RELATIVE ABUNDANCE, SEASONAL OCCURRENCE, AND DISTRIBUTION OF MARINE BIRDS IN THE NORTHERN GULF OF MEXICO

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ABSTRACT

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Marine birds in the U.S. Gulf of Mexico have long been poorly studied. Given statutory obligations to protect migratory birds and endangered species, three broad-scale vessel and aerial programs initiated since 2010 have now surveyed the entire northern Gulf. Vessel coverage alone exceeds 700 d and 74,000 km of observer effort using 300-m strip transects. We supplemented these survey data with earlier, smaller-scale studies, eBird checklists, literature reviews, and other less accessible sources to create snapshot summaries of relative abundance, seasonal occurrence, and regional distribution for 117 taxa of marine and water birds reported from the northern Gulf (113 of which were substantiated with physical evidence). Using taxonomic and functional criteria, we identified 56 taxa characteristic of open shelf, slope, and pelagic waters (federal jurisdiction), 41 taxa with primarily coastal affinities (state and federal jurisdiction), and 20 taxa of sea and diving ducks. High species richness of marine birds in the northern Gulf is attributed to (1) a temperate-to-tropical gradient facilitating diverse marine environments year-round; (2) varied geographic origins of marine bird species using the Gulf; and (3) a mostly enclosed sea basin acting as a vagrant trap for wide-ranging species. Our taxonomic list and status updates seek to bridge information gaps for marine birds now subject to accelerated commercial uses of this region's continental shelf, including newly proposed offshore wind energy development. Other applications include guiding risk and vulnerability assessments of Gulf marine birds, providing core content for seabird observer training, and prioritizing environmental impact reviews and monitoring programs in offshore energy construction and operations plans.

Key words: Gulf of Mexico, marine birds, distribution, relative abundance, seasonality

INTRODUCTION

Despite being one of the most heavily industrialized seas in the world (Mehan & Casey, 2023; Paolo et al., 2024), studies of marine avifauna in the Gulf of Mexico lag significantly behind those for other shelf regions in North America. Outer continental shelf surveys for marine birds had begun in most U.S. and Canadian waters by the 1970s (e.g., Briggs et al., 1987; Brown et al., 1975; Powers, 1983). Except for studies of north-central waters (Duncan & Havard, 1980; Ribic et al., 1997), opportunistic field studies (Davis et al., 2000; Davis & Fargion, 1996), and literature syntheses (Clapp et al., 1982a, 1982b, 1983), no dedicated broad-scale aerial or region-wide vessel surveys were available to characterize the relative abundance, seasonal occurrence, and habitat of marine birds in waters across the entire northern Gulf of Mexico. Until now, not even a complete species list was readily available for this region.

Since the 2010 *Deepwater Horizon* blow-out and oil spill (Deepwater Horizon Natural Resource Damage Assessment Trustees [DHNRDAT], 2016; Harzl & Pickl, 2012), large-scale surveys, including two dedicated programs, were launched to better understand the risks, vulnerabilities, and conservation needs of Gulf seabirds (e.g., Haney et al., 2019; Michael et al., 2022). Synoptic surveys now cover the entire northern Gulf under U.S. jurisdiction, providing unprecedented coverage that enables more accurate assessments of the relative abundance, environmental associations, and habitat use of focal species (e.g., Jodice et al., 2021). Heavy industrialization continues to accelerate in the Gulf, however, with offshore wind energy (Bureau of Ocean Energy Management [BOEM] 2022a, 2022b; Farmer et al., 2023) and aquaculture (Riley et al., 2021; Farmer et al., 2022) recently added to existing high use levels from commercial fishing (Chen, 2017), shipping traffic (e.g., BOEM & National Oceanic and Atmospheric Administration [NOAA], 2024), and extraction plus storage of hydrocarbons (Gallaway et al., 2006; Kaiser & Narra, 2019).

Here, we condense findings from three large-vessel survey programs, and we supplement them with earlier literature reviews, individual ocean-going seabird projects, eBird checklists, and other sources, all with the express purpose of updating the status

of 117 species of open-water marine birds and sea ducks reported from the northern Gulf of Mexico. This abridged compilation is intended to (1) provide updated species occurrence data that can be used to create training materials for new seabird observers in future aerial and vessel survey programs, (2) select focal species for Gulf environmental assessments and impact statements (e.g., Regional Wildlife Science Collaborative for Offshore Wind [RWSC], 2024), and (3) identify research opportunities for profiling the risks and vulnerabilities of seabirds to offshore commercial wind energy development (e.g., Kelsey et al., 2018; Robinson Willmott et al., 2013). These applications include formal environmental reviews of wind energy area designations and leasing permits granted on the Gulf's continental shelf (e.g., BOEM, 2022c).

STUDY AREA AND METHODS

Northern Gulf environment

The Gulf of Mexico is a semi-enclosed, warm-temperate to subtropical marginal sea, with a surface area cover of approximately 1.5 million km^2, a water volume of 2,434 million km^3, and a mean depth of 1,615 m (McKinney et al., 2021). In the U.S. Gulf (i.e., within the U.S. Exclusive Economic Zone [EEZ], extending from shore to 200 nautical miles [370 km]), the continental shelf is broad and shallow off the west coast of Florida, much of Louisiana, and Texas. It narrows substantially at the Mississippi Delta, where two river-incised bathymetric gradients form the Mississippi and DeSoto Canyons (Spies et al., 2016). Over 150 rivers flow into the Gulf, with 85% of this fluvial water originating in the United States, 64% of which comes from the Mississippi River. The Mississippi discharges water from 42% of the lower 48 contiguous states of the U.S. mainland at a rate of ~19,000 m^3·s^{-1} (Wiseman et al., 1997) and carries ~2.4 billion kg of sediment annually (Ellis & Dean, 2012). Except for tropical storms and other severe weather events, the Gulf possesses a low wave-energy and micro-tidal coastline, with average wave height and tidal range of about 0.5 m and < 1 m, respectively (Passeri et al., 2016).

For resource purposes, the outer continental shelf (OCS) of the U.S. northern Gulf is divided into three planning areas (PAs) by the Bureau of Ocean Energy Management (BOEM): Western (WPA), Central (CPA), and Eastern (EPA; Fig. 1). Oil and gas activity is most abundant in the CPA, intermediate in the WPA, and least abundant in the EPA. Each planning area is further differentiated by unique oceanographic features and environmental processes that regulate marine resources and that influence the area's biological productivity.

The WPA contains a coastal, inner-shelf current running upcoast (north) during summer, facilitating coastal upwelling during warmer seasons (Morey et al., 2005). Other currents along the WPA shelf break are more variable, reinforced by anticyclonic Loop Current (LC) eddies from the EPA or CPA. These features collide with

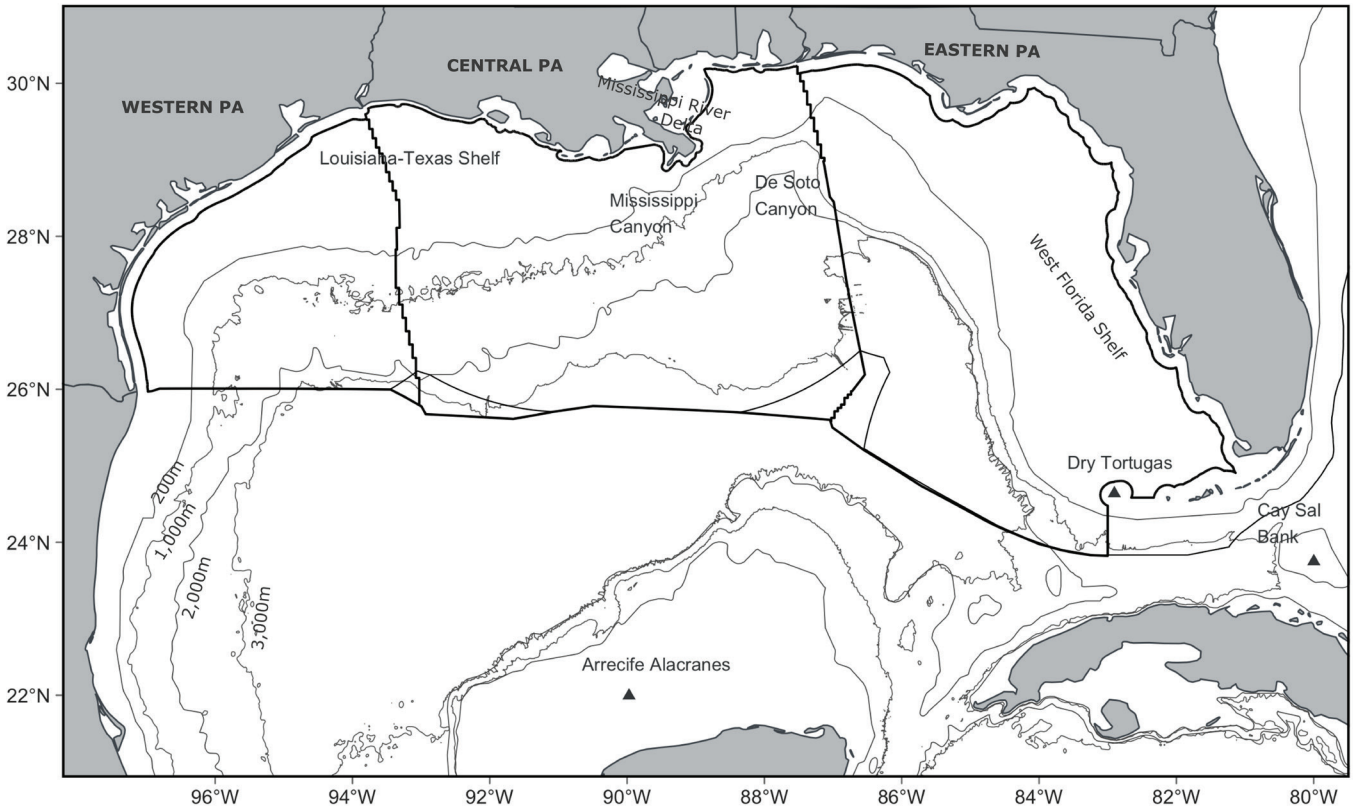

Fig. 1. The northern Gulf of Mexico, with waters under U.S. jurisdiction delimited by the international boundary of the Exclusive Economic Zone and three Bureau of Ocean Management (BOEM) resource Planning Areas (PAs; Western PA, Central PA, and Eastern PA). Principal seabird breeding colonies in the adjacent southern Gulf of Mexico are indicated with triangles at the Arrecifes Alacranes, Mexico; the Dry Tortugas, Florida, USA; and Cay Sal Bank, Bahamas. Gulf bathymetric zones are indicated with thin continuous lines. Maps were created using bathymetry data (NOAA ERD from https://coastwatch.pfeg.noaa.gov, state boundaries from https://www2.census.gov/, manually placed location names, EEZ shapefile from https://www.marineregions.org/downloads.php, global boundaries from the tmap; Tennekes, 2018).

the western Gulf's shelf edge after drifting westward for weeks to several months (Nowlin et al., 2005; Vidal et al., 1992).

Mississippi River discharge dominates the CPA. Along-shore currents are complex, influenced by this freshwater discharge, eddy shedding, and a wind regime dynamic on both regional and seasonal time scales. The Louisiana-Texas (LATEX) Coastal Current (LTCC) distributes freshwater, sediment, and nutrients along the CPA continental shelf from the Delta (Jarosz & Murray, 2005). Typically flowing downcoast (i.e., westward in fall, winter and spring), the LTCC reverses upcoast towards the east during summer. Meso-scale processes in the CPA strongly shape the location, size, and contents of water masses having varied physical properties (turbidity, color, salinity, temperature; Nowlin et al., 2005; Schiller et al., 2011). Coastal squirts (10 to 30 km wide, 200 km long streams of cool water) form southwest of the Delta under strong northeast winds. Narrow, high-velocity coastal jets (> 75 cm·s^{-1}) ultimately spread laterally, forming mushroom-shaped features with counter-rotating vortices that are 75 km wide along the shelf edge (Walker et al., 1996).

Outer shelf and deeper waters in the EPA are dominated by frontal and temporal dynamics of the western boundary LC. Current dynamics include frontal eddies as well as cyclonic and anti-cyclonic rings that separate entirely from the LC (e.g., Oey et al., 2005). In contrast to the WPA, cyclonic eddies (upwelling cold-core rings, CCRs) are most often found in this planning area, with the frequency of CCR occurrence surpassing that of warm-core rings (WCRs) anywhere else in the Gulf of Mexico (Vukovich, 2007). Northward penetration of the LC into the northern Gulf varies over time, as do the current's east-west movements. The latter entrains Mississippi River discharge waters eastward and southward over the continental shelf (Morey et al., 2005; Weisberg & Liu, 2017). Inner shelf circulation in the EPA is predominantly upwelling-favourable over the west Florida shelf in winter (October–April), then down-welling conducive in warmer months (June–September; Liu & Weisberg, 2012).

Habitats and taxa

The geographic domain of this synthesis encompasses the U.S. Gulf coastal plain to ~100 km inland (roughly approximating the post-hurricane depositional zone for displaced marine birds), and all open waters inside the U.S. EEZ (Fig. 1). Outer boundaries to the Gulf basin have been delimited by Felder et al. (2009, p. 6). Open-water habitats used by marine birds in the Gulf are characterized broadly by bathymetry: continental shelf ≤ 200 m, continental slope 200–2,000 m, and pelagic > 2,000 m. Within the shelf zone, we further distinguished potentially overlapping avian habitats defined by distance as near-coast (≤ 10 km from shore; jurisdiction of individual states), and by bathymetry as inner-shelf (0–20 m), middle-shelf (20–60 m), and outer-shelf waters (60–200 m).

Seabird taxa covered in this work include all species that are structurally and functionally capable of interacting directly (e.g., feeding, resting) with open marine waters beyond the intertidal and surf zones. These include diving and sea ducks (Anseriformes); grebes (Podicipediformes); phalaropes, skuas, alcids, gulls, terns, and skimmers (Charadriiformes); tropicbirds (Phaethontiformes); loons (Gaviiformes); shearwaters, petrels and albatross (Procellariiformes); frigatebirds, boobies, and cormorants (Suliformes); and pelicans (Pelecaniformes). As behavior and habitat use of bird species frequenting continental shelf and pelagic waters of the Gulf tend to be idiosyncratic (e.g., Jodice et al., 2021), more detailed biological information about life histories of individual species is described elsewhere (Gleason et al., 2024).

