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Distribution of Four Pinnipeds (*Zalophus californianus*, *Arctocephalus philippii townsendi*, *Phoca vitulina richardii*, and *Mirounga angustirostris*) on Islands off the West Coast of the Baja California Peninsula, Mexico

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Abstract

In the western region of the Baja California Peninsula, Mexico, four species of pinnipeds are found: the California sea lion (*Zalophus californianus*), the Guadalupe fur seal (*Arctocephalus philippii townsendi*), the Pacific harbor seal (*Phoca vitulina richardii*), and the northern elephant seal (*Mirounga angustirostris*). Their populations have changed in recent decades as a result of banning their commercial exploitation and government protection. These changes also have impacted their distribution, so it is necessary to have updated information. Herein, we present information about the distribution of the four species on a local scale, on 16 islands off the west coast of the Baja California Peninsula. These data were obtained from boat surveys during the winter and summer of 2009. The California sea lion and the northern elephant seal were found on all the islands except San Roque. New records for the northern elephant seal on the islands of Todos Santos Sur [South], San Jerónimo, and Asunción are presented. The Guadalupe fur seal was only found on Guadalupe Island and the San Benito Archipelago; however, it is now present in new areas on the island. This expansion is especially noticeable on the San Benito Este and Oeste [East and West] Islands. The harbor seal was found on all the islands in the study area except Guadalupe. This seal has only been recorded on the three San Benito islands in recent years. These changes in the distribution of the four species should be considered in future studies on abundance and other ecological topics, especially those concerning population growth and recolonization.

Key Words: California sea lion, Guadalupe fur seal, harbor seal, elephant seal, new records, expansion, local scale distribution, recolonization

Introduction

Four species of pinnipeds can be found in Mexico and are mainly distributed along the western coast of the Baja California Peninsula in the Pacific Ocean. They are two species of otariid, the California sea lion (*Zalophus californianus*) and the Guadalupe fur seal (*Arctocephalus philippii townsendi*), which reproduce during summer, and two species of phocid, the Pacific harbor seal (*Phoca vitulina richardii*) and the northern elephant seal (*Mirounga angustirostris*) which mate during winter. During the 19th century and the first part of the 20th century, the commercial exploitation of these species altered their abundance and distribution in the whole region of California in the United States and along the Baja California Peninsula.

Of these four species, only the Guadalupe fur seal is considered endemic to this region (Maravilla-Chávez & Lowry, 1999), although there are increasing reports of sightings in California (Hanni et al., 1997). The Guadalupe fur seal's historic range previous to its exploitation may have been from the Revillagigedo Islands to Point Reyes in California (Anthony, 1925). The other three species have wider distributions beyond the Pacific Ocean off Baja California. The California sea lion is distributed from British Columbia in Canada to central Mexico and in the Gulf of California (Orr & Helm, 1989). However, there are five distinct genetic populations: three in the Gulf of California and two in

the Pacific west off the Baja California peninsula—one comprising San Miguel, San Nicolas, and Coronados Islands; and one further south, comprising San Benito, Cedros, Asunción, and Margarita Islands (Schramm et al., 2009). Northern elephant seals have a narrower terrestrial distribution, ranging from central California to the middle of the Baja California Peninsula (Maravilla-Chávez & Lowry, 1996). Because they suffered a genetic bottleneck due to their exploitation, all present individuals are genetically very similar (Abadía, 2006). Finally, Pacific harbor seals have the broadest distribution, ranging from the coast of Japan to central Baja California where at least three populations have been found: (1) Japan, Russia, Alaska, and northern British Columbia; (2) southern British Columbia and Puget Sound, Washington; and (3) the outer coast of Washington, Oregon, and California (Burg et al., 1999). However, Burg et al. (1999) did not include samples from Baja California's harbor seals.

None of the previous works on the four pinniped species in Mexico have included a detailed, local description of their distribution on the islands off the west coast of the Baja California Peninsula. This region is under consideration by the Mexican government to be declared a biosphere reserve (Comisión Nacional de Areas Naturales Protegidas [CONANP], 2005; Pringle, 2015). Therefore, we think it is of utmost importance to present baseline information to include in the reserve's future management program. Knowing the exact distribution of pinniped colonies may be a useful resource for managing human activities (e.g., fishing and human settlements) on the islands and other conservation measures for these species that are protected under Mexican law (Secretaría de Medio Ambiente y Recursos Naturales [SEMARNAT], 2010). Furthermore, if pinniped populations continue to grow as they have over the last few decades, this study will help identify how their distribution changes over time, including the colonization of new islands. In consequence, the objective of this paper is to present updated and detailed information about the distribution of all the pinnipeds that are found on islands in the Mexican Pacific off the west coast of the Baja California Peninsula.

