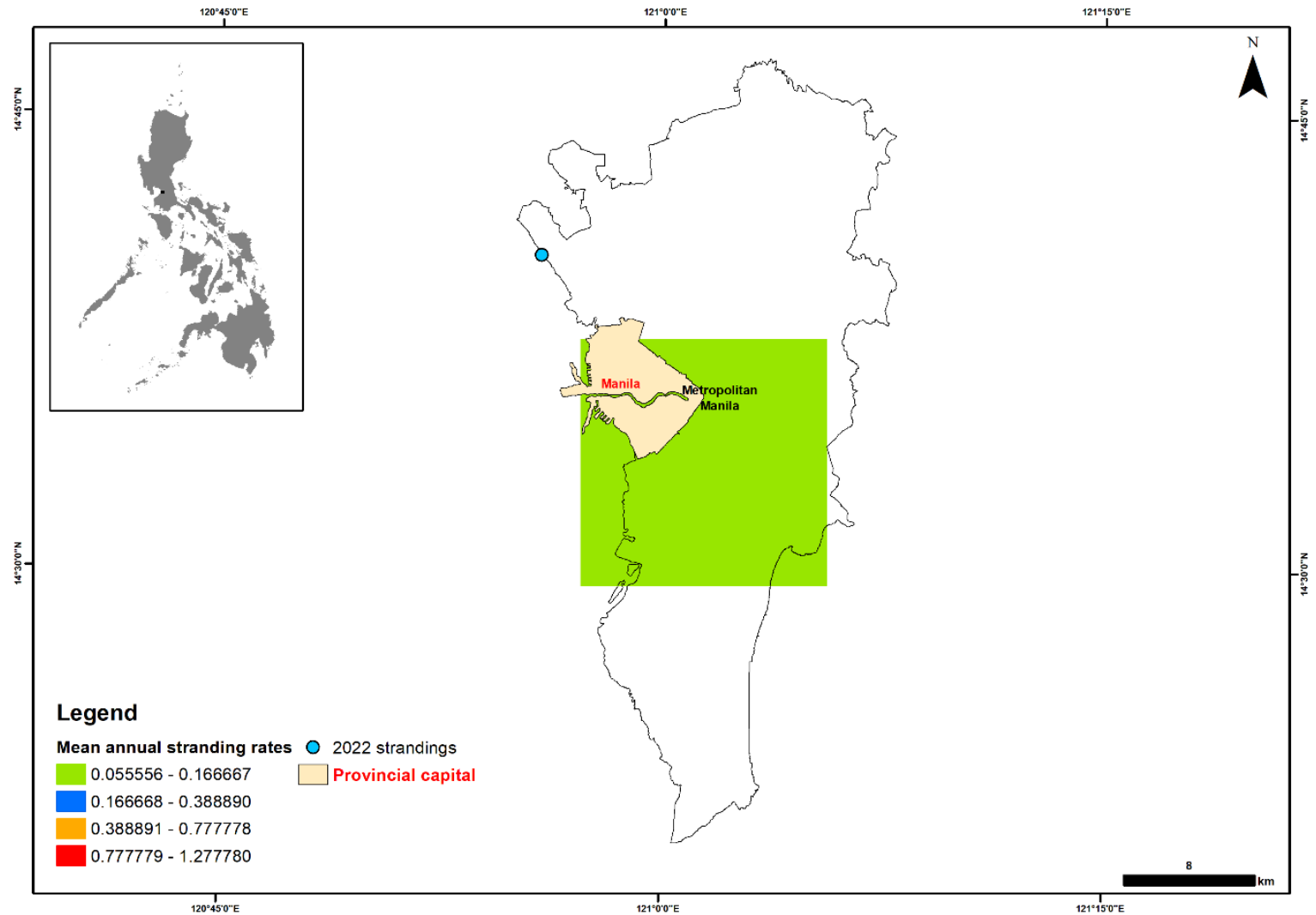


FIGURE 100. MARINE MAMMAL STRANDING STATUS IN NCR.