Vessel and aerial surveys

Data from the northern Gulf were gathered during three large-scale survey programs that cumulatively exceeded 700 d and 74,000 km of on-effort coverage (Table 1). For the species-based summary, we used only vessel survey data collected inside the context of spatial boundaries for the three designated PAs (Fig. 1), thereby excluding data from ~100 survey days conducted in extremely shallow (state-jurisdictional) waters, non-U.S. portions of the Gulf, or in the eastern Florida Straits outside of the Gulf proper.

Surveys for detecting post-spill injuries during the *Deepwater Horizon* oil spill Natural Resources Damage Assessment (NRDA Bird Study 6, hereafter NRDA 6) counted seabirds and assessed mortality and visible oiling of birds (not covered in this review) encountered along opportunistic track lines set by other (entirely non-avian) objectives. NRDA 6 (n = 27 cruise legs totaling 285 d) was carried out across the northern Gulf in the U.S. EEZ from July 2010 to July 2011. Methodology relied on 300-m wide strip transects recorded in ≤ 10-min bins (Haney et al., 2019). Spatial coverage was mostly, but not exclusively, over the continental shelf.

Dedicated surveys with standardized, repeated track lines were designed for the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS), a project specifically conceived to model distributions of seabird and other marine predators in the BOEM planning areas. GoMMAPPS (n = 20 multi-day cruises undertaken for 293 d total, with some opportunistic and the majority dedicated) was conducted in the northern Gulf, with data

TABLE 1
Effort metrics and minimum spatial resolutions (in km) employed in several larger-scale vessel survey programs for marine birds in the northern Gulf of Mexico

Program[a]	Years	Survey days	Distance (km)	Resolution (km)
GulfCet I	1992–1994	160	22,600	unknown
GulfCet II	1996–1998	77	10,900	10.0–17.2
NRDA 6	2010–2011	285	16,800	≤ 3
GoMMAPPS	2017–2019	293	39,000	continuous
AMAPPS/VSAD	2021–2024	122	18,200	continuous

[a] Refer to Methods for additional details on methodological similarities and differences among these marine bird survey programs.

entered continuously onto Panasonic™ Toughbook, GPS-equipped laptops using program SEEBIRD (version 4.3.7; Ballance & Force, 2016). Vessel coverage of GoMMAPPS extended from April 2017 to September 2019 using 300-m wide strip transects in 0–100, 100–200, 200–300, and 300+ m recording bins, mostly over deep continental shelf edge, slope, and pelagic waters. We also used GoMMAPPS aerial survey data to supplement details about species composition, relative abundance, and seasonal phenology of marine birds in coastal Gulf waters. GoMMAPPS aerial effort included 1,800 transects (400-m wide, three transects/site, one site = 40 km^2 hexagon grid cluster) covering 72,000 km^2 within 50 km of the Gulf coastline between the Florida Keys and Texas-Mexico border (Davis et al., 2022). Using methodology identical to GoMMAPPS, additional vessel coverage was gathered on repositioning legs for the Atlantic Marine Assessment Program for Protected Species (AMAPPS) during transits to or from Gulf ports, and during both 2023 and 2024 survey seasons of the dedicated Vessel Surveys for Abundance and Distribution (VSAD) program sponsored by the *Deepwater Horizon* Open Ocean Trustee Implementation Group (122 d; Table 1).

Much of the more recent seabird survey data can be accessed at National Centers for Environmental Information (NCEI): https://www.ncei.noaa.gov/archive/accession/0247205, and https://www.ncei.noaa.gov/archive/accession/0247206, and at DOI https://doi.org/10.25921/vyg0-tv44, and https://doi.org/10.25921/afrq-h385. Additional details about survey methodology and protocols, as well as the ancillary meta-data collected, are described elsewhere (Haney et al., 2019; Jodice et al., 2021; Michael et al., 2022, 2023).

Historical sources

Newer survey data for Gulf marine birds were integrated with historical studies and reviews available before 2010, including three large, taxa-based volumes that synthesized marine birds for waters of the entire southeastern U.S. (Clapp et al., 1982a, 1982b, 1983). Despite being several decades old, those compilations included all taxa categories treated in the present work, and clearly delineated Gulf from Atlantic status for each marine bird species. Products available from the eBird online platform were also consulted for species reported from the Gulf, including maps, incidental, and regular checklists. Reports for marine birds found dead during and after the *Deepwater Horizon* blow-out and spill (e.g., Haney et al., 2014, supplement; Industrial Economics, Inc. [IEI], 2015) were consulted as an additional check on coverage for all potential species found in the Gulf. Species were deemed to have adequate substantiation in the Gulf if voucher specimens and/or photographs in the public domain (e.g., on eBird, museum records) were available for independent verification. "Sight report" was used to designate notable reports not having such physical substantiation.

Earlier aerial surveys for Gulf marine birds were also reviewed, including Fritts & Reynolds (1981; one survey in August, November only), Fritts et al. (1983; one survey each in February, April, June, August, October, December only), and Keller et al. (1984). The spatially incomplete nature of Gulf coverage in the first two aerial survey programs is depicted in Fig. 2.7 of Davis & Fargion (1996, p. 24). Opportunistic vessel programs for birds include Hoffman et al. (1981), Davis & Fargion (1995; GulfCet I program), and Davis et al. (2000a, 2000b, 2000c; GulfCet II program). Study areas for these earlier vessel surveys were more restricted than the entire U.S. northern Gulf (e.g., Fargion & Davis, 1994; Fritts et al., 1983; Ribic et al., 1997). Some earlier Gulf surveys lacked dedicated seabird observers, so data were gathered incidentally, even across cruise legs within a given survey program (Davis et al., 2000a). Despite inconsistent survey methodology within projects (Davis et al., 2000b, pp. 275–276), variable spatial scales to survey methodology (Table 1), and exclusion of some marine bird taxa (Duncan & Havard, 1980)—which confound derivation of Gulf-wide patterns of relative abundance—all historical sources were useful for filling gaps in seasonal phenologies and cross-shelf distributions, especially for the more common species.

Imperilment status, seasonal occurrence, and relative abundance

For marine and water bird species, we provide a global, national, and Gulf-regional imperilment status (if any) with each species account. Global imperilment status was based on criteria of the International Union for Conservation of Nature (IUCN) and BirdLife International (BirdLife International, 2024) and is reported for every species. If warranted, imperilment status under the U.S. Endangered Species Act (ESA) of 1973 was designated as: LT = Listed Threatened, LE = Listed Endangered, PT = Proposed Threatened, PE = Proposed Endangered, or Candidate = CA. Species designated as U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern were denoted by the USFWS as BCC. Species were also identified as endangered, threatened, or BCC by individual Gulf states (Burger, 2017; USFWS, 2021). Species of Greatest Conservation Need (SGCN), as designated via the five Gulf state wildlife action plans, are listed in Appendix 1, Table A3 (available on the website).

Based on annual likelihood of its detection Gulf-wide, and considering sources that were not standardized by effort, the non-breeding relative abundance for each species characteristic of open waters was denoted by five temporal frequency categories: common (seen annually with high probability [≥ 75%] in appropriate marine habitat and season), uncommon (seen annually with medium probability [25%–74%] in appropriate marine habitat and season), rare (seen annually with low probability [< 25%] in appropriate marine habitat and season), casual (5–10 reports per decade Gulf-wide, or 1–2 reports per decade since ~1980), and accidental (< 5 reports per decade Gulf-wide, or less than one record per decade since ~1980). An additional index was used for seabirds expected in open water habitats of the Gulf of Mexico, based on the likelihood of daily detection (if available) using standardized methods in aerial or large vessel surveys conducted since 2010. The detection likelihood was categorized as follows: regularly observed (observed ≥ 50% days in appropriate habitat and season), occasionally observed (observed < 50% days in appropriate habitat and season), approximate or exact number of detections indicated, or undetected. For species that may flock or aggregate into larger group sizes, we indicate notable maximum counts when applicable. Quarterly seasons were defined as: winter (December–February), spring (March–May), summer (June–August), and fall (September–November).

RESULTS

OVERVIEW

Standardized coverage exceeded 100 total survey days in each of the three northern Gulf PAs (Fig. 1), with the highest temporal coverage in the CPA (336 d), followed by the EPA (245 d) and WPA (136 d). Seasonal coverage also varied across the three PAs: winter

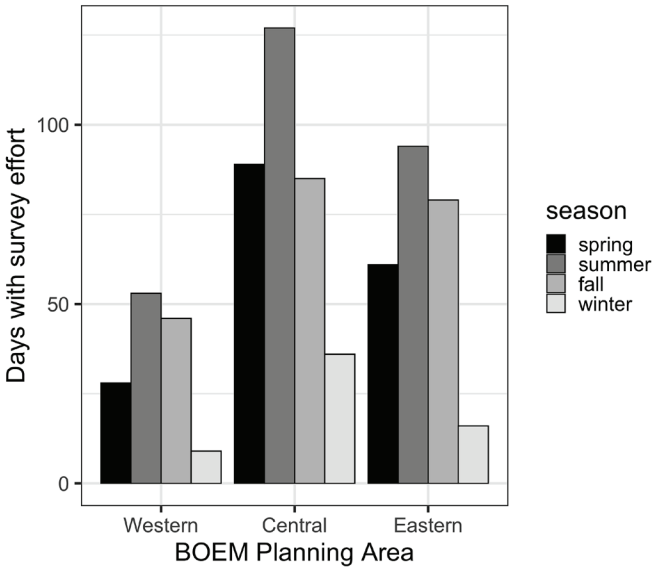

Fig. 2. Allocation of vessel survey effort by season across the three Bureau of Ocean Management (BOEM) Planning Areas (Western, Central, and Eastern) in the northern Gulf of Mexico, USA. Vessel effort includes coverage from three projects: *Deepwater Horizon* oil spill Natural Resources Damage Assessment Bird Study 6 (NRDA 6), Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS), and partial (Gulf-only) Vessel Surveys for Abundance and Distribution/Atlantic Marine Assessment Program for Protected Species (VSAD/AMAPPS) (refer to text). Seasons were defined as winter (December–February), spring (March–May), summer (June–August), and fall (September–November).

was comparatively less well-surveyed by vessels than other seasons (Fig. 2). Summer and fall received the greatest seasonal coverage in each PA. Geographic coverage was generally near-synoptic when combined over all three survey programs (Fig. 3), although some notable spatial gaps remain on the west Florida shelf during winter and spring.

Our synthesis identified 117 species of marine, coastal, and other aquatic bird species reported from the U.S. portion of the northern Gulf of Mexico (taxonomy and standard species order follow Chesser et al., 2024, and IOC World Bird List [14.2]). Reports of four taxa (Indian Yellow-nosed Albatross *Thalassarche carteri*, Black-bellied Storm Petrel *Fregetta tropica*, Fea's Petrel *Pterodroma feae*, Red-legged Cormorant *Poikilocarbo gaimardi*) currently lack adequate physical documentation, so their status here is considered unresolved (these are subsequently denoted with "?" before and "[]" surrounding the species name). We identified 56 taxa characteristic of waters overlying the continental shelf, continental slope, and pelagic zones, i.e., waters that fall solely under U.S. federal jurisdiction (Outer Continental Shelf Lands Act, 1953). In addition, we identified 41 species that typically occur near the shoreline in state waters. Lastly, we found 20 taxa of sea and diving ducks reported from the U.S. Gulf region.

The WPA and EPA were more species-rich than the CPA (Table 2), with each reporting a greater proportion of the total number of species found in the entire northern Gulf (85%–86% vs. 74% in the CPA). This pattern was consistent across categories of species examined. For species typically occurring in the Gulf every year, just 25–31 species comprised taxa most characteristic of shelf, slope, and pelagic waters in each of the BOEM PAs (Table 3).

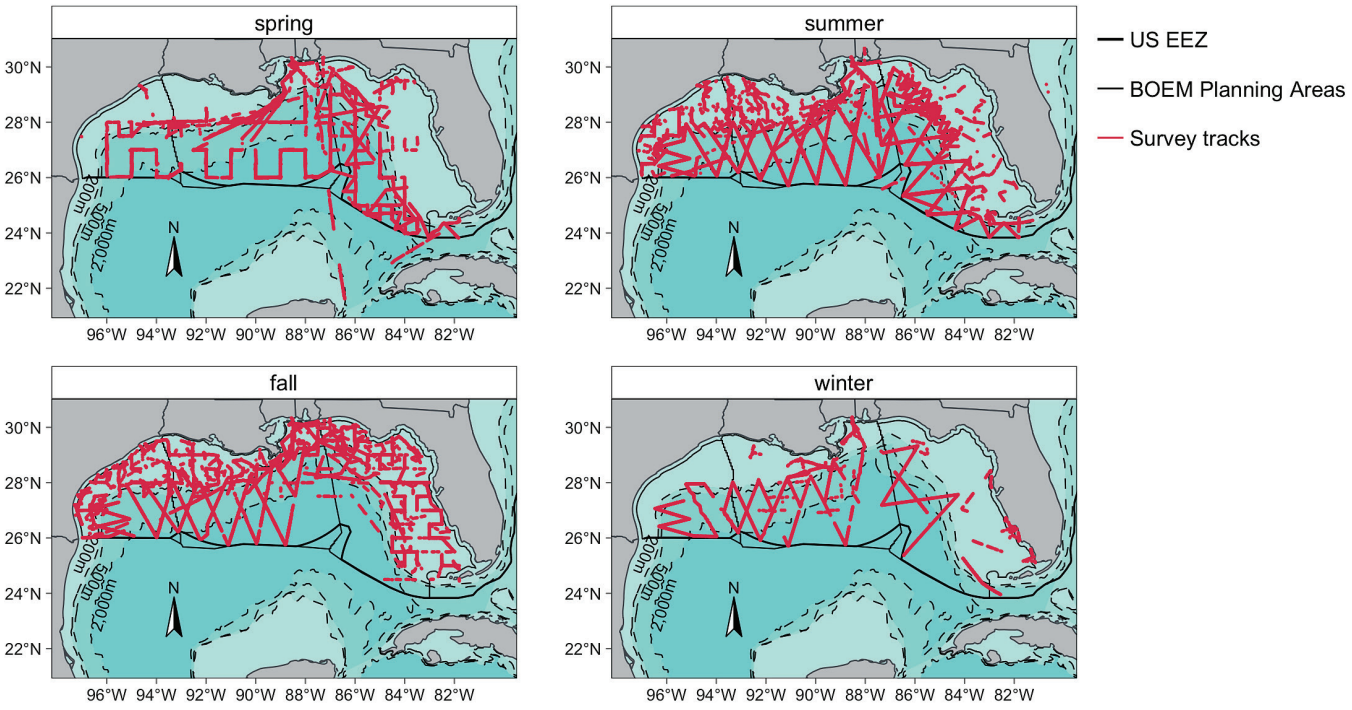

Fig. 3. Geographic vessel survey effort by season across three Bureau of Ocean Energy Management (BOEM) planning areas in the northern Gulf of Mexico, USA. Seasons were defined as winter (December–February), spring (March–May), summer (June–August), and fall (September–November). Maps were created using bathymetry data (NOAA ERD from https://coastwatch.pfeg.noaa.gov, state boundaries from https://www2.census.gov/, manually placed location names, EEZ shapefile from https://www.marineregions.org/downloads.php, global boundaries from the tmap; Tennekes, 2018).