One of the most exploited species was the northern elephant seal, which was heavily hunted during the 19th century, causing it to be declared extinct three times (in the 1870s, in 1884, and in 1892; Le Boeuf & Laws, 1994). In the 1910s, two small groups were found—first on Guadalupe Island and later on the San Benito Islands (Bartholomew & Hubbs, 1960)—but it was not until 1938 that the first evidence of reproduction on Guadalupe Island was observed (Bartholomew & Hubbs, 1960). Its recovery continued with reproductive colonies reported on San Benito in 1930 and on the Channel Islands in the 1950s and in 1961 (Bartholomew & Hubbs, 1960; Le Boeuf & Laws, 1994). Despite its population recovery, the genetic diversity is very low, a symptom of a genetic bottleneck (Abadía, 2006). Its most updated distribution goes from the Farallon Islands in California to Natividad Island in Baja California, including the following Mexican islands: Coronados, San Martín, Guadalupe, San Benito, Cedros, and Natividad (Bartholomew & Hubbs, 1952; Stewart & DeLong, 1995; Maravilla-Chávez & Lowry, 1996).

The Guadalupe fur seal has a similar history to the elephant seal. After heavy exploitation that almost caused its extinction twice, in 1892 and 1928 (Thoburn, 1899; Hubbs, 1956), the species found refuge on Guadalupe Island, which remained its only colony until the 1990s when the population started growing at an exponential rate (Gallo-Reynoso, 1994). In 1997, a small group was discovered on San Benito Este [East] (Maravilla-Chávez & Lowry, 1999). Both colonies have shown important expansions in their distributions that have been well-documented; Hernández Montoya (2009) described a continuous distribution along the east coast of Guadalupe Island, from Punta Norte [North Point] to Campo Sur [South Camp]. On San Benito, their distribution started at two sites on San Benito Este in 1997; and in 2006, they had occupied most of the eastern and northeastern shores of this island. One year later, they had expanded to the whole island, except for the southeast point. In 2007, they also occupied the northeast area of San Benito Centro [Central] and the south of San Benito Oeste [West] (Aurioles-Gamboa et al., 2010). Although their genetic diversity has been described as moderate (Bernardi et al., 1998), evidence of a genetic bottleneck is present (Weber et al., 2004).

As with other pinnipeds, the harbor seal was hunted during the 19th century. It is estimated that only a few hundred individuals survived in isolated areas of the California coast (Bonnot, 1928), although there is no information about their possible exploitation in Mexico during that time. There are no molecular studies on the harbor seal in Mexico, but in the U.S., a genetic bottleneck has not been found in this species (Lamont et al., 1996). It was not until the second half of the 20th century that the populations began to recover at an accelerated pace in the U.S. (Barlow et al., 1995). Its current distribution has a southern limit in the East Pacific on Natividad Island according to Burns (2009); however, others indicate Asunción Island as the southern limit (Maravilla-Chávez & Lowry, 1996).

The history of exploitation of the California sea lion in Mexico has been less severe, although they have been hunted, first by the indigenous groups and later by whalers, as well as by sea otter (*Enhydra lutris*) and Guadalupe fur seal hunters. The lesser quantity and quality of their fat, skin, and meat made its exploitation a secondary activity compared to that of other pinnipeds and the sea otters (Zavala-González & Mellink, 2000). Currently, its distribution includes Canada, the U.S., and the Pacific coast of Mexico, as well as the Gulf of California. The population has been divided into three stocks: (1) Canada and the U.S., (2) the Mexican Pacific, and (3) the Gulf of California (Lowry et al., 1992). However, Schramm et al. (2009) found that there is genetic evidence to differentiate two populations in the Pacific and three in the Gulf of California. In 2000, during surveys in the Mexican Pacific, Lowry & Maravilla-Chávez (2005) found colonies on Coronados, San Jerónimo, Cedros, Piedra Colorada (islet next to Cedros), San Benito Oeste, Natividad, Asunción, and Santa Margarita. The same authors previously reported individuals on Todos Santos, San Martín, and Guadalupe (Maravilla-Chávez & Lowry, 1996).