DISCUSSION

MEAN ANNUAL STRANDING RATES USING FISHNET TOOL TO IDENTIFY HOTSPOT MUNICIPALITIES/CITIES

Fishnet of 15 km x 15 km was employed again to determine municipality/city stranding hotspots. However, in this technical report (TR), mean annual stranding rates per grid were calculated and used as basis for identifying the stranding hotspots instead of total stranding events. About 35% of the total grids (495 of 1422) along the Philippine coastline had stranding events from 2005 to 2022 (see Figure 1). There were 33 municipality/city stranding hotspots identified (see Table 2). Among the 33 stranding hotspots, there were seven municipalities/cities that belong to the very high mean annual stranding rate grid category. These were Santa Ana (with a mean annual stranding rate of 1.2778), Badoc-Southern Currimao (1.2222), Dagupan City-Eastern Lingayen (1.1111), Western Lingayen-Labrador-Sual (0.9444), Pagudpud (0.8889), Cabugao-Sinait-San Juan (0.8889), and Sanchez Mira-Claveria (0.8333). Ilocos Region remains the primary region of concern since it hosts 14 stranding hotspot municipalities/cities. This region requires special attention both in strategic management and research. Note that Regions 2, 5, 11, and 12 were considered as areas of concern as well. The Fishnet Tool was useful for identifying municipal/city level areas of concern. These specific areas should be the primary or focal areas of interest for the concerned Provincial Fisheries Officers and BFAR Regional Directors in terms of strategic management or planning of training and the like. Previous reports (Aragones et al. 2010, 2017, 2022; Aragones and Laggui, 2019) which also presented regional hotspots practically showed very similar trends.

THE REGIONAL AND PROVINCIAL HOTSPOTS IN 2021-2022

In the previous TR (Aragones et al. 2022), the top five regions were Region 1 (n=26), Region 5 (n=26), Region 6 (n=25), Region 4B (n=22) and Region 7 (n=23). In the current TR, the top five regions were Region 1 (n=52), Region 12 (n=25), Region 5 (n=24), Region 6 (n=24), and Region 4B (n=18). Three of the regional hotspots were in Luzon, one in Visayas, and one in Mindanao. Region 1 had double stranding events in the current TR (n=52) from the previous TR (n=26). Region 1, Region 4B, Region 5, and Region 6 remained as regional hotspots based on the previous TR while Region 12 was a new regional hotspot in the current TR. These five regional hotspots accounted for 64% of the total stranding events from 2021 to 2022. Regions 3, 7, and 11 were the regions with the fewest number of stranding events among regions, with six stranding events each. In the previous TR, BARMM had the least stranding events (n=4).

The stranding events recorded per province were significantly higher in the current TR than in the previous TR. The top provinces with the highest frequency recorded in the last TR were Palawan (n=10), Negros Occidental (n=10), Ilocos Norte (n=9), Ilocos Sur (n=9), Cagayan (n=9), Cebu (n=9), and Sarangani (n=9). In the current TR, the top five provinces were Sarangani (n=22), Ilocos Sur (n=20), Pangasinan (n=14), Ilocos Norte (n=11), and Cagayan (n=10). Sarangani, Ilocos Sur, and Cagayan consistently remained in the list of provinces with the highest recorded stranding events. About 69% of the total stranding events in the top five provinces in the current TR were recorded in 2022.

HIGH ANNUAL STRANDING FREQUENCIES RECORDED IN 2021-2022 – PART OF DECLINING/ OSCILLATING PLATEAU

Based on this 18-year stranding database, the total annual stranding frequencies appear to form a plateau from 2014 to 2022 and the plateau was starting to decline on 2021 (see Figure 2). Although a decline in the plateau was observed, the stranding event figures are still high, and periodic oscillations are expected within this plateau. The sustained high number of stranding events may be an artifact of various factors. The growing network of PMMSN, accessibility of electronic communication, and to roads, of the masses contribute to this sustained reporting. Aragones et al. (2023, manuscript submitted) identified that the strandings may be caused by various natural and anthropogenic factors including seasonal and oceanographic factors, fisheries interactions, chemical and noise pollution, and diseases. The PMMSN through the Marine Mammal Research and Conservation Laboratory of the UP IESM is continuously examining the causes and effects of these factors on marine mammal strandings nationwide.