TABLE 2
Vessel survey effort and species richness of marine birds varied longitudinally by Bureau of Ocean Management Planning Area (PA) in the northern Gulf of Mexico

Survey variable	Western PA	Central PA	Eastern PA
Total vessel survey-days	136	336	245
Number marine bird species	48	42	47
Additional coastal bird species	33	27	35
Number diving/sea duck species	20	17	18
Total species richness	101	86	100

TABLE 3
Number of marine bird species that typically occur annually within each Bureau of Ocean Management Planning Area (PA) in the northern Gulf of Mexico

Relative abundance[a]	Western PA	Central PA	Eastern PA
Rare (< 25%)	7	5	9
Uncommon (25%–74%)	5	6	7
Common (≥ 75%)	15	14	15
Total species expected annually	27	25	31

[a] Likelihood of being detected each year within suitable Gulf habitats and seasons. If relative abundance varied seasonally, a species was categorized by the highest relative abundance in any one season.

Several individual species with widespread distributions exhibit distinct patterns of relative abundance across the PAs (Table 4). Sooty Tern *Onychoprion fuscatus*, Bridled Tern *O. anaethetus*, and Sargasso Shearwater *Puffinus lherminieri* were more abundant in the EPA. Atlantic Brown Booby *Sula l. leucogaster* was slightly more abundant in the WPA. The relative abundance of Cory's Shearwater *Calonectris borealis* was relatively even across the PAs, though it was slightly more abundant in the WPA. Similarly, Magnificent Frigatebird *Fregata magnificens* was distributed evenly across the PAs, with one metric of its abundance (percent of survey days detected) being highest in the CPA.

Species accounts

Red-necked Phalarope *Phalaropus lobatus*. IUCN: Least Concern. Rare fall (August–October, with local peaks ≥ 35 birds) and casual spring migrant visitor (April–May) to shelf, near-coast, sounds, and bay waters of each PA (eBird; Clapp et al., 1983). Accidental visitor in mid-summer (June–July) and late fall through early spring (November–March). Status is enigmatic due to gaps in seasonal or geographic coverage, although GulfCet surveys indicate large wintering populations are unlikely in the WPA and CPA (Davis & Fargion, 1996, p. 300). Occasionally detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Red Phalarope *Phalaropus fulicarius*. IUCN: Least Concern. Accidental visitor to shelf waters, sounds, and bays of each PA (eBird). Scattered reports of singles or small groups (≤ six birds), but too sparse to confirm seasonal phenology Gulf-wide. Historical accounts suggest it is an uncommon winter resident in shelf waters

TABLE 4
Cumulative numbers of selected marine birds detected during large vessel surveys, with effort-adjusted relative abundance (birds/survey day and percentage of survey days detected) compared across three Bureau of Ocean Management Planning Areas (PAs) in the northern Gulf of Mexico

Species	Western PA	Central PA	Eastern PA
Sooty Tern *Onychoprion fuscatus*	898	1,525	8,442
Number/survey day	7.13	4.98	**37.86**[a]
Percent survey days	15.08	15.36	36.32
Bridled Tern *Onychoprion anaethetus*	173	320	450
Number/survey day	1.37	1.05	2.02
Percent survey days	22.22	18.95	30.04
Cory's Shearwater *Calonectris borealis*	56	88	84
Number/survey day	0.44	0.29	0.38
Percent survey days	13.49	11.76	12.11
Sargasso Shearwater *Puffinus lherminieri*	234	387	2039
Number/survey day	1.86	1.26	9.14
Percent survey days	23.02	17.97	36.32
Atlantic Brown Booby *Sula l. leucogaster*	138	162	164
Number/survey day	1.10	0.53	0.74
Percent survey days	34.92	25.82	30.49
Magnificent Frigatebird *Fregata magnificens*	266	444	304
Number/survey day	2.11	1.45	1.36
Percent survey days	15.08	22.22	18.38

[a] Bold-faced values indicate the maximum values for that metric of effort-adjusted relative abundance for the species across the three BOEM planning areas.

of EPA: 30–300 birds daily off Florida (FL) panhandle, mostly > 45 km from shore (range: 8–80 km), late fall through early spring (13 October–11 April 1948–1953; Newman, 1954; Weston, 1953). Occasionally detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

South Polar Skua *Stercorarius maccormicki*. IUCN: Least Concern. Accidental late spring and fall visitor in each PA (eBird). Two reports in Texas (TX) shelf and slope waters (WPA): 01 October 2004 and 15 October 2017 (Hodne, 2022a). One photo report 38–53 km southeast of South Pass, Plaquemines Parish, Louisiana (LA; CPA): 17 August 2024 (Newfield, 2024). Two reports from FL (EPA): Marco Island Beach, Collier County, 27 August–01 Sept 2017, and along Alabama (AL) beaches and FL panhandle from Gulf Shores, AL to St Andrews State Park, FL, 31 July–09 September 2020. Detected twice (sight reports) on Gulf vessel surveys (one in CPA, 28 May 2017, 28.005°, -88.679°, GoMMAPPS; one in EPA, 18 November 2010, 26.251°, -82.233°, NRDA 6).

Pomarine Jaeger *Stercorarius pomarinus*. IUCN: Least Concern. Uncommon shelf-slope fall visitor and winter resident throughout each PA (October–May), but less common in spring, and rare or casual from June to September. Among the most widespread marine birds during winter in pelagic waters yet found also in near coast to outer continental shelf waters. Typically observed solo or in small groups, but flocks of 80–100 occur during migratory movements and in mid-winter (eBird; e.g., Davis & Fargion, 1996, p. 301; Kent, 2014). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Parasitic Jaeger *Stercorarius parasiticus*. IUCN: Least Concern. Rare late fall (October–November) visitor, uncommon winter resident (December–March), and casual spring visitor (April–May) throughout each PA. Casual to accidental visitor in warmer months (June–September). Most prevalent over continental shelf, and usually less pelagic than Pomarine Jaeger. Frequently attends trawlers. Typically solo, but groups of two to six sometimes observed during coastal movements and storms. Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Long-tailed Jaeger *Stercorarius longicaudus*. IUCN: Least Concern. Casual visitor during fall (13 August–28 November) in each PA. Accidental visitor in early winter (01 December) in WPA, and in spring (28 April–29 May) in EPA and CPA. May be overlooked or under-reported due to similarities with Parasitic Jaeger. Typically occurs in shelf waters, but like other jaegers, sometimes occurs at shore or well inland. Detected at least three times on Gulf vessel surveys (05 May 2011, 24.995°, -84.323°; 09 May 2011, 29.919°, -86.934°; 24 August 2018, 26.936°, -86.076°; NRDA 6, GoMMAPPS).

Little Auk *Alle alle*. IUCN: Least Concern. Accidental vagrant in the EPA (Bay County, FL, 06 December 1939, specimen; Stevenson, 1950). A possible second report (undated) from Wakulla County, FL (https://specifyportal.floridamuseum.ufl.edu/birds/). Not detected on Gulf aerial or vessel surveys.

Razorbill *Alca torda*. IUCN: Least Concern. Accidental irruptive winter visitor (photos, specimens). Reports in EPA from April 1976, Franklin County, FL; May 1979, Santa Rosa County, FL (both Duncan & Havard, 1980); and 13 April 2005, Dunedin Causeway, Pinellas County, FL (Kratter & Small, 2007; https://specifyportal.floridamuseum.ufl.edu/birds/). Widespread irruption into the Gulf, 08 December 2012 to 27 April 2013, with multiple reports (some with > 30 birds) in southwest FL and Florida Keys (EPA), smaller, sparser numbers ranging north and west to Cameron Parish, Louisiana (LA) in the CPA, and to near Flower Gardens Bank, TX in WPA (includes some MS and AL eBird reports). Additional reports from Wakulla and Manatee Counties, FL, 23 December 2013 to 14 January 2014. Usually near land, but also in shelf waters, e.g. ~10 km west of Clearwater Pass, Pinellas County, FL (Smith, 2012) to > 140 km from shore near Flower Gardens Bank, TX (https://www.texasbirdrecordscommittee.org/home/report-archives/2013-annual-report). Not detected on Gulf aerial or vessel surveys.

Long-billed Murrelet *Brachyramphus perdix*. IUCN: Near Threatened. Accidental vagrant (e.g., Sealy & Carter, 2012) in northern Gulf. Four reports with photos and specimens in EPA: 26–27 December 1986, Honeymoon Island, Pinellas County, FL (FOS 1990); 04 December 1993, University of Central Florida #2081, Fort DeSoto, Pinellas County, FL (Muschlitz, 1995); 16–28 March 1994, Cedar Key, Levy County, FL (Greer, 1994); 28 November 1994, University of Florida #39297, St. Petersburg, Pinellas County, FL (Bowman, 2006). One hypothetical report from CPA (13 April 2005, Grand Terre, Jefferson Parish, LA; Anonymous, 2024). Not detected on Gulf aerial or vessel surveys.

Ancient Murrelet *Synthliboramphus antiquus*. IUCN: Least Concern. USFWS: BCC. Accidental vagrant in northern Gulf; one report from CPA. Specimen from LA coastal plain, Lake Pontchartrain, Orleans Parish, 06 May 1954 (Lowery, 1974). Not detected on Gulf aerial or vessel surveys.

Black-legged Kittiwake *Rissa tridactyla*. IUCN: Vulnerable. Casual visitor during winter and early spring in all PAs (December–April). Accidental visitor in late spring, summer, and fall. Usually along coastal plains, shorelines, and near-coast waters; some reports ≥ 35 km from shore (eBird). Not detected on Gulf aerial or vessel surveys.

Sabine's Gull *Xema sabini*. IUCN: Least Concern. Rare (WPA) to accidental (CPA and EPA) migrant visitor to northern Gulf during fall (August–November). Accidental visitor in other seasons. Normally reported along coastal plains, shorelines, and near-coast waters, but also encountered in shelf waters out to ≥ 120 km from shore (eBird; Hodne, 2022b). Not detected on Gulf aerial or vessel surveys.

Bonaparte's Gull *Chroicocephalus philadelphia*. IUCN: Least Concern. Common winter resident (October–May) in each PA, accidental visitor in other seasons, usually found along coastal plains, shorelines, and near-coast waters. Aggregates > 60 km offshore over inner- and mid-shelf waters during winter (Clapp et al., 1983), especially off panhandle FL. Occasionally detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Laughing Gull *Leucophaeus atricilla*. IUCN: Least Concern. Common breeder and permanent resident throughout entire northern Gulf in each PA. Highest numbers along coastal plains, shorelines, sounds, bays, estuaries, and near-coast and inner-shelf waters, but small groups and solo birds occur at low density anywhere over the shelf and occasionally in pelagic waters of the Gulf (e.g., southern border of the U.S. EEZ). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Herring Gull *Larus argentatus*. IUCN: Least Concern. Common fall, winter, and spring visitor across entire northern Gulf in each PA. Uncommon nearshore, and an accidental visitor in outer shelf waters during summer, when it is a rare and highly localized breeder along the coast (Fontenot et al., 2012, p. 13). In winter, usually occurs along coastal plains, shorelines, and over near-coast and inner-shelf waters, but also highly pelagic in deep waters of the Gulf. Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Brown Noddy *Anous stolidus*. IUCN: Least Concern. Breeds only in EPA at Dry Tortugas, FL (05 February–07 November); casual visitor to CPA (19 May–26 September, including storm-driven strays); rare visitor in late spring to fall in WPA (21 May–25 October). Total Gulf breeding population ~6,500 pairs (Dry Tortugas and Campeche Bank colonies; Morales-Vera et al., 2017; Riska, 1984). Apparently absent mid-winter throughout northern Gulf. Uncommon over shelf waters (*cf*. Surman & Wooler, 2003), and rare in northern Gulf far from southernmost portion of EPA. Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Black Noddy *Anous minutus*. IUCN: Least Concern. Accidental spring visitor in Western PA (four reports; Hodne, 2022c); casual spring and summer visitor (30 March–16 August) in EPA, where one to three birds occur locally but regularly with Brown Noddy at Dry Tortugas, FL. Unreported from CPA. Not detected on Gulf aerial or vessel surveys.