Methods

Boat surveys were carried out around 16 islands in the Mexican Pacific, from Coronados near the U.S.-Mexico border to Asunción in Baja California Sur. These islands were (named from north to south) Coronados (Norte, Centro, Pilón de Azúcar, and Sur) [North, Central, Pile of Sugar, and South], Todos Santos (Norte y Sur) [North and South], San Martín, San Jerónimo, Guadalupe, San Benito (Oeste, Centro, and Este) [West, Central, and East], Cedros, Natividad, San Roque, and Asunción (Figure 1).

The surveys were accomplished during two seasons in 2009—winter (January, February, and March) and summer (July and August)—to coincide with the breeding seasons of otariids (summer) and phocids (winter). One survey was conducted at each location per season. During each trip, we circumnavigated every island one time per season, taking photographs of the entire coast from a distance of between 10 and 50 m, depending on the weather and wave strength, using a digital camera (Canon® EOS 10D) with a telephoto lens (Canon® 100 to 400 mm f/4.5). At the same time, the camera position was recorded in a GPS track using a Garmin® GSMAP GPS. Both instruments were configured with the same hour, so we could georeference all the pictures using *RoboGeo*®, Version 6.32.

The georeferenced photographs were later grouped into panoramic pictures and reviewed individually, counting all the pinnipeds present and classifying them by species using *Image Pro Plus*®, Version 6.1. Later, this information was grouped into a database and integrated into maps using the program *ArcMap*®, Version 9.3. The distribution maps are available as Electronic Supplementary Materials on the *Aquatic Mammals* website (www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=10&Itemid=147).

Results

California Sea Lion

These otariids were found on the following islands: Coronados Norte, Centro, and Sur; Todos Santos Norte and Sur; Punta Banda islets (south of Todos Santos and next to Punta Banda Peninsula); San Martín; San Jerónimo; Guadalupe; San Benito Oeste, Centro, and Este; Cedros; Natividad; and Asunción (Figure 1).

On the Coronados Islands, during the summer, most of the sea lions were found on Coronados Norte, which is farther away from the other three islands (Electronic Supplementary Material [ESM] Figure 1). On Coronados Sur, where most of the human activity occurs (a navy outpost and many aquaculture enclosures), we only found one individual. During the winter, the distribution was similar, although most of the animals were located on the west side of these islands (ESM Figure 1). These islands are the most abundant colony in the north of the peninsula with around 7% of the total population (Table 1). Moving towards the south on Todos Santos, during the summer, sea lion counts were very low, with only nine on Todos Santos Norte and four on a rock on the southern point of Todos Santos Sur (ESM Figure 2). In contrast, there were many more individuals on a group of islets 5.5 km south of Todos Santos Sur called Punta Banda Rocks, close to the Punta Banda Peninsula (ESM Figure 3). During the winter, there were a few more sea lions on Todos Santos Norte, but still the majority of animals were on the Punta Banda Rocks.

On San Martín, all the sea lions were located on the west shore in the summer (ESM Figure 4). This coast is composed of cliffs, with strong waves and a dense kelp forest (*Macrocystis pyrifera*). These conditions made approaching the shore more difficult for small boats. During the winter, they dispersed a little more to the south but remained on the west side. Continuing south on San Jerónimo, almost all of the sea lions were located in the south during the summer, both on the east and west coasts of the island, and on an

islet near the southern point (ESM Figure 5). During the winter, it was not possible to navigate along the west shore due to weather conditions; most sea lions were found in the southeast point.

The most oceanic island in this area is Guadalupe where, during the summer, most of the sea lions were found on a big islet south of the island, called El Zapato [The Shoe] (ESM Figure 6). A few more are located on El Toro [The Bull], another big islet to the south, and some individuals were scattered on the northern shore of the main island. During the winter, they moved around the central and southern parts of the east side of Guadalupe. The sea lion population in this island is very small, around 0.3% of the entire regional population (Table 1).