SPECIES COMPOSITION & THE CRITICALLY ENDANGERED DUGONG

The species composition of the strandings in 2021 to 2022 was similar with the previous TR. The top five most frequently stranded marine mammals in the previous TR were spinner dolphin, pygmy sperm whale, Fraser's dolphin, dugong, and melon-headed whale. In the current TR, the spinner dolphin and dugong remained in the list of top five. The top five species in the current TR were spinner dolphin, short-finned pilot whale, dugong, Risso's dolphin, and pantropical spotted dolphin. The sustained high stranding records of dugong has been alarming. Based on the previous TR, dugong had a total of 84 stranding records for 16 years (from 2005 to 2020) nationwide. Meanwhile, in 2005 & 2022, the dugong strandings increased to 104, with a 20-stranding difference after two years. This resulted in an increase of the annual average number of dugongs that strand from 5 to 6 (2005 to 2022). The top three provinces with the most dugong stranding incidences in the 2-yr period were Sarangani (n=6), Palawan (n=4), and Guimaras (n=3). The dugong has been declared as a critically endangered species in the Philippines since 2004 (DENR Administrative Order 2004-15). Aside from the dugong's high stranding events, an alarmingly high proportion of the strandings involved dead dugongs (84%). Without rapid and proper management and conservation measures, the persistence of dugongs in the Philippines in the future is bleak. Table 3 shows the latest checklist of marine mammals recorded in the Philippines with strandings per region since 2003.

REFLOAT/RELEASE AND REHABILITATION

Based on the recorded stranding events in 2021 and 2022, 55% (n=123) involved marine mammals that were alive upon initial sighting (see Figure 4). Meanwhile, 45% (n=100) of the stranded animals were found dead (beached). Of the live animals, 54% were released (n=66), 23% eventually died (n=34), 8% rehabilitated (n=10), and 10% have undetermined status (n=12). Out of the 10 cases rehabilitated, eight died, and one released, and one transported to Ocean Adventure (OA) for long-term and professional care. The one transferred to OA (a female pygmy killer whale) is covered by a MOA between BFAR 1 and OA, i.e., for non-releasable cases. Note that this animal was a victim of dynamite blast fishing and apparently showed signs of compromised acoustic capacity.

SUMMARY

The main findings from the analyses of this two-year (2021-2022) dataset are summarized as follows:

- A total of 1409 marine mammal stranding events have been recorded in the Philippines from 2005 to 2022.
- A total of 223 strandings from 2021 to 2022. This comprised 16 % of the total stranding events, to date.
- In a moving average of the annual stranding frequencies from 2005 to 2022, the first six years (2005-2010) was 37, followed by the next six (2011-2016) was 84, and the last six years (2017-2022) was 114.
- Total annual stranding frequencies had plateaued in the last seven years (2014-2022) and the plateau started to decline (oscillate) in 2020.
- Out of the 1422 grids (15 x 15km) along the Philippine coastline, 35% (n=495) had incidences of stranding from 2005 to 2022.
- Thirty-three (33) stranding hotspots on a municipal/city level were identified. The hottest of the stranding hotspots or those with very high mean annual stranding rates were Santa Ana in Cagayan (with a mean annual stranding rate of 1.2778), Badoc-Southern Currimaos in Ilocos Norte (1.2222), Dagupan City-Eastern Lingayen in Pangasinan (1.1111), Western Lingayen-Labrador-Sual in Pangasinan (0.9444), Pagudpud in Ilocos Norte (0.8889), Cabugao-Sinait-San Juan in Ilocos Sur (0.8889), and Sanchez Mira-Claveria in Cagayan (0.8333).
- The top five regions with the highest number of stranding records in the last two years: Region 1 (n=52), Region 12 (n=25), Region 5 (n=24), Region 6 (n=24), and Region 4B (n=18). The five (5) hotspot regions accounted for 64% of the total stranding events from 2021 to 2022.
- The top seven provinces with the highest frequency of recorded strandings were Sarangani (n=22), Ilocos Sur (n=20), Pangasinan (n=14), Ilocos Norte (n=11), and Cagayan (n=10).
- By season, 32% of the total strandings occurred during MAM season (n=72), 30% during JJA season (n=62), 21% during SON season (n=46), and 19% during DJF season (n=43).
- The majority of the strandings in 2021 to 2022 involved single stranding events (n=201). There were only six records of mass strandings, two out of habitat, and 14 UMEs.
- About 55% (n=123) of the recorded events in 2021 and 2022 involved live marine mammals. The rest were found dead upon sighting (45%, n=100). The figure for live stranded animals was relatively higher than the previous report (2019-2020, 37%).
- The top six most frequently stranded species from 2021 to 2022 were spinner dolphins (n=34), short-finned pilot whale (n=26), dugong (n=20), Risso's dolphin (n=17), Fraser's dolphin (n=16), and pantropical spotted dolphin (n=16).
- The number of stranding records is most alarming for the dugong (n=20) as it is a critically endangered species in the Philippines. The top three provinces with the most dugong stranding incidences in the 2-yr period were Sarangani (n=6), Palawan (n=4), and Guimaras (n=3).
- Overall, out of all stranded marine mammals found initially alive, 54% were released (n=66), 23% died (n=34), 8% rehabilitated (n=10), and 10% have undetermined status (n=12). Out of the ten marine mammals rehabilitated, eight eventually died, one released, and one transported to Ocean Adventure for long-term and professional care.