Sooty Tern *Onychoprion fuscatus*. IUCN: Least Concern. Common breeder in southern Gulf at the Dry Tortugas and Campeche Bank atolls, localized breeder (a few pairs) scattered along northern Gulf coastlines (e.g., Murphy, 2009), and common widespread early spring to early fall visitor (March–September) throughout entire northern Gulf in each PA. Gulf breeding population ≥ 180,000 pairs (almost all on Dry Tortugas and Campeche Bank atolls; Huang et al., 2017; Morales-Vera et al., 2017). Accidental or casual visitor October to January, during which time the majority depart Gulf. Most abundant in outer shelf, slope, and pelagic zones; sometimes present over near-coast and middle-shelf waters. Daily maxima in waters over the shelf can reach 100 (WPA; eBird) to 300–500 birds (EPA; GoMMAPPS, VSAD). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Bridled Tern *Onychoprion anaethetus.* IUCN: Least Concern. Uncommon widespread spring to fall visitor (May–early November) throughout entire northern Gulf in each PA. Accidental (CPA and WPA) to casual (EPA) visitor in other months. Mostly occurs from middle shelf to slope and in pelagic waters. Usually solo, in pairs, or small groups near *Sargassum* or perched on flotsam; however, daily counts can reach maxima of 75–100 (e.g., GoMMAPPS; Whitbeck, 1997). Up to ~240 pairs present during breeding season on Islas Desterrada, Muertos, Perez, and Blanca (Arrecifes Alacranes, Campeche Bank; eBird); Cay Sal Bank, Bahamas, hosts ~1,200 pairs (Mackin et al., 2015). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Black Tern *Chlidonias niger*. IUCN: Least Concern. USFWS: BCC. Common non-breeding visitor in warmer seasons (April–early November) to entire northern Gulf in each PA; casual in winter (December–March). Aggregates along coastal plain, beaches, estuaries, bays, near-coast and inner-shelf waters. Regularly occurs in small numbers in outer shelf, slope, and pelagic waters when joining mixed-species tern flocks or associated with *Sargassum*. Large concentrations occur along lower Texas coast (Laguna Madre, Matagorda Bay) and near Mississippi River outflow (Michael et al., 2024). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Roseate Tern *Sterna dougallii*. IUCN: Least Concern. ESA: LT. Uncommon and very local breeder (25 February–07 October) in southeastern Gulf at Florida Keys, EPA (150–300 pairs; Zambrano et al., 2000). Accidental to casual in WPA and CPA, with reports from all months (Clapp et al., 1983; Duncan & Havard, 1980; Hodne, 2022d). Restricted Gulf marine range; absent in shelf waters except in Florida Straits and relatively shallow waters north and northeast of outer Keys to latitude of Fort Myers, FL (e.g., eBird). Occasionally detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Common Tern *Sterna hirundo*. IUCN: Least Concern. USFWS: BCC. Common winter resident, and spring and fall migrant visitor, to WPA and EPA (rare in CPA; eBird); uncommon in June–July, and very local, rare breeder in CPA (~30 pairs coastal LA; Remsen et al., 2019). Typically uses near-coast and inner-shelf habitats, but during migratory movements can form mono- or multi-specific flocks in waters over outer shelf and deeper waters. Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Arctic Tern *Sterna paradisaea*. IUCN: Least Concern. Accidental or casual migrant visitor (April–October) in each PA, generally solo birds, but two birds reported twice (21 June 1988, Cameron Parish, LA, and 30 July 2016, Lee County, FL; eBird). Most Gulf reports involve coastal sites, but some occur in outer shelf and slope waters (e.g., one at 27.40°, -87.40° on 12 August 1997; Davis et al., 2000c, p. 185). Habitually occurs well offshore during migratory movements. Not detected on Gulf aerial and vessel surveys.

Royal Tern *Thalasseus maximus*. IUCN: Least Concern. Common breeder and permanent resident throughout entire northern Gulf in each PA. Highest numbers over near-coast and inner-shelf waters (Rolland et al., 2020). Solo birds and pairs occur out to middle- and outer-shelf waters, although this strong-flying species occurs throughout all regions of the Gulf. Sometimes seen in "hundreds" > 120 km from land, e.g., off west FL (Clapp et al., 1983. p. 402). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Sandwich Tern *Thalasseus sandvicensis*. IUCN: Least Concern. USFWS: BCC. Common breeder and permanent resident throughout entire northern Gulf in each PA. Highest numbers in near-coast and inner-shelf waters, although solo birds occur at low density in middle- and outer-shelf waters, especially in mixed-species foraging flocks. Reported in the "hundreds" > 120 km from land, e.g., off west FL (Clapp et al., 1983, p. 402). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

White-tailed Tropicbird *Phaethon lepturus*. IUCN: Least Concern. USFWS: BCC. Accidental visitor in WPA (03 July 2010, Padre Island National Seashore; Hodne, 2022e), with additional reports (~13 from Clapp et al., 1982a alone) insufficiently distinguished from *P. aethereus* (e.g., Fargion & Davis, 1994, p. 300; Schallmann, 2022). Accidental visitor in CPA, a specimen retrieved during *Deepwater Horizon* oil spill along beach at Fort Morgan, AL (30.22453°,

-88.01585°); other CPA reports lack photographic support (e.g., Anonymous, 2024). Casual to rare in EPA near Dry Tortugas in spring and early summer (06 April–19 June), with near-coast reports from Pinellas County, FL, 31 August 1977, and Collier County, 25 August 2012 (eBird), and Lee County, FL (https://specifyportal.floridamuseum.ufl.edu/birds/). Detected more than seven times on Gulf vessel surveys: 10 August 2017, 27.546°, -88.452°; 18 July 2024, 26.121°, -87.478° (each in CPA); 26 September 2010, 25.906°, -84.000°; 15 August 2018, 24.888°, -84.089°; 19 August 2018, 25.364°, -86.201°; 07 June 2024, 26.571°, -84.668°; 08 June 2024, 25.661°, -84.662° (all in EPA; NRDA 6, GoMMAPPS, VSAD). Status not well-resolved in the Gulf.

Red-billed Tropicbird *Phaethon aethereus*. IUCN: Least Concern. USFWS: BCC. Rare spring through fall visitor (11 March–25 October) in each PA. The "expected" tropicbird in most of the northern Gulf. Solo birds can occur over outer shelf (Velarde et al., 2014), as well as in pelagic waters. Occasionally detected on Gulf vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Common Loon *Gavia immer*. IUCN: Least Concern. Common winter resident in all PAs (October–May). Casual to rare during summer. Widespread in near-coast waters but occasionally detected on inner- and middle-shelf out to depths of ~40–50 m and ≥ 100 km from shore (Jodice, 1993; Kenow et al., 2023, NRDA 6, GoMMAPPS). Aggregations of up to 600 birds 17 km off Mississippi (MS) coast (Long & Paruk, 2014). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Atlantic Yellow-nosed Albatross *Thalassarche chlororhynchos*. IUCN: Endangered. Accidental in northern Gulf. In WPA (all TX; Hodne, 2022f), reports from Port Isabel, Cameron County (14 May 1972); Brownsville, Cameron County (06 February 1977; Arvin, 1977); South Padre Island, Cameron County (28 October 1976); San Jose Island, Aransas County (11 July 1997); and outer-shelf waters east of South Padre Island (26 September 2003; but see next entry). In CPA (LA), photographed off Holly Beach, Cameron Parish (09 May 1970; http://www.losbird.org/lbrc/ynal.html). In EPA (FL), reports from St. Marks Light, Wakulla County (03 July 1983; Hoffman, 1994); off Tarpon Springs, Pinellas County (01 May 2000); and off Clearwater Pass, Pinellas County (09 November 2014). Not detected on Gulf aerial or vessel surveys.

?[Indian Yellow-nosed Albatross *Thalassarche carteri*]. IUCN: Endangered. Not substantiated in Gulf; attribution of a Texas report to this species at South Padre Island (28 October 1976; Hodne, 2022f) lacks support. Not verified as straying into North Atlantic; accidental even in South Atlantic (e.g., eBird).

Wilson's Storm-Petrel *Oceanites oceanicus*. IUCN: Least Concern. Rare visitor (04 April–15 November) to EPA and CPA (west to about -91.5º). Accidental in WPA (11 June 2015, Hodne, 2022g; 16 and 18 August 2017, GoMMAPPS). A few winter-early spring reports (December–March) from FL Keys region (eBird). Dispersed at low density over shelf, slope, and pelagic habitats, with counts reaching daily maxima of 25–30 birds (e.g., Clapp et al., 1982a; VSAD). Sometimes nearer to shore, especially off Mississippi Delta and north of Keys on southwest FL shelf. Gulf status remains enigmatic: reports prior to 2000 generally failed to differentiate clearly from Band-rumped Storm-Petrel *Hydrobates castro*. Occasionally detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

?[Black-bellied Storm Petrel *Fregetta tropica*]. IUCN: Least Concern. Unsubstantiated in Gulf. A report of seven birds in EPA allegedly caught on hook-and-line in waters off St. Marks, FL, circa 1851, with a specimen to Philadelphia Academy of Sciences (later lost). Report remains uncertain regarding identity and locality (Banks et al., 2006; Guris et al., 2004). During 2004–2010, however, at least four reports occurred elsewhere in southeastern U.S. (off NC, 31 May–14 August; eBird). Not detected on Gulf aerial or vessel surveys.

Leach's Storm Petrel *Hydrobates leucorhous*. IUCN: Vulnerable. Rare visitor to shelf, slope and pelagic waters throughout northern Gulf (all PAs; 5 March–8 October). Individuals observed in winter may be non-breeders of this species (GoMMAPPS; Fargion & Davis, 1994). Dispersed at low density over outer shelf, slope, and pelagic waters, with daily maximum counts sometimes of 60+ birds (Hodne, 2022h). Occasionally detected on Gulf vessel surveys.

Band-rumped Storm Petrel *Hydrobates castro*. IUCN: Least Concern. USFWS: BCC. Uncommon to common visitor throughout northern Gulf (all PAs; 05 March–13 December). Storm petrels observed in winter may be non-breeders of this species (Fargion & Davis, 1994; GoMMAPPs). Dispersed at low density over outer shelf, slope, and pelagic habitats, with daily counts sometimes reaching 70–100 birds (Hodne, 2022i; GoMMAPPS). Because long-distance trans-Atlantic movement in Monteiro's Storm Petrel *Hydrobates monteiroi* is undocumented (Bolton et al., 2008; Neves et al., 2023), birds of this group are likely "Grant's" cool-season breeding form of *castro* (Azores, Berlengas, Canary, Salvage Islands; Woolfenden et al., 2001). Regularly detected during Gulf vessel surveys.

Trindade Petrel *Pterodroma arminjoniana*. IUCN: Vulnerable. Accidental in northern Gulf. One photo report from WPA, at the Port Aransas Jetty in near-coast waters, Nueces County, TX, 22 February 2022 (Cantrell, 2022). Reported once on Gulf vessel surveys (sight report) in the EPA off west FL (14 September 2019, 26.317°, -83.001°, at about the time that Hurricane Humberto was developing off east FL).

Black-capped Petrel *Pterodroma hasitata*. IUCN: Endangered. ESA: LE. USFWS: BCC. Rare to casual visitor (04 February–16 September) in waters of EPA and CPA, respectively (GoMMAPPS); accidental visitor in WPA (28 May–05 November; Hodne, 2022j). Likely year-round visitor to Gulf. Breeding origin(s) remain(s) unclear (Jodice et al., 2015, 2021). Primarily at LC edge and associated waters eastward of -91.5°. Dispersed at very low density over outer shelf, slope, and pelagic habitats, with maximum daily counts of two to three birds (NRDA 6, GoMMAPPS). Regularly detected locally (eastern Gulf) during large-scale vessel surveys.

?[Fea's Petrel *Pterodroma feae*]. IUCN: Near Threatened. USFWS: BCC. Accidental; unsubstantiated in the northern Gulf. Three sight-only reports (all GoMMAPPS), two from EPA (23 July 2017, 27.341°, -86.070°; 24 July 2017, 28.299°, -86.705°), and one from CPA (29 May 2017; 28.487°, -89.418°); all in outer shelf, slope, or pelagic waters. EPA birds in mixed-species foraging flocks (Pomarine Jaeger, Sooty Tern, Sargasso Shearwater, Magnificent Frigatebird); CPA bird was solo, flushed sitting very near ship bow (GoMMAPPS). Detected three times on large-scale Gulf vessel surveys.

Stejneger's Petrel *Pterodroma longirostris*. IUCN: Vulnerable. Accidental in northern Gulf: one report from WPA. Desiccated

specimen and photos of a bird found on the beach along TX coastal plain, Mustang Island (near Corpus Christi), Nueces County, TX, 15 September 1995 (TBRC Accepted Records, 1995). Not detected on Gulf aerial or vessel surveys.

Bulwer's Petrel *Bulweria bulwerii*. IUCN: Least Concern. Accidental in the EPA. A sight report 14 May 1969, Rebecca Passage, between Marquesas Keys and the Dry Tortugas, FL (Clapp et al., 1982a; Taylor, 1972), and a bird photographed 31 August 2021, Pensacola Beach, Escambia County, FL, after passage of Hurricane Ida (Duncan & Kaufmann, 2022; see also UFN 54794 at https://specifyportal.floridamuseum.ufl.edu/birds/). Also reported (photographed) just outside the southern Gulf near the Yucatan Channel (Chacón, 2017). Not detected on Gulf aerial or vessel surveys.

White-chinned Petrel *Procellaria aequinoctialis*. IUCN: Vulnerable. Accidental in northern Gulf; one report from WPA. One floundering in the surf on 27 April 1986 near Rollover Pass, Galveston County, TX (Hodne, 2022k). Photographed alive but died later during rehabilitation (Pranty et al., 2008). Not detected on Gulf aerial or vessel surveys.

Cory's Shearwater *Calonectris borealis*. IUCN: Least Concern. USFWS: BCC. Uncommon late-spring, summer, and fall visitor to each PA (May–November). Casual to rare during winter and spring in EPA (December–April). Occurs, at times, in near-coast and inner-shelf waters, most typically within ~50 km of shore (Pulich, 1982), in outer shelf, slope, and pelagic zones. Dispersed in low numbers, inexplicably absent from suitable habitat during peak season, yet daily highs reach ~100–200 locally in the WPA (Hodne, 2022l; Hofmann et al., 1981). Occasionally attends fishing vessels (NRDA 6), at least in WPA. Regularly detected on Gulf vessel surveys (NRDA 6, GoMMAPPS, VSAD; also see next).

Scopoli's Shearwater *Calonectris diomedea*. IUCN: Least Concern. USFWS: BCC. Verified with photographs in each PA (e.g., eBird, GoMMAPPS, VSAD), although any differences in habitats, distribution, or seasonal occurrence between the *Calonectris* species in the Gulf of Mexico require further evaluation.

Wedge-tailed Shearwater *Ardenna pacifica*. IUCN: Least Concern. Accidental in northern Gulf. Three reports with photographs from WPA: 15 June 2022, Calhoun County, TX (LeClaire, 2022); 23 October 2023, Nueces County, TX (McIntyre, 2023); and 08 July 2024, associated with landfall of Hurricane Beryl, Lake Conroe, Montgomery County, TX (Olsen, 2024). Two reports with photographs from EPA: 31 August 2021, Pinellas County, FL (Plage, 2021); 06 August 2024, associated with passage of Tropical Storm Debby, Pasco County, FL (Colontonio, 2024). Three reports were near the coast, one was inland, and one TX report occurred ~45 km from shore. Not detected on Gulf aerial or vessel surveys.