On the San Benito archipelago, the second biggest colony in this region (Table 1), the sea lions

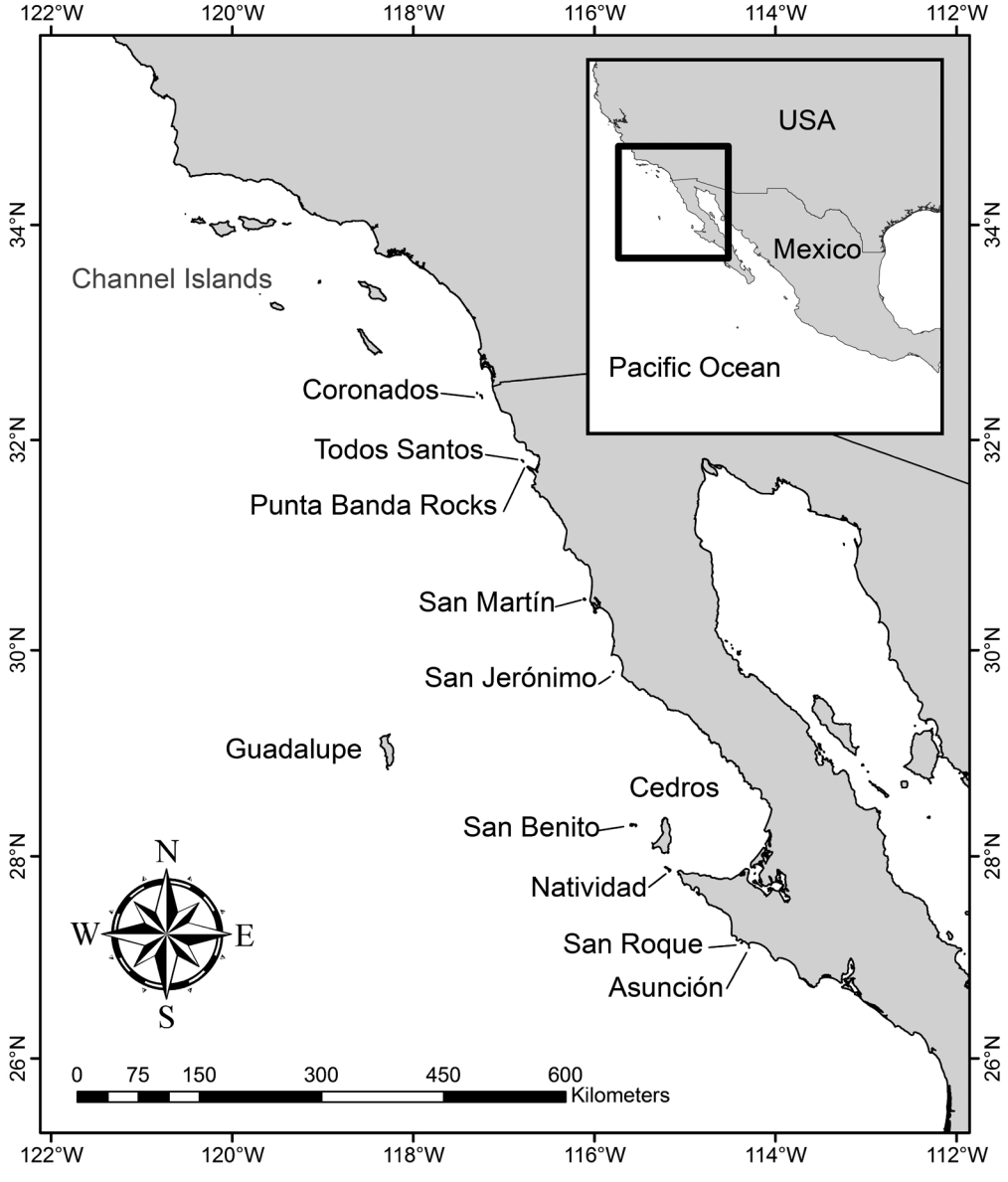

Figure 1. Location of the islands within the study area (black) with the Channel Islands as reference (grey)

Table 1. Distribution of the regional population of pinnipeds in percentages by island during their reproductive season in 2009; percentages of Pacific harbor seals (*Phoca vitulina richardii*) do not include animals found along the coast of the Baja California Peninsula.