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APPENDIX

Appendix 1. Marine mammal stranding report form (from Aragonés et al. 2013).

STRANDING RESPONSE REPORT FORM			
CODE NUMBER: _____		COMMON NAME: _____	
CALL RECEIVED BY: _____		GENUS: _____	
TEAM LEADER: _____		SPECIES: _____	
		Affiliation: _____	
		Contact nos: _____	
A. LOCAL CONTACT INFO		B. STRANDING SITE ADDRESS AND DESCRIPTION	
Date of Stranding: _____ Time of stranding: _____		Region _____ Province _____ City/Municipality _____	
Name of Contact: _____		Address _____	
Tel. Numbers: _____		Weather condition _____	
		Water condition _____	
Observations of local contact:		Stranding site accessible by road? <input type="checkbox"/> yes <input type="checkbox"/> no	
Approximate size of animal (meters): _____		Type of beach: <input type="checkbox"/> sand <input type="checkbox"/> silt <input type="checkbox"/> mangrove <input type="checkbox"/> rock	
First observed: <input type="checkbox"/> beach/land <input type="checkbox"/> floating <input type="checkbox"/> swimming		Animal Location: _____	
Animal condition <input type="checkbox"/> live <input type="checkbox"/> fresh dead <input type="checkbox"/> decomposing		<input type="checkbox"/> on the beach <input type="checkbox"/> in the water <input type="checkbox"/> direct sunlight <input type="checkbox"/> under shade	
C. OCCURRENCE DETAILS		D. STRANDING RESULT OF HUMAN ACTIVITY?	
<input type="checkbox"/> single stranding <input type="checkbox"/> cow and calf		<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not determined	
<input type="checkbox"/> mass stranding how many? _____		<i>If yes, check one or more</i>	
		<input type="checkbox"/> boat collision <input type="checkbox"/> shot <input type="checkbox"/> fishery interaction	
		Other: _____	
E. CONDITION UPON EXAM BY STRANDING TEAM			
Time of arrival of stranding team: _____			
<input type="checkbox"/> alive <input type="checkbox"/> fresh dead <input type="checkbox"/> moderate decomposition <input type="checkbox"/> advance decomposition <input type="checkbox"/> mummified/skeletal			
Comments: _____			
F. MORPHOLOGICAL DATA		G. ANIMAL DISPOSITION	
Sex: <input type="checkbox"/> male <input type="checkbox"/> female <input type="checkbox"/> unknown		<input type="checkbox"/> left at site <input type="checkbox"/> transferred for rehabilitation	
Age Class: <input type="checkbox"/> adult <input type="checkbox"/> subadult <input type="checkbox"/> calf		Date: _____	
Straight Length (meters): _____ <input type="checkbox"/> actual <input type="checkbox"/> estimated		Facility: _____	
Weight (kilograms): _____ <input type="checkbox"/> actual <input type="checkbox"/> estimated		Other: _____	
Photos or videos taken <input type="checkbox"/> yes <input type="checkbox"/> no		<input type="checkbox"/> relocated and released	
Who has the photos/videos? _____		<input type="checkbox"/> disentangled and released	
		<input type="checkbox"/> died	
		<input type="checkbox"/> euthanized	
		Assessment of the animal (check one or more)	
		<input type="checkbox"/> sick <input type="checkbox"/> abandoned/orphaned	
		<input type="checkbox"/> injured <input type="checkbox"/> unknown	
		<input type="checkbox"/> deemed healthy <input type="checkbox"/> Other: _____	
H. STATUS OF CARCASS		I. NECROPSY DONE?	
<input type="checkbox"/> left at site		<input type="checkbox"/> yes <input type="checkbox"/> no	
<input type="checkbox"/> buried Location: _____		If yes...	
<input type="checkbox"/> towed/sunk Location: _____		Date: _____ Place: _____	
<input type="checkbox"/> frozen Location: _____		Necropsied by: _____	
<input type="checkbox"/> educational/scientific collection		(print name)	
<input type="checkbox"/> Other: _____		Tissue samples collected? <input type="checkbox"/> yes <input type="checkbox"/> no	
		Where are the samples stored: _____	