Short-tailed Shearwater *Ardenna tenuirostris*. IUCN: Least Concern. Accidental in northern Gulf; one report from EPA. Photos taken and specimen (UF 41873) of a bird retrieved on 07 July 2000 by a fishing vessel 40 km west of Sanibel Island, Lee County, FL (Kratter & Steadman, 2003). Not detected on Gulf aerial or vessel surveys.

Sooty Shearwater *Ardenna grisea*. IUCN: Near Threatened. Accidental in CPA, casual to rare in WPA and EPA. Accidental to casual in shelf waters (Duncan & Havard, 1980), rare in near-coast waters. Gulf reports from all months, peaking in June and December (eBird). Detected once on recent Gulf vessel surveys (NRDA 6).

Great Shearwater *Ardenna gravis*. IUCN: Least Concern. Rare summer and fall visitor to each PA (July–December) in most years, seemingly more regular in EPA. Accidental to casual visitor from mid-winter through early summer (January–June). Dispersed at low density mostly in shelf waters, at times near land (GoMMAPPS); up to ~80 per day were sighted near the coast during strong onshore winds. Uncommon during irruptive years with higher vagrancy and more strandings (Haman et al., 2013; Lee, 2009; Rogers & Hull, 2016). Except for one specimen from LA (29.30017°, -89.70655°), an additional 11 carcasses retrieved in July and August 2010 from the *Deepwater Horizon* oil spill were all found in panhandle FL and adjacent Mobile Bay, AL. Occasionally detected on Gulf vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Manx Shearwater *Puffinus puffinus*. IUCN: Least Concern. USFWS: BCC. Accidental in EPA, ≥ five reports, two storm-driven (December and July, Escambia County, FL; January, Santa Rosa County, FL; June, Monroe County, FL; Langridge, 1983, eBird). Sight report of five birds, 11 August 1997, at western edge of EPA (near 27.73°, -87.25°), during GulfCet II (Davis et al., 2000c, p. 183). Accidental in CPA (11 March 1999, specimen, 84 km SSW of Southwest Pass, Mississippi River (Louisiana Ornithological Society, n.d.), although up to five reports mid- to late-summer in the same vicinity in deep water (Davis et al., 2000b). Carcass retrieved during *Deepwater Horizon* oil spill (Haney et al., 2014) from CPA (30.230°, -87.969°). Casual visitor in WPA (≥ 11 reports; February, June–October; Hodne, 2022m, GoMMAPPS). Reports from all seasons, mostly near-coast, but also ≥ 170 km from shore (in mixed-species feeding flocks). Gulf status poorly resolved. Detected three times on Gulf vessel surveys (17 and 18 February 2018; GoMMAPPS).

Sargasso Shearwater *Puffinus lherminieri*. IUCN: Least Concern. USFWS: BCC. Common warm-season visitor to all three PAs (June–November). The closest colony to the Gulf, and one of the world's largest, is at Cay Sal Bank, Bahamas (Mackin et al., 2015; Fig. 1). Dispersal westwards into Gulf waters occurs March–May. Present year-round in the EPA, although accidental or casual visitor December–February, and seemingly entirely absent December–April in CPA and WPA. Widely dispersed from middle-shelf seaward to slope and pelagic waters, often near *Sargassum*. Regularly detected on Gulf vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Magnificent Frigatebird *Fregata magnificens*. IUCN: Least Concern. USFWS: BCC. Common warm-season (March–November) visitor throughout northern Gulf. Casual-to-rare during winter (December–February) in WPA and CPA, uncommon in EPA, mostly in coastal southwestern FL and the Keys. Nearest breeding on western Keys (less than or equal to 250 pairs historically; Clapp et al., 1982a), and atolls of Campeche Bank, Mexico (~260 pairs; Morales-Vera et al., 2017). Gulf non-breeding roosts may contain 3,000–10,000 birds (Chandeleur Islands, LA; Clapp et al., 1982a; Lowery, 1974), some of which include birds exogenous to the Gulf, including failed breeders from Cayman Islands (Austin et al., 2019, supplement; Fig. S4). Widely dispersed over coastal plain, near-coast, inner- and middle-shelf waters; frequently attends fishing vessels. Solo birds and small groups less common in outer shelf where species

associate with oil and gas platforms or in mixed-species flocks. Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Masked Booby *Sula dactylatra*. IUCN: Least Concern. USFWS: BCC. Uncommon year-round visitor in waters in each PA, but casual or rare during mid-winter in northern Gulf. Breeding permanent resident in southern Gulf on Campeche Bank, Mexico (≥ 1,600-2,500 pairs; Morales-Vera et al., 2017; Tunnell & Chapman, 2000), with a smaller colony (up to 100–130 individuals) at Middle Key, Dry Tortugas, FL. Except near colonies and roosts, typically solo and widely dispersed over outer shelf, slope, and pelagic waters, often near *Sargassum*. Occasionally attends fishing vessels near the coast; follows ships preying on flying fish trying to escape vessels. Regularly detected on Gulf vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Nazca Booby *Sula granti*. IUCN: Least Concern. Accidental in WPA. A single adult was photographed and videoed 104 km east of South Padre Island, Cameron County, TX (26.384°, -96.176°) on 03 August 2024 during a VSAD Gulf vessel survey (Sutherland et al., 2025).

Blue-footed Booby *Sula nebouxii*. IUCN: Least Concern. Accidental visitor to WPA: South Padre Island, Cameron County, TX (05 October 1976, photographed; Clapp et al., 1982a), and one sight report from Big Shell Beach, Kenedy County, TX, 28 December 1986 (Baker, 1986). Additional photographic reports from interior TX (eBird). Unreported from CPA and EPA. Not detected on Gulf aerial or vessel surveys.

Atlantic Brown Booby *Sula l. leucogaster*. IUCN: Least Concern. Common, nearly ubiquitous year-round visitor to shelf and slope waters in each PA of the northern Gulf. Breeding permanent resident in southern Gulf on the Campeche Bank, Mexico (≥ 100 pairs; Morales-Vera et al., 2017; Tunnell & Chapman, 2000), with a few potential breeders at Cay Sal Bank (Mackin et al., 2015). Widely distributed over shelf, slope, and pelagic waters, less common in near-coast waters, but frequently reported from land (eBird). Solo birds and small groups (three to five) habitually follow vessels and prey on flying fish that take flight. Often roosts on oil and gas platforms, as well as ship bows, superstructure, and anchor wells. Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

Red-footed Booby *Sula sula*. IUCN: Least Concern. USFWS: BCC. Accidental (WPA and CPA) to rare (EPA) year-round visitor throughout waters of the northern Gulf. Very small breeding population in southern Gulf on Campeche Bank, Mexico (~15 pairs; Morales-Vera et al., 2017). Sparsely distributed over outer shelf, slope, and pelagic waters. Solo birds may follow ships for flying fish, sometimes roosting on ship superstructures. Occasionally detected on Gulf vessel surveys (GoMMAPPS, VSAD).

Northern Gannet *Morus bassanus*. IUCN: Least Concern. Common winter resident (November–March), and uncommon migrant during fall (October) and spring (April–May) throughout northern Gulf. Some immatures and subadults remain in northern Gulf over warmer months (June–September), as casual visitors in WPA and CPA, rare visitors in EPA. Due to the east-west orientation of migration, abundance is typically lower and seasonal phenology shorter in western Gulf (Gunter & Burke, 1977). Found in waters ranging from just off beaches to near-coast, inner-shelf, and middle-shelf areas. Migrants occur almost anywhere in Gulf waters. Notable concentrations occur in Mississippi Sound, around the Mississippi River Delta outflow, and along portions of the LATEX shelf (Fig. 1). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS).

Brown Pelican *Pelecanus occidentalis*. IUCN: Least Concern. USFWS: BCC. Common permanent resident across entire northern Gulf in each PA. Breeds in ~70 Gulf colonies (19 in WPA, 45 in CPA, six in EPA: Capitolo et al., 2023). Generally restricted to bays, estuaries, sounds, and near-coast and inner-shelf waters. Non-breeders also found in middle- and outer-shelf waters, especially if attending trawlers or roosting on oil and gas platforms. During winter, some post- and non-breeders disperse east-west across PAs, and north-south across the open Gulf to Mexico (King et al., 2013; Lamb et al., 2020). Regularly detected on Gulf aerial and vessel surveys (NRDA 6, GoMMAPPS, VSAD).

DISCUSSION

Given its centralized location with the continent, the Gulf of Mexico is frequented by coastal aquatic and marine birds (both migrant and breeding) from throughout North America and beyond. Most (~76%) of the numerically dominant species found in marine waters breed outside the northern Gulf, with 41% nesting entirely outside the Gulf, including the nearby Caribbean and Bahamas (Michael et al., 2023). Relatively few marine species breed across the entire northern Gulf coast proper (e.g., Laughing Gull, Royal Tern, Brown Pelican). For taxa that are fully documented in the Gulf (n = 113 species), only 22% breed at locations in the Gulf or adjacent Caribbean region combined.

Geographic origins for marine birds from outside the Gulf are varied (e.g., Michael et al., 2023: Table 2), reflecting mixed temperate and tropical conditions in this marginal sea (e.g., McKee & Rooth, 2008). Some species are Northern Hemisphere migrants from continental interior or high Arctic breeding grounds (Red Phalarope, Pomarine Jaeger, Black Tern). Trans-oceanic movements to Gulf waters from the eastern North Atlantic occur in Band-rumped Storm Petrels and Cory's Shearwaters, whereas Wilson's Storm Petrels and Great Shearwaters originate from the South Atlantic Ocean. Even from closer West Indian breeding sites, certain tropical or subtropical seabird species (e.g., Black-capped Petrels, Red-billed Tropicbirds) face convoluted over-water routes (the narrow Yucatan Channel and Florida Straits) through biologically impoverished seas to reach the Gulf.

A notable fraction (19%) of species found in the Gulf derive, in part, from the Pacific Ocean and its continental margins, mostly as accidentals (e.g., Long-billed Murrelet, Short-billed Gull *Larus brachyrhynchus*, Elegant Tern *Thalasseus elegans*, Blue-footed Booby; see also Appendix, Table A2). The Gulf basin may serve to "trap" such vagrants—once vagrants enter, exiting this nearly enclosed water body may be difficult. Some Pacific species, however, are notoriously strong flyers (e.g., White-chinned Petrel, Short-tailed Shearwater). Pacific seabird taxa may also be displaced into the Atlantic by tropical storms, typically by first crossing the Isthmuses of Tehuantepec or Panama. From there, vagrants could eventually reach the northern Gulf. However, tagging studies have shown that some Atlantic and Pacific marine birds move across regions independently of such weather events (Lamb et al., 2018).

This suggests that overland movements between the Pacific and Gulf may be more common than currently understood.

The last synthesis of Gulf seabirds occurred a half-century ago (Clapp et al., 1982a, 1982b, 1983). We found that integrating multiple sources for observations of seabirds in the Gulf facilitated a more complete list of marine birds for this region and provided seasonal or distributional patterns that were better informed than previous summaries. No single source that we consulted included all the Gulf species covered here (also refer to Appendix, Tables A1, A2). We consulted state checklists (e.g., annual rare bird committee reports), because national compilations often overlooked important regional information. However, sources that did not adjust for observer effort could distort patterns of spatial and seasonal occurrence. Species eBird maps in the Gulf were biased towards near-coast waters (e.g., recreational boating) and restricted lanes used by cruise ships in deeper waters. To provide more accurate indices of abundance and distribution for resource planning, our synthesis suggests that comparisons using synoptic spatial coverage (Fig. 2), and those that adjust relative abundance by survey effort (Table 4), would lead to more reliable assessments.

Even in the comparatively well-studied U.S. western North Atlantic (RWSC, 2024), regional syntheses for marine birds overlook species. Some omissions result from arbitrary exclusion of taxa found at low densities within U.S. jurisdiction but breed elsewhere (e.g., the Atlantic *Pterodroma*; Krüger et al., 2018; Militão et al., 2017; Raine et al., 2021). Other omissions arise from outdated taxonomy or an over-reliance on national (rather than global) data sources. Additionally, the fragmented and varied formats for archiving seabird information (e.g., grey literature, eBird, unpublished projects, online supplements) can lead to the neglect of some of the most at-risk species. Comprehensive summaries of all marine birds reported from the Gulf of Mexico have been difficult to find. Our synthesis aims to support species-based priority-setting objectives in an OCS region currently undergoing accelerated infrastructure development in northern Gulf waters (e.g., Farmer et al., 2022, 2023).

Although we identified more than 50 species of marine birds that frequent Gulf waters, fewer species may require evaluation for impact assessments. Some Gulf species are accidental or casual, reported less frequently than every year or decade (e.g., Appendix, Table A2). In any given BOEM planning area, only 25–31 marine bird species are expected to occur annually (Table 2). As few as 17 species account for 99% of relative seabird density Gulf-wide (Michael et al., 2023). Thus, a much smaller subset of species—well below the 113+ species summarized here—may be sufficient for assessing the impacts of various Gulf environmental stressors, both anthropogenic and natural (e.g., Jodice et al., 2019: Table 6.3). Given that only one Gulf-wide vessel survey (GoMMAPPS) was completed in the past decade (*cf*. Kinlan et al., 2012, p. 60), some data reported here also serve as a baseline to detect future medium- and long-term temporal changes in the Gulf of Mexico, including those related to marine climate change (*cf.* Clairbaux et al., 2021; Gibson et al., 2023; Orgeret et al., 2022).

This synthesis also can inform the design of next-generation surveys to address the unique seasonal and spatial scales of impacts expected from offshore wind energy development (ADGC, 2024). The Gulf is home to species not regularly detected along most of the eastern U.S. Atlantic, including Brown Noddy, Sooty Tern, Bridled Tern, Magnificent Frigatebird, and three tropical *Sula* species (Masked Booby, Atlantic Brown Booby, Red-footed Booby). Over the 14 years of our surveys, we occasionally found it challenging to find observers experienced in identifying the tropical seabirds, so revising training modules to include more species would be beneficial. Other applications of our synthesis include guiding aerial and vessel-based site characterization surveys (BOEM, 2020), pre- and post-construction monitoring surveys (ADGC, 2024), and process-oriented studies to evaluate seabird attraction (Johnston et al., 2022), displacement (Cook et al., 2018; Garthe et al., 2023; van Bemmelen et al., 2023), and collision risk (Mikami et al., 2022; Lane et al., 2020). These studies are now expected to be integral components of monitoring protocols used to evaluate avian impacts around offshore energy infrastructure (RWSC, 2024).