Species	California sea lion	Guadalupe fur seal	Pacific harbor seal	Northern elephant seal
Seasons	Summer 2009	Summer 2009	Winter 2009	Winter 2009
Islands				
Coronados	7.1	0	6.6	1
Todos Santos	0.9	0	11.2	< 0.1
San Martín	1.1	0	6.3	< 0.1
San Jerónimo	5.8	0	25.7	0.1
Guadalupe	0.3	65.5	0	54.1
San Benito	22.9	34.4	1.5	32.6
Cedros	32.3	0	5.9	12
Natividad	9.3	0	18.2	< 0.1
San Roque	0	0	17.9	0
Asunción	20.3	0	6.8	< 0.1

were spread all around San Benito Este during the winter. In the summer, they gathered along the south shore (ESM Figure 7). On San Benito Centro, there was a similar pattern: during the winter, they were all around the island; but in the summer, they stayed mostly on the east side and a few on the north shore. This island was where most of the California sea lions were found in the whole archipelago. On San Benito Oeste, sea lions were found on the south, west, and north shores during the winter; during the summer, they left the north and remained on the south and west coasts.

The largest island in the study area is Cedros; it had the largest population of sea lions, with around 32% of the total regional population in 2009 (Table 1). Here, during both seasons, most sea lions gathered along the northern coast, although during the summer, they spread over a wider area. This is the most isolated area of the island, far away from the island's town (southeast of the island; population approximately 1,340; Instituto Nacional de Estadística y Geografía [INEGI], 2010), with strong waves and beaches surrounded by high cliffs (ESM Figure 8). There was also an important sea lion concentration on an islet called La Colorada, southwest of Cedros Island. In contrast with these remote locations, there was a group of about 50 sea lions that frequently rested on the docks and buoys of the salt company's harbor during the summer (reproductive season). This shows that they seem to look for undisturbed places to breed but not necessarily for resting. Close to Cedros, 15 km to the south, is Natividad, where, during both seasons, most sea lions were on the north and northwest shores of the island, including an islet called Roca Amarilla [Yellow Rock], although during the summer, they showed a wider distribution. During the winter, a few individuals rested on southern parts of the island (EMS Figure 9).

The islands of Asunción and San Roque in the southernmost part of the study area are separated by only 9 km. Despite this closeness, on Asunción, there was an abundant population that was found all around the island during summer and in the west and northeast during winter, including the islets north of the island (ESM Figure 10) during both seasons; while on San Roque, there were no sea lions. This was the most noticeable exception in the California sea lion's distribution in our study area.

Guadalupe Fur Seal

The distribution of the Guadalupe fur seal is limited to Guadalupe Island and the San Benito Archipelago, with Guadalupe being the largest colony with approximately 65% of the total population (Table 1). On Guadalupe, during the reproductive season (summer), almost the entire east coast and the south point were occupied with a high abundance; there were also some individuals on the west side but in lower densities (ESM Figure 11). In the nonreproductive season (winter), they limited their distribution to the east side and the south point. On the San Benito Islands, during the summer, most animals gathered along

the southern coast of San Benito Oeste and Este, as well as on the northeast of San Benito Centro (ESM Figure 12). During the winter, they spread to occupy all of San Benito Este, with higher abundances in the northeast. On San Benito Oeste, most of the individuals remained in the southern portion, but others rested in the northeast. Finally, on San Benito Centro, there were two small groups on the southern shore.

Pacific Harbor Seal

This phocid was observed on the following islands: Coronados Norte, Centro, Pilón de Azúcar, and Sur; Todos Santos Sur; San Martín; San Jerónimo; San Benito Oeste, Centro, and Este; Cedros; Natividad; San Roque; and Asunción (Figure 1), with the highest abundance found on San Jerónimo (26%), Natividad (18%), and San Roque (18%) (Table 1). On Coronados during the reproductive season (winter), we found them mainly on Coronados Sur, and some on Coronados Centro. During the summer, they spread to the four islands, but most of them remained on Coronados Sur (ESM Figure 13). On the Todos Santos Islands, during the winter, they were distributed on the east and southwest shore of Todos Santos Sur; during the summer, their abundance decreased (ESM Figure 14). On the volcanic island of San Martín, in the winter, there were a few individuals along the southern and eastern coasts, but most of the harbor seals were concentrated in a small sandy bay in the southeast; in the summer, there were also a few dispersed individuals in the southwest of the island (ESM Figure 15).