Please scan and email the form to lemaragones@gmail.com, lemdva2001@yahoo.com, and strandings@oceanadventure.com.ph.

PLATES

A COLLECTION OF MARINE MAMMAL STRANDING PHOTOS FOR 2021

REGION 1 STRANDINGS



Plate 1 & 2. 'Neri', a pantropical spotted dolphin that stranded in Narvacan, Ilocos Sur on 8 November 2021. Photos by: PMMSN 1 Chapter



Plate 3 & 4. A Fraser's dolphin that stranded in Dagupan, Pangasinan on 13 November 2021. Photos by: Bryner Arias



Plate 5 & 6. A melon-headed whale 'Eco', receiving supportive care after being stranded in Agoo, La Union on 16 April 2021. Photos from: BFAR Region

REGION 2 STRANDINGS



Plate 7 & 8. A pantropical spotted dolphin that stranded in Palaui Island, Santa Ana, Cagayan on 22 August 2021. Photos by: Jackie Carpio

REGION 5 STRANDINGS



Plate 9. Mass stranding event of Fraser's dolphins (13) on 26 January 2021. Photo by: Nonie Enolva

REGION 6 STRANDINGS



Plate 10. A dugong found dead in Buenavista, Guimaras on 18 March 2021.
Photo by: PNP Buenavista Guimaras

REGION 9 STRANDINGS



Plate 11. A short-finned pilot whale stranded in Bolong Beach, Zamboanga City on 24 June 2021. Photo by: Capt. Ruben Coros

REGION 12 STRANDINGS



Plate 12 & 13. A female short-finned pilot whale released on 3 September 2021 after being beached on 29 August 2021 in Glan, Sarangani. Photo by: PMMSN 1 Chapter

A COLLECTION OF MARINE MAMMAL STRANDING PHOTOS FOR 2022

REGION 1 STRANDINGS



Plate 14. ‘Maxene’, a pygmy killer whale that stranded in Ilocos Sur 5 December 2023. ‘Maxene’ was one of the five pygmy killer whales that was involved in the mass stranding event in the region. Photos by: PMMSN 1 Chapter



Plate 15. A Fraser’s dolphin with severe jaw injuries found in the coast of Urbiztondo, San Juan, La Union. Photo by: Dr. Hasmin Chogsayan



Plate 16. A Risso’s dolphin calf that stranded in Gabut, Ilocos Norte on 27 June 2022. Photo by: PMMSN 1 Chapter

REGION 5 STRANDINGS



Plate 17. An adult Risso's dolphin that stranded in Sorsogon Bay on 31 May 2022. Photo from: Bicol Express



Plate 18. An Irrawaddy dolphin found in Calabanga, Camarines Sur on 16 August 2022. This was the first evidence of Irrawaddy dolphin in the Pacific Ocean side/eastern waters of the Philippines Photo by: Nonie Enolva

REGION 8 STRANDINGS



Plate 19. A Bryde's whale that stranded in Tarangnan, Samar on 13 June 2022. Photo by: Owee Magos