The survey data collected continuously or at relatively small scales (ranging from 100 m to 4 km) are used here to support spatially explicit analyses of conservation risks faced by Gulf marine birds due to offshore commercial energy development in the outer continental shelf. Data from GoMMAPPS and other recent vessel surveys were used to evaluate seabird proximity to chronic hydrocarbon exposure near offshore oil and gas platforms (Michael et al., 2022), assess risks to marine birds when designating future wind energy areas for Gulf leasing (BOEM, 2022), and to update knowledge on the geographic ranges of at-risk species (Jodice et al., 2021). Additionally, these survey data help identify species disproportionally impacted by the 2010–2011 *Deepwater Horizon* blow-out and spill, guiding restoration planning (DHNRDAT, 2016). Future studies can use these data to address how the Gulf environment influences marine bird distributions and habitat use. Seabird interactions with meso-scale oceanographic features, such as frontal eddies, cyclonic and anti-cyclonic rings, river plumes, and current jets, remain important research areas in the Gulf (*cf*. Ribic et al., 1997).

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REFERENCES

Anonymous. (2024). *The birds of southeastern Louisiana*. Retrieved September 23, 2024, from https://domlibs.fr/faune_flore/docs/AMN_USA_birds_southeastern_louisiana_purrington.pdf

Arvin, J. (1977, February 06). *Checklist S19330816*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S19330816

Avian Displacement Guidance Committee. (2024). *Guidance for pre- and post-construction monitoring to detect changes in marine bird distributions and habitat use related to offshore wind development*. Report to the Offshore Wind Environmental Technical Working Group (E-TWG). https://www.nyetwg.com/avian-displacement-guidance

Austin, R. E., De Pascalis, F., Arnould, J. P., Haakonsson, J., Votier, S. C., Ebanks-Petrie, G., Austin, T., Morgan, G., Bennet, G. & Green, J. A. (2019). A sex-influenced flexible foraging strategy in a tropical seabird, the magnificent frigatebird. *Marine Ecology Progress Series*, *611*, 203–214. https://doi.org/10.3354/meps12859

Baker, N. (1986, 28 December). *Checklist S27468428*. eBird. Retrieved March 9, 2025, from https://ebird.org/tx/checklist/S27468428

Ballance, L. & Force, M. (2016). *Seabird distribution and abundance survey protocols*. Ecosystems Studies Program, Southwest Fisheries Science Center. https://swfsc-publications.fisheries.noaa.gov/publications/CR/2009/2009Santora.pdf

Banks, R. C., Cicero, C., Dunn, J. L., Kratter, A. W., Rasmussen, P. C., Remsen Jr., J. V., Rising, J. D., & Stotz, D. F. (2006). Forty-seventh supplement to the American Ornithologists' Union check-list of North American birds. *The Auk*, *123*(3), 926–936. https://doi.org/10.1093/auk/123.3.926

Birdlife International. (2024). *The IUCN Red List: Identifying the birds that most need our help*. Retrieved February 8, 2024, from http://datazone.birdlife.org/species/search

Bolton, M., Smith, A. L., Gómez-Díaz, E., Friesen, V. L., Medeiros, R., Bried, J., Roscales, J. L., & Furness, R. W. (2008). Monteiro's Storm-Petrel *Oceanodroma monteiroi*: a new species from the Azores. *Ibis*, *150*(4), 717–727. https://doi.org/10.1111/j.1474-919X.2008.00854.x

Bowman, R. (2006). Fifteenth Report of the Florida Ornithological Society Records Committee: 2003–2005. *Florida Field Naturalist*, *34*(3), 69–102.

Briggs, K. T., Tyler, W. B., Lewis, D. B., & Carlson, D. R. (1987). Bird communities at sea off California: 1975 to 1983. Studies in Avian Biology, *11*, 1−74. https://doi.org/10.2307/4087784

Brown, R. G. B., Nettleship, D. N., Germain, P., Tull, C. E., & Davis, T. (1975). *Atlas of Eastern Canadian Seabirds*. Canadian Wildlife Service. Retrieved March 10, 2025, from CW66-44-1975-eng.pdf

Bureau of Ocean Energy Management. (2020). *Guidelines for providing avian survey information for renewable energy development on the outer continental shelf pursuant to 30 CFR Part 585.* https://www.boem.gov/sites/default/files/documents/newsroom/Avian%20Survey%20Guidelines.pdf

Bureau of Ocean Energy Management. (2022a). *Gulf of Mexico activities*. Retrieved February 8, 2024, from https://www.boem.gov/renewable-energy/state-activities/gulf-mexico-activities

Bureau of Ocean Energy Management. (2022b). Gulf of Mexico activities. Retrieved February 8, 2024 from https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Gulf%20of%20Mexico%20OCS%20Region%20Call%20for%20Information%20and%20Nominations%20Map.pdf

Bureau of Ocean Energy Management. (2022c). Request for concurrence on preliminary wind energy areas for the Gulf of Mexico area identification process pursuant to 30 C.F.R.§585.211(b). https://www.boem.gov/sites/default/files/documents//Draft%20Area%20ID%20Memo%20GOM%20508.pdf

Bureau of Ocean Energy Management, & National Oceanic and Atmospheric Administration (NOAA). (2024). *AIS vessel transit counts 2022* [Data set]. MarineCadastre. https://marinecadastre.gov/downloads/data/ais/ais2022/AISVesselTransitCounts2022.zip

Burger, J. (2017). Avian resources of the northern Gulf of Mexico. In C. H. Ward (Ed.), *Habitats and biota of the Gulf of Mexico: Before the Deepwater Horizon Oil Spill. Volume 2: Fish resources, fisheries, sea turtles, avian resources, marine mammals, diseases and mortalities.* Springer. https://doi.org/10.1007/978-1-4939-3456-0

Cantrell, S. (2022, February 22). *Checklist S103532054*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S103532054

Capitolo, P. J., Davis, J. N., Parker, M. W., Williams, W. A., Yorba, N., Ramirez, B. M., & Ford, R.G. (2023). *Colonial waterbird monitoring with aerial photographic surveys in the northern Gulf of Mexico, 2010–2021*. Colibri Ecological Consulting, LLC. & R. G. Ford Consulting. https://twi-aviandata.s3.amazonaws.com/avian_monitoring/dotting_information/2010-2021_DWH_Colonial_Waterbird_Monitoring_Combined_Final.pdf

Chacón, R. (2017, October 27). *Checklist S41030608*. eBird Mexico. Retrieved March 12, 2024, from https://ebird.org/averaves/checklist/S41030608

Chen, Y. (2017). Fish resources of the Gulf of Mexico. In C. H. Ward (Ed.) Habitats and biota of the Gulf of Mexico*: Before the Deepwater Horizon Oil Spill. Volume 2: Fish resources, fisheries, sea turtles, avian resources, marine mammals, diseases and mortalities.* Springer. https://doi.org/10.1007/978-1-4939-3456-0

Chesser, R. T., Billerman, S. M., Burns, K. J., Cicero, C., Dunn, J. L., Hernández-Baños, B. E., Jiménez, R. A., Johnson, O., Kratter, A. W., Mason, N. A., Rasmussen, P. C., & Remsen, J. V, Jr. (2024). *Check-list of North American birds*. American Ornithological Society. Retrieved August 28, 2024, from https://checklist.americanornithology.org/taxa/

Clairbaux, M., Mathewson, P., Porter, W., Fort, J., Strøm, H., Moe, B., Fauchald, P., Descamps, Helgason, H. H., Bråthen, V. S., Merkel, B., Anker-Nilssen, T., Bringsvor, I. S., Chastel, O., Christensen-Dalsgaard, S., Danielsen, J., Daunt, F., Dehnhard, N., Erikstad, K. E., . . . Grémillet, D. (2021). North Atlantic winter cyclones starve seabirds. *Current Biology*, *31*(17), 3964–3971. https://doi.org/10.1016/j.cub.2021.06.059

Clapp, R. B., Banks, R. C., Morgan-Jacobs, D., & Hoffman, W. A. (1982a). *Marine birds of the southeastern United States and Gulf of Mexico. Part I. Gaviiformes through Pelecaniformes*. FWS/OBS-82/01. U.S. Fish and Wildlife Service, Division of Biological Services.

Clapp, R. B., Banks, R. C., Morgan-Jacobs, D., & Hoffman, W. A. (1982b). *Marine birds of the southeastern United States and Gulf of Mexico. Part II. Anseriformes*. FWS/OBS-82/20. U.S. Fish and Wildlife Service, Division of Biological Services.

Clapp, R. B., Morgan-Jacobs, B., & Banks, R. C. (1983). *Marine birds of the southeastern United States and Gulf of Mexico. Part III. Charadriiformes*. FWS/OBS-83/30. U.S. Fish and Wildlife Service, Division of Biological Services.

Colontonio, J. (2024, August 06). *Checklist S190474937*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S190474937

Cook, A. S., Humphreys, E. M., Bennet, F., Masden, E. A., & Burton, N. H. (2018). Quantifying avian avoidance of offshore wind turbines: Current evidence and key knowledge gaps. *Marine Environmental Research*, *140*, 278–288. https://doi.org/10.1016/j.marenvres.2018.06.017

Davis, K. L., Silverman, E. D., Sussman, A. L., Wilson, R. R., & Zipkin, E. F. (2022). Errors in aerial survey count data: Identifying pitfalls and solutions. *Ecology and Evolution*, *12*(3), e8733. https://doi.org/10.1002/ece3.8733

Davis, R. W., & Fargion, G. S. (1996). *Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, Vol 2*. OCS Study MMS 96-0027. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. https://espis.boem.gov/Final%20Reports/3297.pdf

Davis, R. W., Evans, W. E., & Würsig, B. (2000a). *Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Vol 1: Executive summary.* OCS Study MMS 2000-002. U.S. Department of Interior, Geological Survey, Biological Resources Division, and Minerals Management Service, Gulf of Mexico OCS Region. https://digital.library.unt.edu/ark:/67531/metadc955566/m2/1/high_res_d/3152.pdf

Davis, R. W., Evans, W. E., & Würsig, B. (2000b). *Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations*. Vol 2: *Technical report.* OCS Study MMS 2000-003. U.S. Department of Interior, Geological Survey, Biological Resources Division, and Minerals Management Service, Gulf of Mexico OCS Region. https://espis.boem.gov/final%20reports/3153.pdf

Davis, R. W., Evans, W. E., & Würsig, B. (2000c). *Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Vol 3: Data Appendix.* OCS Study MMS 2000-004. US Department of Interior, Geological Survey, Biological Resources Division, and Minerals Management Service, Gulf of Mexico OCS Region. https://espis.boem.gov/final%20reports/3154.pdf

Deepwater Horizon Natural Resource Damage Assessment Trustees. (2016). *Deepwater Horizon oil spill: Final programmatic damage assessment and restoration plan and final programmatic environmental impact statement*. http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

Duncan, C. D., & Havard, R.W. (1980). Pelagic birds of the northern Gulf of Mexico. *American Birds*, *34*(2), 122–132.

Duncan, L. R., & Kaufmann, D. (2022). Florida's first confirmed record of Bulwer's Petrel (*Bulweria bulwerii*) and a first for the Gulf of Mexico. *Florida Field Naturalist*, *50*(4), 94–99.

Ellis, J. T., & Dean, B. J. (2012). Gulf of Mexico processes. *Journal of Coastal Research*, *60*(10060), 6–13. https://doi.org/10.2112/SI_60_2

Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884 (1973), codified at 16 U.S.C. § 1531–1544.

Fargion, G. S., & Davis, R. W. (1994). *Marine mammals and birds in the northwestern Gulf of Mexico: GulfCet Cruises 01-07*. Technical Report 94-04-T. Texas A&M University. https://espis.boem.gov/Final%20Reports/3722.pdf

Farmer, N. A., Powell, J. R., Morris Jr., J. A., Soldevilla, M. S., Wickliffe, L. C., Jossart, J. A., MacKay, J. K., Randall, A. L., Bath, G. E., Ruvelas, P., Gray, L., Lee, J., Piniak, W., Garrison, L., Hardy, R., Hart, K. M., Sasso, C., Stokes, L., & Riley, K.L. (2022). Modeling protected species distributions and habitats to inform siting and management of pioneering ocean industries: A case study for Gulf of Mexico aquaculture. *PLoS One*, *17*(9), e0267333. https://doi.org/10.1371/journal.pone.0267333

Farmer, N. A., Garrison, L. P., Litz, J. A., Ortega-Ortiz, J. G., Rappucci, G., Richards, P. M., Powell, J. R., Bethea, D. M., Jossart, J. A., Randall, A. L., Steen, M. E., Matthews, T. N., & Morris Jr., J. A. (2023). Protected species considerations for ocean planning: A case study for offshore wind energy development in the U.S. Gulf of Mexico. *Marine and Coastal Fisheries*, *15*(3), e10246. https://doi.org/10.1002/mcf2.10246

Felder, D. L., Camp, D. K. & Tunnell Jr., J. W. (2009). An introduction to Gulf of Mexico biodiversity assessment. In D. L. Felder & D. K. Camp. (Eds.), Gulf of Mexico–Origins, waters, and biota: Vol. 1, Biodiversity. Texas A&M Press. https://doi.org/10.1086/659907

Florida Ornithological Society. (1990). Records Committee Report. *Florida Field Naturalist*, *18*(3), 67–68.

Fontenot, W. R., Cardiff, S. W., Demay, R. A., Dittmann, D. L., Hartley, S. B., Jeske, C. W., Lorenz, N. Michot, T. C., Purrington, R. D., Seymour, M. A., & Vermillion, W. G. (2012). *A catalog of Louisiana's nesting seabird colonies*. Report Number 34. Barataria-Terrebonne National Estuary Program. https://doi.org/10.13140/RG.2.2.31794.91840

Fritts, T. H., & Reynolds, R. P. (1981). *Pilot study of the marine mammals, birds and turtles in OCS areas of the Gulf of Mexico*. FWS/OBS-81/36. US Fish and Wildlife Service, Division of Biological Services.

Fritts, T. H., Irvine, B., Jennings, R. D., Collum, L. A., Hoffman, W., & McGehee, M. A. (1983). *Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters*. FWS/OBS-82/65. U. S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region.