On San Jerónimo Island, it was not possible to survey the west coast due to the strong waves in the winter (ESM Figure 16). On the east side, most harbor seals were found along the northeast and southwest coasts, protected from the strong waves. In the summer, there were individuals along the west and the southeast of the island. The San Benito Archipelago is the farthest site from the Baja California Peninsula where harbor seals are present. During the winter, they were dispersed around the three islands, mostly in small groups of around four harbor seals; and in the summer, only a small group was found on San Benito Oeste (ESM Figure 17).

On Cedros Island, the harbor seal's distribution was very sparse in the winter, with most individuals in the central section of the island, both on the east and west coasts (ESM Figure 18). In the summer, there was a noticeable change, with most harbor seals along the north and south shores, mainly on a southeastern islet called La Colorada. On Natividad, during the winter, they were found along the north and south shores, with an important number on an islet called Roca Plana [Flat Rock] in the southeast, across from the island's town (ESM Figure 19). During the summer, they dispersed and were located on the north, south, and southeast shores of the island, including on Roca Plana.

San Roque was the only island in this region that was only inhabited by harbor seals; no other pinnipeds were found there. During the winter, they gathered mostly along the east and south coasts, as well as some along the northeast shore (ESM Figure 20). In the summer, they maintained a similar distribution but with a lower abundance. Close by, on Asunción, during the winter and summer, most individuals were along the north and northeast coasts of the island, including the islets; only a few harbor seals were found along the southeast coast (ESM Figure 21).

Northern Elephant Seal

The current distribution of this species shows its ability to recover and expand from the last remaining colony on Guadalupe Island (Hubbs, 1956). Currently, they are found on the following islands: Coronados, Todos Santos Sur, San Martín, San Jerónimo, Guadalupe, San Benito, Cedros, Natividad, and Asunción. The largest colonies are still on Guadalupe and the nearby islands of San Benito and Cedros; combined, they represent 98.8% of the regional population (Table 1).

Elephant seals were distributed on all four Coronado Islands. During the winter, they were found in small, dispersed groups in the Sur, Centro, and Pilón de Azúcar Islands; while in the summer, they were found in the Norte, Sur, and Centro Islands (ESM Figure 22). Similarly, on Todos Santos Sur, there were two groups on beaches on the southeast coast, but only during the winter (ESM Figure 23). On San Martín Island, they were only found in the winter, in a small sandy bay, southeast of the island (ESM Figure 24). On San Jerónimo Island, they were found along the north and southeast coasts during the winter, and only on the southwest coast during the summer (ESM Figure 25).

On Guadalupe, during the summer, they were on beaches on the northern part of the island, such as Campo Norte and Playa Elefante [Elephant Beach], as well as dispersed individuals on the west and southeast coasts. In the winter, most of the elephant seals were found on the north coast but also at Playa Elefante and on the southeast coast (ESM Figure 26). On the San Benito Archipelago, their distribution during the winter was widespread, with individuals in most of the shoreline of the three islands (ESM Figure 27). However, during the winter, there were sites with high elephant seal density such as the beaches

on the southeast coast of San Benito Este, on the north and west coasts of San Benito Centro, and on the northeast coast of San Benito Oeste. In contrast, during the summer, they were less widespread. On Cedros, during the winter, they were along the northeast coast and on two beaches at the north point; while in the summer, they only occupied two areas along the northwest coast (ESM Figure 28).

A few individuals were found on the northeast coast of Natividad during the summer (ESM Figure 29). They were also found in small numbers on the northeast shore of Asunción during the summer, and only two elephant seals were in the same area of Asunción during the winter (ESM Figure 30).

Discussion

California Sea Lion

The California sea lion has the broadest distribution of all pinnipeds in Mexico, ranging from islands off the west coast of the Baja California Peninsula to southern islands in the Mexican Pacific and in the Gulf of California (Carretta et al., 2007). Despite being one of the most studied species in the region, there is little detailed information about their distribution on each island in Mexico. Bartholomew & Hubbs (1952) drew a map of the sea lion's distribution on the San Benito Archipelago during the winter of 1950. The map shows a complete occupation of the three islands. Fifty-nine years later, its distribution seems to have shortened in the east and north coasts of San Benito Oeste, although due to the lack of a time series between both studies, it is difficult to support this as a fact.

Distribution differences between seasons on all studied islands were few; in general, there was a more dispersed distribution with a lower abundance during the winter. This may be due to their reproductive strategy since during the summer, adults gather in reproductive areas where the males establish their territories (Odell, 1975). At the end of the breeding season, adult males migrate from their rookeries in Baja California and southern California to northern California, Oregon, Washington, and British Columbia to feed and rest until the next reproductive season (Mate, 1975; Aurioles-Gamboa et al., 1983).