Gallaway, B. J., Gazey, W. J., Cole, J. G., & Fechhelm, R. G. (2007). Estimation of potential impacts from offshore liquefied natural gas terminals on red snapper and red drum fisheries in the Gulf of Mexico: an alternative approach. *Transactions of the American Fisheries Society*, *136*(3), 655–677. https://doi.org/10.1577/T06-062.1

Garthe, S., Schwemmer, H., Peschko, V., Markones, N., Müller, S., Schwemmer, P., & Mercker, M. (2023). Large-scale effects of offshore wind farms on seabirds of high conservation concern. *Scientific Reports*, *13*(1), 4779. https://doi.org/10.1038/s41598-023-31601-z

Gibson, D., Riecke, T. V., Catlin, D. H., Hunt, K. L., Weithman, C. E., Koons, D. N., Karpanty, S. M. & Fraser, S. M. (2023). Climate change and commercial fishing practices codetermine survival of a long-lived seabird. *Global Change Biology*, *29*(2), 324–340. https://doi.org/10.1111/gcb.16482

Gleason, J. S., Sussman, A. L., Davis, K. L., Haney, J. C., Hixson, K. M., Jodice, P .G. R., Lyons, J. E., Michael, P. E., Satgé, Y. G., Silverman, E. D., Zipkin, E. F., & Wilson, R. R. (2025). Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS): Seabird Surveys in the Northern Gulf of Mexico, 2017–2020. U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program.

Greer, M. (1994, March 20). *Checklist S66584324*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S66584324

Gunter, G., & Burke, W. (1977). Notes on the status of the gannet (*Morus bassanus*) in the Gulf of Mexico, with a record from Mississippi. *Gulf Research Reports*, *6*(1), 83–86. https://doi.org/10.18785/grr.0601.12

Guris, P. A., Overton, M. D., Tove, M. H., & Wiltraut, R. (2004). First North American record of Black-bellied Storm-Petrel (*Fregetta tropica*). *North American Birds*, *58*(4), 618–621.

Haman, K. H., Norton, T. M., Ronconi, R. A., Nemeth, N. M., Thomas, A. C., Courchesne, S. J., Segars, A., & Keel, M. K. (2013). Great Shearwater (*Puffinus gravis*) mortality events along the eastern coast of the United States. *Journal of Wildlife Diseases*, *49*(2), 235–245. https://doi.org/10.7589/2012-04-119

Haney, J.C., Geiger, H.J., & Short, J.W. (2014). Bird mortality from the *Deepwater Horizon* oil spill. II. Carcass sampling and exposure probability in the coastal Gulf of Mexico. *Marine Ecology Progress Series*, *513*, 239–252. https://doi.org/10.3354/meps10839

Haney, J. C., Hemming, J. M., & Tuttle, P. (2019). Pelagic seabird density and vulnerability in the Gulf of Mexico to oiling from the *Deepwater Horizon* oil spill. *Environmental Monitoring and Assessment*, *191*(supplement 4), 818. https://doi.org/10.1007/s10661-019-7921-2

Harzl, V., & Pickl, M. (2012). The future of offshore oil drilling—an evaluation of the economic, environmental and political consequences of the *Deepwater Horizon* incident. *Energy & Environment*, *23*(5), 757–770. https://doi.org/10.1260/0958-305X.23.5.757

Hodne, G. (2022a). *South Polar Skua*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/spsk/

Hodne, G. (2022b). *Sabine's Gull*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/sagu/

Hodne, G. (2022c). *Black Noddy*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/blno/

Hodne, G. (2022d). *Roseate Tern*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/rost/

Hodne, G. (2022e). *White-tailed Tropicbird*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/wttr/

Hodne, G. (2022f). *Yellow-nosed Albatross*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/ynab/

Hodne, G. (2022g). *Wilson's Storm-Petrel*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/wisp/

Hodne, G. (2022h). *Leach's Storm-Petrel*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/lesp/

Hodne, G. (2022i). *Band-rumped Storm-Petrel*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/bstp/

Hodne, G. (2022j). *Black-capped Petrel.* Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/bcpe/

Hodne, G. (2022k). *White-chinned Petrel*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/wcpe/

Hodne, G. (2022l). *Cory's Shearwater.* Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/cosh/

Hodne, G. (2022m). *Manx Shearwater*. Seabirds of Texas. Retrieved March 9, 2025, from https://texaspelagics.com/texas_seabirds/mash/

Hoffman, W. (1994). Yellow-nosed Albatross specimen from Key Largo. *Florida Field Naturalist*, *22*(3), 75–77.

Hoffman, W., Fritts, T. H., & Reynolds, R. P. (1981). Whale sharks associated with fish schools off south Texas. *Northeast Gulf Science*, *5*(1), 55–57.

Hoffman, W., & Woolfenden, G. E. (1988). A specimen of the Asiatic Marbled Murrelet from Florida. *Florida Field Naturalist*, *16*(2), 37–38.

Huang, R. M., Bass Jr., O. L., & Pimm, S. L. (2017). Sooty Tern (*Onychoprion fuscatus*) survival, oil spills, shrimp fisheries, and hurricanes. *PeerJ*, *5*, e3287. https://doi.org/10.7717/peerj.3287

Industrial Economics, Inc. (2015). *Deepwater Horizon/Mississippi Canyon 252 Oil Spill Natural Resource Damage Assessment technical report: Estimating the offshore mortality of birds killed by DWH oil.* Deepwater Horizon Natural Resource Damage Assessment and Restoration Program. U.S. Fish & Wildlife Service, U.S. Department of the Interior. https://www.fws.gov/doiddata/dwh-ar-documents/788/DWH-AR0011784.pdf

Jarosz, E., & Murray, S. P. (2005). Velocity and transport characteristics of the Louisiana-Texas Coastal Current. *American Geophysical Union Geophysical Monograph Series*, *161*, 143–156. https://doi.org/10.1029/161GM11

Jodice, P. G. R. (1993). Distribution of wintering loons in the northeastern Gulf of Mexico. In L. S. Morse, S. Stockwell & M. Pokras. (Eds.), *Proceedings from the Bar Harbor, ME, USA 1992 Conference on the Loon and its Ecosystem: Status, Management, and Environmental Concerns*. College of the Atlantic Bar Harbour, US Fish and Wildlife Service.

Jodice, P. G. R., Ronconi, R. A., Rupp, E., Wallace, G. E., & Satgé, Y. (2015). First satellite tracks of the endangered Black-capped Petrel. *Endangered Species Research*, *29*(1), 23–33. https://doi.org/10.3354/esr00697

Jodice, P. G. R., Adams, E. M., Lamb, J., Satgé, Y., & Gleason, J. S. (2019). GoMAMN Strategic bird monitoring guidelines: Seabirds. In R. R. Wilson, A. M. V. Fournier, J. S. Gleason, J. E. Lyons & M. S. Woodrey (Eds.), *Strategic bird monitoring guidelines for the northern Gulf of Mexico.* Mississippi Agricultural and Forestry Experiment Station Research Bulletin 1228, Mississippi State University.

Jodice, P. G. R., Michael, P. E., Gleason, J. S., Haney, J. C., & Satgé, Y. G. (2021). Revising the marine range of the endangered Black-capped Petrel *Pterodroma hasitata*: occurrence in the northern Gulf of Mexico and exposure to conservation threats. *Endangered Species Research*, *46*, 49–65. https://doi.org/10.3354/esr01143

Johnston, D. T., Thaxter, C. B., Boersch-Supan, P. H., Humphreys, E. M., Bouten, W., Clewley, G. D., Scragg, E. S., Masden, E. A., Barber, L., Conway, G. J. Clark, N. A., Burton, N. H. K., & Cook, A. S. C. P. (2022). Investigating avoidance and attraction responses in Lesser Black-backed Gulls *Larus fuscus* to offshore wind farms. *Marine Ecology Progress Series*, *686*, 187–200. https://doi.org/10.3354/meps13964

Kaiser, M. J., & Narra, S. (2019). A retrospective of oil and gas field development in the U.S. outer continental shelf Gulf of Mexico, 1947–2017. *Natural Resources Research*, *28*, 685–715. https://doi.org/10.1007/s11053-018-9414-3

Keller, C. E., Spendelow, J. A., & Greer, R. D. (1984). *Atlas of wading bird and seabird nesting colonies in coastal Louisiana, Mississippi, and Alabama: 1983*. FWS/OBS-84/13. U.S. Fish and Wildlife Service, Division of Biological Services.

Kelsey, E. C., Felis, J. J., Czapanskiy, M., Pereksta, D. M., & Adams, J. (2018). Collision and displacement vulnerability to offshore wind energy infrastructure among marine birds of the Pacific Outer Continental Shelf. *Journal of Environmental Management*, *227*, 229–247. https://doi.org/10.1016/j.jenvman.2018.08.051

Kenow, K. P., Fara, L. J., Houdek, S. C., Bray, B. R., Heard, D. J., Meyer, M. W., Fox, T. J., Kratt, R., & Henderson, C. L. (2023). Dive characteristics of Common Loons wintering in the Gulf of Mexico and off the southern US Atlantic coast. *Journal of Field Ornithology*, *94*(1), 1. https://doi.org/10.5751/JFO-199-940101

Kent, A. (2014, March 9). *Checklist S17506214*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S17506214

King, D. T., Goatcher, B. L., Fischer, J. W., Stanton, J., Lacour, J. M., Lemmons, S. C., & Wang, G. (2013). Home ranges and habitat use of Brown Pelicans (*Pelecanus occidentalis*) in the northern Gulf of Mexico. *Waterbirds*, *36*(4), 494–500. https://doi.org/10.1675/063.036.0406

Kinland, B. P., Zipkin, E. F., O'Connell, A. F., & Caldow, C. (2012). Statistical analyses to support guidelines for marine avian sampling: Final report. OCS Study BOEM 2012-101, NOAA Tech Memo NOS NCCOS 158. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/2012/OCS-Study-BOEM-2012-101.pdf

Kratter, A. W., & Steadman, D. W. (2003). First Atlantic Ocean and Gulf of Mexico specimen of Short-tailed Shearwater. *North American Birds*, *57*(2), 277–279.

Kratter, A. W., & Small, S. (2007). First record of Northern Fulmar (*Fulmarus glacialis*) for Florida, and notes on other North Atlantic seabird specimen records in 2004–2005. *Florida Field Naturalist*, *35*(1), 22–25.

Krüger, L., Paiva, V. H., Petry, M. V., Montone, R. C., & Ramos, J. A. (2018). Population estimate of Trindade Petrel *Pterodroma arminjoniana* by the use of predictive nest habitat modelling. *Bird Conservation International*, *28*(2), 197–207. https://doi.org/10.1017/S0959270916000289

Lamb, J. S., Newstead, D. J., Koczur, L. M., Ballard, B. M, Green, M. C., & Jodice, P. G. R. (2018). A bridge between oceans: overland migration of marine birds in a wind energy corridor. *Journal of Avian Biology*, *49*(2), e01474. https://doi.org/10.1111/jav.01474

Lamb, J. S., Satgé, Y. G., & Jodice, P. G. R. (2020). Seasonal variation in environmental and behavioural drivers of annual-cycle habitat selection in a nearshore seabird. *Diversity and Distributions*, *26*(2), 254–266. https://doi.org/10.1111/ddi.13015

Lane, J. V., Jeavons, R., Deakin, Z., Sherley, R. B., Pollock, C. J., Wanless, R. J., & Hamer, K. C. (2020). Vulnerability of Northern Gannets to offshore wind farms: Seasonal and sex-specific collision risk and demographic consequences. *Marine Environmental Research*, *162*, 105196. https://doi.org/10.1016/j.marenvres.2020.105196

Langridge, H. P. (1983). First record of Manx Shearwater for the Gulf Coast of Florida. *Florida Field Naturalist*, *11*(3), 54.

LeClaire, J. (2022, June 15). *Checklist S113012252*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S113012252

Lee, D. S. (2009). Mass die-offs of Greater Shearwaters in the western North Atlantic: Effects of weather patterns on mortality of a trans-equatorial migrant. *The Chat*, *73*(2), 37–47.

Liu, Y., & Weisberg, R.H. (2012). Seasonal variability on the West Florida shelf. *Progress in Oceanography*, *104*, 80–98. https://doi.org/10.1016/j.pocean.2012.06.001

Long, D., & Paruk, J. D. (2014). Unusually large wintering flock of Common Loons foraging in the Gulf of Mexico. *Southeastern Naturalist*, *13*(4), 49–51. https://doi.org/10.1656/058.013.0406

Louisiana Ornithological Society. (n.d.) *Manx Shearwater*, Puffinus puffinus. Retrieved March 9, 2025, from http://www.losbird.org/lbrc/rlmash.html

Lowery, G. H. (1974). *Louisiana birds*. Louisiana State University Press.