On Cedros and San Martín, sea lions were located at the most inaccessible sites of the islands, surrounded by cliffs, with strong waves, apparently as far as possible from human settlements, and with kelp forests in the case of San Martín. This may be a response to human disturbance. This island is used seasonally by fishermen from the nearby town of San Quintin who have a small camp on the island. On Cedros Island, there is a town and an industrial harbor in the southeast of the island where between 1,340 and 4,500 people live (INEGI, 2010; Gobierno del Estado Baja California [GBC], 2014). The people of this town used to bring their pets to the island, so currently there are packs of feral dogs on the island's interior. García-Aguilar (2012) found that these dogs' most common prey are elephant seals and California sea lions, so their distribution in protected sites may be a response to predators. Further research is necessary on this topic to evaluate if feral dogs or human activities are changing the distribution of sea lions on these islands and, if so, what conservation strategies could be applied.

Guadalupe Fur Seal

The first sighting of Guadalupe fur seals recolonizing the San Benito Archipelago was in 1997 on San Benito Este (Maravilla-Chávez & Lowry, 1999). Since then, the population and its distribution have continued to increase, with the last count at 2,113 in 2008 (Aurioles-Gamboa et al., 2010). After settling on San Benito Este, by 2000, they were located in the middle of its east coast. Later on, in 2006, they had occupied the rest of the east coast and the middle of the west coast on the same island. The last reports in 2007 and 2008 show an almost complete occupation of San Benito Este, except for the southwest corner, as well as the colonization of the south coast of San Benito Oeste and the northeast coast of San Benito Centro (Aurioles-Gamboa et al., 2010). Our 2009 data show that their expansion has continued. San Benito Este was completely occupied, including the southeast corner, although only in the summer. On San Benito Centro, there also were more scattered individuals on the east, south, and southwest shores. On San Benito Oeste, they were occupying new areas: the west coast during the summer and the north coast in the winter. This information confirms that the fur seal is continuing to expand its distribution on San Benito, and we recommend further monitoring and research on the growing distribution and abundance of fur seals on these islands, including their interaction with other pinnipeds, to assess how their expansion could affect their populations. Currently, this archipelago is not part of any natural protected area, but it is a crucial habitat for the four species of pinnipeds in Mexico as it contains the second largest colonies of California sea lions, Guadalupe fur seals, and northern elephant seals in this region.

Guadalupe Island is still the most important colony for this species. Gallo-Reynoso (1994) and Hernández Montoya (2009) described that during 1991 through 1993 and the reproductive season of 2006, respectively, the fur seals were distributed

along the east coast of the island, with higher abundances in the middle section and the lowest number in the northeast and southeast. Our data found that the distribution was still the same, with the exception of scattered individuals on the west coast during the summer and a large concentration of animals at the southwest point. Also, the abundance of individuals was more evenly spread along the east coast; this shows that their expansion was taking place from the central east to the north and south of the island.

Pacific Harbor Seal

Previous works on the Pacific harbor seal's distribution in Mexico are scarce; only Padilla-Villavicencio (1990) reported the distribution from Coronados to Natividad. Their presence on San Roque and Asunción was first noticed by Maravilla-Chávez & Lowry (1996) in 1992. During the same survey, Maravilla-Chávez & Lowry did not find any harbor seals on the San Benito Islands and neither did Brownell et al. (1974) in 1968. Aurioles-Gamboa et al. (2010) mentioned the presence of around 100 harbor seals at this archipelago, distributed on the three islands, but mainly on San Benito Oeste and Este, although these authors did not report the year they found the harbor seals. Their presence at the archipelago may be the beginning of a colonization process, probably with animals coming from Cedros as it is the nearest colony.

There are seasonal differences in their small-scale distribution and abundance (Lubinsky, 2010). While in winter they tend to be more abundant (Lubinsky, 2010) and concentrated; in some cases, they also use different parts of the same island. For example, on Coronados, during the winter, they were only present on Coronados Sur; while in the summer, they dispersed to the other three islands. This species has been described as philopatric because individuals tend to use the same reproductive sites each year (Pitcher & McAllister, 1981; Yochem et al., 1987; Härkönen & Harding, 2001; Lowry et al., 2001). After their reproductive period, it is possible that the individuals move around the same island, and this may explain the changes in their distribution. It is also possible that they are moving between islands. Although they have been described as a nonmigratory species, with only local movements associated with reproduction and foraging (Reeves et al., 2002; Nowak, 2003), this generalization may not be attributed to all their populations. Tracking studies have found individuals traveling up to 550 km from one place to another (Pitcher & McAllister, 1981; Brown & Mate, 1983).

In addition to the islands, harbor seals also use pocket beaches along the main coast of the Baja California Peninsula, especially along the north coast (Lubinsky, 2010). This is one of the least studied pinnipeds in Mexico, and more research is needed, including the location of their colonies along the Baja California Peninsula coast, which remains unknown.

Northern Elephant Seal

The distribution of northern elephant seals has grown substantially from their last remaining colony on Guadalupe Island (Bartholomew & Hubbs, 1960). Today, they can be found on most of the islands in our study area, as well as on the Channel Islands and along the California coast (Odell, 1974; Stewart et al., 1994; Reeves et al., 2002). Previous works have described their distribution on the Mexican islands of Coronados (Le Boeuf et al., 1975; Antonelis & Fiscus, 1980; Stewart et al., 1994; Maravilla-Chávez & Lowry, 1996), San Martín (Le Boeuf & Mate, 1978), Guadalupe (Anthony, 1925; Bartholomew & Boolootian, 1960; Rice et al., 1965; Stewart et al., 1994), San Benito (Bartholomew & Boolootian, 1960; Rice et al., 1965; Brownell et al., 1974; Stewart et al., 1994; Maravilla-Chávez & Lowry, 1996; García-Aguilar, 2004), Cedros (Rice et al., 1965; Brownell et al., 1974; Stewart et al., 1994; Maravilla-Chávez & Lowry, 1996), and Natividad (Le Boeuf & Mate, 1978). In this study, we present new records of their presence on the islands of Todos Santos Sur, San Jerónimo, and Asunción. These records may represent the beginning of a recolonization process on these islands; therefore, it is necessary to keep monitoring them. This information should be taken into account for new natural protected areas and for the environmental impact of new human activities on these islands.

According to the literature, the first islands to be recolonized were the Channel Islands in 1925 (Stewart et al., 1994). In Mexico, some animals were seen during those days on Cedros and San Benito, although in such small numbers that they were not considered reproductive colonies (Anthony, 1925). By 1991, 64% of all the births were estimated to be taking place on the islands of San Nicolas and San Miguel, California (Stewart et al., 1994). If today's major colonies on Guadalupe, Benito, Cedros, and the Channel Islands continue to increase, it is very possible that the colonies on Coronados, Todos Santos, Natividad, and San Jerónimo will grow due to immigration from other rookeries, besides local births. Although juvenile and female elephant seals have been described as highly philopatric (Le Boeuf & Laws, 1994; Oliver et al., 1998), females are also known to move to adjacent colonies when their breeding grounds become too crowded (Le Boeuf, 1972; Reiter et al., 1981).

Conclusion

Even though the information on pinniped colonies in Mexico is scarce, there is some evidence that individuals have been changing their distribution, at least during the last 35 y. This has been mainly explained by the demographic recovery of the species after hunting ceased. The small-scale distribution information presented herein is important to monitor how species such as the Guadalupe fur seal or the elephant seal continue their recovery from exploitation, expanding their distribution on the islands and colonizing new ones. For the Pacific harbor seal, there is little information about this species in Baja California; thus, it is difficult to assess if the population is increasing, moving, or declining. In the case of the California sea lion, where the Mexican population seems to be declining (Hernández Camacho et al., 2016) and California's populations are increasing (Carretta et al., 2016), some authors argue that individuals from Mexico are moving to California (Hernández Camacho et al., 2016). Distribution information, along with population data, may help to support or refute this hypothesis. Today, the threats that the four pinniped species in Mexico encounter are difficult to identify and are less predictable regarding their effects on their populations—for example, El Niño, the Pacific Decadal Oscillation, and climate change. Most of these events have been shown to have an effect on the distribution and abundance of some pinniped species, mainly due to the movement or scarcity of their prey (Elorriaga-Verplancken et al., 2016). Therefore, both countries have to work together in the conservation of the four pinniped species discussed herein.

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