Mackin, W. A., Moore, P., Lee, D. S., & Ferguson, L. M. (2015). Seabirds of the Cay Sal Bank, The Bahamas. *Waterbirds*, *38*(4), 407–414. https://doi.org/10.1675/063.038.0404

McIntyre, J. (2023, October 23). *Checklist. S152938657*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S152938657

McKee, K. L., & Rooth, J. E. (2008). Where temperate meets tropical: Multi-factorial effects of elevated CO_2, nitrogen enrichment, and competition on a mangrove-salt marsh community. *Global Change Biology*, *14*(5), 971–984. https://doi.org/10.1111/j.1365-2486.2008.01547.x

McKinney, L. D., Shepherd, J. G., Wilson, C. A., Hogarth, W. T., Chanton, J. Marawski, S. A., Sandifer, P. A., Sutton, T., Yoskowitz, D., Wowk, K. Özgökmen, T. M., Joye, S. B., & Caffey, R. (2021). The Gulf of Mexico. *Oceanography*, *34*(1), 30–43. https://doi.org/10.5670/oceanog.2021.115

Mehan, A., & Casey, Z. S. (2023). Blue infrastructures: An exploration of oceanic networks and urban-industrial-energy interactions in the Gulf of Mexico. *Sustainability*, *15*(18), 13699. https://doi.org/10.3390/su151813699

Michael, P. E., Hixson, K. M., Haney, J. C., Satgé, Y. G, Gleason, J. S., & Jodice, P. G. R. (2022). Seabird vulnerability to oil: Exposure potential, sensitivity, and uncertainty in the northern Gulf of Mexico. *Frontiers in Marine Science*, *9*, 880750. https://doi.org/10.3389/fmars.2022.880750

Michael, P. E., Hixson, K. M., Gleason, J. S., Haney, J. C., Satgé, Y. G., & Jodice, P. G. R. (2023). Migration, breeding location, and seascape shape seabird assemblages in the northern Gulf of Mexico. *PLoS One*, *18*(6), e0287316. https://doi.org/10.1371/journal.pone.0287316

Michael, P. E., Gleason, J. S., Haney, J. C., Hixson, K. M., Satgé, Y. G., & Jodice, P. G. R. (2024). Black Terns (*Chlidonias niger*) beyond the breeding grounds: occurrence, relative density, and habitat associations in the northern Gulf of Mexico. *Wilson Journal of Ornithology*, *136*(2), 220–236. https://doi.org/10.1676/23-00069

Mikami, K., Kazama, K., Kazama, M. T., & Watanuki, Y. (2022). Mapping the collision risk between two gull species and offshore wind turbines: Modelling and validation. *Journal of Environmental Management*, *316*, 115220. https://doi.org/10.1016/j.jenvman.2022.115220

Militão, T., Dinis, H. A., Zango, L., Calabuig, P., Stefan, L. M., & González-Solis, J. (2017). Population size, breeding biology and on-land threats of Cape Verde Petrel (*Pterodroma feae*) in Fogo Island, Cape Verde. *PLoS One*, *12*(4), e0174803. https://doi.org/10.1371/journal.pone.0174803

Morales-Vera, T. E., Ruz-Rosado, F. D., Velarde, E., & Keith, E. O. (2017). Status of seabird nesting populations on Arrecife Alacranes, Gulf of Mexico. *Marine Ornithology*, *45*(2), 175–185. https://doi.org/10.5038/2074-1235.45.2.1225

Morey, S. L., Zavala-Hidalgo, J., & O'Brien, J. J. (2005). The seasonal variability of the continental shelf circulation in the northern and western Gulf of Mexico from a high-resolution numerical model. *American Geophysical Union Geophysical Monograph Series*, *161*, 203–218. https://doi.org/10.1029/161GM16

Murphy, J. (2009). Nesting of Sooty Terns (*Onychoprion fuscatus*) in the eastern panhandle of Florida. *Florida Field Naturalist*, *37*(4), 146–148.

Muschlitz, B. P. (1995). Asiatic Marbled Murrelet: first spring record in North America. *Florida Field Naturalist*, *23*(2), 30–32.

Neves, V. C., Carroll, G., Schäfer, W. C., Hereward, H. F. R., & Quillfeldt, P. (2023). Consistent foraging habitat use by a vulnerable breeding seabird highlights potential areas for protection in the mid-Atlantic Ocean. *Marine Ecology Progress Series*, *716*, 107–121. https://doi.org/10.3354/meps14353

Newfield, N. L. (2024, August 17). *Checklist S192162757*. eBird. Retrieved March 9, 2025, https://ebird.org/checklist/S192162757

Newman, R. J. (1954). The changing seasons; the spring migration: April 1–May 31; Central Southern Region. *Audubon Field Notes*, *8*, 316–319.

Nowlin Jr., W. D., Jochens, A. E., Dimarco, S. F., Reid, R. O., & Howard, M. K. (2005). Low-frequency circulation over the Texas-Louisiana continental shelf. *American Geophysical Union Geophysical Monograph Series*, *161*, 219–240. https://doi.org/10.1029/161GM17

Oey, L. -Y., Ezer, T., & Lee, H. -C. (2005). Loop Current, rings and related circulation in the Gulf of Mexico: A review of numerical models and future challenges. *American Geophysical Union Geophysical Monograph Series*, *161*, 31–56. https://doi.org/10.1029/161GM04

Olsen, T. (2024, July 08). *Checklist S186171541*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S186171541

Outer Continental Shelf Lands Act, 43 U.S.C. § 1332(3) (1953).

Orgeret, F. Thiebault, A., Kovacs, K. M., Lydersen, C., Hindell, M. A., Thomson, S. A., Sydeman, W. J., & Pistorius, P. A. (2022). Climate change impacts on seabirds and marine mammals: The importance of study duration, thermal tolerance and generation time. *Ecology Letters*, *25*(1), 218–239. https://doi.org/10.1111/ele.13920

Paolo, F., Kroodsma, D., Raynor, J., Hochberg, T., Davis, P., Cleary, J., Marsaglia, L., Orofino, S., Thomas, C., & Halpin, P. (2024). Satellite mapping reveals extensive industrial activity at sea. *Nature*, *625*(7993), 85–91. https://doi.org/10.1038/s41586-023-06825-8

Passeri, D. L., Hagen, S. C., Plant, N. G., Bilskie, M. V., Medeiros, S. C., & Alizad, K. (2016). Tidal hydrodynamics under future sea level rise and coastal morphology in the northern Gulf of Mexico. *Earth's Future*, *4*(5), 159–176. https://doi.org/10.1002/2015EF000332

Plage, P. (2021, 31 August). *Checklist S92987646*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S93987646

Powers, K. D. (1983*). Pelagic distributions of marine birds off the northeastern United States*. Technical Memorandum NMFS-F/NEC- 27. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Northeast Fisheries Center. https://repository.library.noaa.gov/view/noaa/5564

Pranty, B., Dunn, J. L., Heinl, S. C., Kratter, A. W., Lehman, P. E., Lockwood, M. W., Mactavish, B., & Zimmer, K. J. (2008). Annual report of the ABA checklist committee, 2007–2008. *Birding*, *40*(6), 33–38.

Pulich, W. (1982). Documentation and status of Cory's Shearwater in the western Gulf of Mexico. *The Wilson Bulletin*, *94*(3), 381–385. https://www.jstor.org/stable/4161658

Raine, A. F., Gjerdrum, C., Pratte, I., Madeiros, J., Felis, J. J., & Adams, J. (2021). Marine distribution and foraging habitat highlight potential threats at sea for the Endangered Bermuda Petrel *Pterodroma cahow*. *Endangered Species Research*, 45, 337–356. https://doi.org/10.3354/esr01139

Regional Wildlife Science Collaborative for Offshore Wind. (2024). *Integrated science plan for offshore wind, wildlife, and habitat in U.S. Atlantic waters*. Version 1.0. Retrieved February 6, 2024, from https://rwsc.org/science-plan

Remsen Jr., J. V., Wallace, B. P., Seymour, M. A., O'Malley, D. A., & Johnson, E. I. (2019). The regional, national, and international importance of Louisiana's coastal avifauna. *The Wilson Journal of Ornithology*, *131*(2), 221–434. https://doi.org/10.1676/18-111

Ribic, C. A., Davis, R., Hess, N., & Peake, D. (1997). Distribution of seabirds in the northern Gulf of Mexico in relation to mesoscale features: Initial observations. *ICES Journal of Marine Science*, *54*(4), 545−551. https://doi.org/10.1006/jmsc.1997.0251

Riley, K. L., Wickliffe, L. C., Jossart, J. A., MacKay, J. K., Randall, A. L., Bath, G. E., Balling, M. B., Jensen, B. M. & Morris Jr., J. A. (2021). *An aquaculture opportunity area atlas for the U.S. Gulf of Mexico*. NOAA Technical Memorandum NOS NCCOS 299. https://doi.org/10.25923/8cb3-3r66

Riska, D. E. (1984). Experiments on nestling recognition by Brown Noddies (*Anous stolidus*). *The Auk*, *101*(3), 605–609. https://doi.org/10.1093/auk/101.3.605

Robinson Willmott, J. C., Forcey, G., & Kent, A. (2013). *The relative vulnerability of migratory bird species to offshore wind energy projects on the Atlantic outer continental shelf: An assessment method and database*. OCS Study BOEM 207. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs.

Rogers, C., & Hull, S. (2016). An irruption of Great Shearwaters, *Ardenna gravis,* into South Australia and adjacent seas during April 2011. *South Australian Ornithologist*, *41*(2), 65–70.

Rolland, V., Nepshinsky, M., Windhoffer, E. D., Liechty, J. S., Minor, A. K., & Pierce, A. R. (2020). Foraging areas and movements of Royal Tern *Thalasseus maximus* at the Isles Dernieres Barrier Islands Refuge, Louisiana. *Marine Ornithology*, *48*(2), 163–168. https://doi.org/10.5038/2074-1235.48.2.1368

Sangster, G., Collinson, J. M., Crochet, P. -A., Knox, A. G., Parkin, D. T., & Votier, S. C. (2012). Taxonomic recommendations for British birds. *Ibis*, *154*(4), 874–883. https://doi.org/10.1111/j.1474-919X.2012.01273.x

Schallmann, J. (2022, October 30). *Checklist S121626307*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S121626307

Schiller, R. V., Kourafalou, V. H., Hogan, P., & Walker, N. D. (2011). The dynamics of the Mississippi River plume: Impact of topography, wind and offshore forcing on the fate of plume waters. *Journal of Geophysical Research*, *116*(C6), C06029. https://doi.org/10.1029/2010JC006883

Sealy, S. G., & Carter, H. R. (2012). Body condition and survival of Long-billed Murrelets, *Brachyramphus perdix*, in North America. *Canadian Field-Naturalist*, *126*(1), 6–14. https://doi.org/10.22621/cfn.v126i1.1288

Smith, R. (2012, March 09). *Checklist S12334800*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S12334800

Spies, R. B., Senner, S., & Robbins, C. S. (2016). An overview of the northern Gulf of Mexico ecosystem. *Gulf of Mexico Science*, *33*(1), 98–121. https://doi.org/10.18785/goms.3301.09

Stevenson, H. M. (1950). Distribution of certain birds in the southeastern United States. *The American Midland Naturalist*, *43*(3), 605–626. https://doi.org/10.2307/2421855

Surman, C. A., & Wooler, R.D. (2003). Comparative foraging ecology of five sympatric terns at a sub-tropical island in the eastern Indian Ocean. *Journal of Zoology*, *259*(3), 219–230. https://doi.org/10.1017/S0952836902003047

Sutherland, K., Metheny, N. & Haney, J.C. (2025). First U.S. Atlantic record of Nazca Booby *Sula granti*, with implications for vagrancy by Pacific seabirds into the Gulf of Mexico. *Marine Ornithology*, *53*(1), in press.

Taylor, J. W. (1972). Probable Bulwer's Petrel off Key West, Florida. *Wilson Bulletin*, *84*(4), 198. https://www.jstor.org/stable/4160200

TBRC Accepted Records (1995, September 15). *Checklist S101387802*. Retrieved March 9, 2025, from https://ebird.org/checklist/S101387802

Tennekes, M. (2018). tmap: Thematic maps in *R*. *Journal of Statistical Software*, *84*(6), 1–39. https://doi.org/10.18637/jss.v084.i06

Tunnell, J. W., & Chapman, B. R. (2000). Seabirds of the Campeche Bank Islands, southeastern Gulf of Mexico. *Atoll Research Bulletin*, *482*, 1–50. https://doi.org/10.5479/si.00775630.482.1

U.S. Fish & Wildlife Service. (2021). Birds of Conservation Concern 2021: Migratory Bird Program. Retrieved March 6, 2024, from https://www.fws.gov/sites/default/files/documents/birds-of-conservation-concern-2021.pdf

Van Bemmelen, R. S., Leemans, J. J., Collier, M. P., Green, R. M. W., Middelveld, R. P., Thaxter, C. B., & Fijn, R. C. (2023). Avoidance of offshore wind farms by Sandwich Terns increases with turbine density. *Ornithological Applications*, *126*(1), 1–10. https://doi.org/10.1093/ornithapp/duad055

Velarde, E., Iturriaga, J. L., Meiners, C., Jiménez, L., Perales, H., Sanay, R., Lozano, M.A., Cabrera-Valenzuela, H. A., & Anaya-Cruz, C. (2014). Red-billed Tropicbird *Phaethon aethereus* occurrence patterns in the state of Veracruz, Gulf of Mexico: possible causes and implications. *Marine Ornithology*, *42*(2), 119–124. https://doi.org/10.5038/2074-1235.42.2.1078

Vidal, V. M. V., Vidal, F. V., & Pérez-Molero, J. M. (1992). Collision of a Loop Current anticyclonic ring against the continental shelf slope of the western Gulf of Mexico. *Journal of Geophysical Research*, *97*(C2), 2155–2172. https://doi.org/10.1029/91JC00486

Vukovich, F. M. (2007). Climatology of ocean features in the Gulf of Mexico using satellite remote sensing data. *Journal of Physical Oceanography*, *37*(3), 689–707. https://doi.org/10.1175/JPO2989.1

Walker, N. D., Huh, O. K., Rouse, L. J., Jr., & Murray, S. P. (1996). Evolution and structure of a coastal squirt off the Mississippi River delta: northern Gulf of Mexico. *Journal of Geophysical Research: Oceans*, *101*(C9), 20643–20655. https://doi.org/10.1029/96JC00919

Weisberg, R. H., & Liu, Y. (2017). On the Loop Current penetration into the Gulf of Mexico. *Journal of Geophysical Research: Oceans*, *122*(12), 9679–9694. https://doi.org/10.1002/2017JC013330

Weston, F. M. (1953). Red Phalarope (*Phalaropus fulicarius*) wintering near Pensacola, Florida. *The Auk*, *70*(4), 491–493. https://doi.org/10.2307/4081363

Whitbeck, M (1997, June 28). *Checklist S83312052*. eBird. Retrieved March 9, 2025, from https://ebird.org/checklist/S83312052

Wiseman, W. J., Jr., Rabalais, N. N., Turner, R. E., Dinnel, S. P., & MacNaughton, A. N. (1997). Seasonal and interannual variability within the Louisiana coastal current: Stratification and hypoxia. *Journal of Marine Systems*, *12*(1-4), 237–248. https://doi.org/10.1016/S0924-7963(96)00100-5

Woolfenden, G. E., Monteiro, L. R., & Duncan, R. A. (2001). Recovery from the northeastern Gulf of Mexico of a Band-rumped Storm-Petrel banded in the Azores. *Journal of Field Ornithology*, *72*(1), 62–65. https://doi.org/10.1648/0273-8570-72.1.62

Zambrano, R., Smith, H. T., & Robson, M. (2000). Summary of breeding Roseate Terns in the Florida Keys: 1974–1998. *Florida Field Naturalist*, *28*(2), 64–68.