OPINION:
A MODEST PROPOSAL—SEABIRDS ARE MARINE CREATURES FIRST, LAND-BASED MARINE PREDATORS SECOND

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ABSTRACT

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Evidence indicates that members of the marine bird research and management communities should view seabirds from the seabirds' perspective, as marine organisms, rather than the pervading view derived from human's interaction with the sea, i.e., as temporary visitors centered on home ports. By doing so, research results and management plans will be more realistic and effective. Seabirds themselves only temporarily visit land in their reproductive attempts, with most of their time otherwise spent at sea, as much as 90% in the lifetimes of some species. This is especially true among seabirds of the more productive stretches of water, such as eastern boundary currents, which as a rule have relatively few islands on which to nest as well as these waters typically being dominated by seasonal, non-breeding species. A case in point is the Pigeon Guillemot *Cepphus columba* of the California Current, a species/population that dwells in waters of the Pacific Northwest for most of the year, except for a quick migration south, then back north, for nesting. It ventures south to then have to compete with far more abundant species. The point is that protecting just seabird nesting islands, but ignoring marine issues within the whole of respective annual ranges, is often not a successful strategy, as exemplified to the extreme by the trend toward extinction of African Penguin *Spheniscus demersus* of the Benguela Current, where seabird species visitors are far more abundant.

Key words: African Penguin, California Current, eastern boundary currents, Farallon Islands, marine ecology, Pigeon Guillemot

The mindset of most participants within the marine bird research and management community, judging from the published literature and the programs of 'seabird group' annual meetings (e.g., PSG 2023), appears consistent with their own life experience. As humans who are neither well adapted nor at-home in the marine environment, when it comes to exploitation of the sea, they head out for a time fishing and then back to port. Depending on the season for the prey/fish of choice, the frequency of trips to sea might be hourly, daily, or even weekly to achieve the effort required to optimize an economically sustainable catch. In the offseason when the prey pulse has gone, it becomes time to just hang out and rest, or even move elsewhere until the next fishing season. Although some anglers, surfers, or maritime buffs may argue otherwise, the human element is on land, the sea being a place only to be visited for a time.

While the need to reproduce by any organism, from virus to seabird, is undeniably important, once a concert of adaptations necessary to accomplish this task has run its course, regarding seabirds, the largest proportion of their lives exist outside of the nesting season and, in most cases, at sea. It has been calculated, for instance, that 90% of an Adelie Penguin's *Pygoscelis adeliae* life is spent at sea, once one considers its non-breeding years as well as the portion of each year spent visiting nesting colonies on land (Ainley 1980). Are these creatures, like humans, just biding their inconsequential time between breeding, i.e., fishing seasons? Anyone who has spent any time on the ocean, a humbling realm for we land creatures, must appreciate the way in which seabirds exploit the wind, waves, and the preyscape to their advantage, with their unparalleled mobility often used to perfection. They are sea creatures first and foremost who make temporary, though necessary, visits to land but otherwise exist in their aquatic element.

A familiar example is provided by the five eastern boundary currents (EBC)—California, Peru, Benguela, Canary, Somali—which provide a vast proportion of fish resources to humans and seabirds (Glantz & Thompson 1981). Their wind-driven upwelling, though it can be seasonally and periodically reduced, provides incredible productivity that supports the world's pre-eminent forage fishes, the clupeoides (sardine, anchovy, herring) and scombrids (mackerel), as well as swarms of invertebrates (euphausiids). These currents also host, or once hosted, an unimaginably abundant community of resident avian fishers (e.g., Murphy 1936, 1981), as well as being the targets for once incredibly abundant seasonal human fishers who occupied home ports (during nesting/fishing seasons) but in many cases traveled long distances from elsewhere (e.g., Glantz & Thompson 1981 [and chapters therein], Spear & Ainley 2008, Block et al. 2011). Illustrating well the marine nature of seabirds is one of these EBCs, the California Current, although what we propose applies as well to seabirds elsewhere. Having been subject to decades of systematic fishery and food web assessments, along with extensive quantification of seabird fauna and their natural history—subjects within which we have been involved—the California Current, without argument, is the best-known stretch of ocean on the planet and is easily the best known of the EBCs.

While EBCs offer incomparable productivity and availability of forage species, they have few islands owing to the subduction of continental plates moving beneath those of the continental coast, thus

'eating' islands. These boundary currents are also characterized by a Mediterranean climate, which leaves any seabird nesting islands that haven't been swallowed by tectonic forces a very limited commodity, but largely xeric and devoid of soil. This means that any burrow-nesting seabird must use natural cavities in which to provide for their home-port needs, with the exception of the once deep guano provided by surface-nesting cousins, the 'guano birds,' at least in the Peru and Benguela upwelling systems (Murphy 1925, Crawford 2007). The coasts of EBCs tend to be deserts or near-deserts, and that limitation leads to intense competition and ultimately to 'floating' portions of populations composed of reproductively mature individuals of breeding age who have lost the competition for nesting space (e.g., Ashy Storm Petrel *Hydrobates homochroa*; Ford *et al*. 2021, Ainley *et al*. ms). Those who own cavities and can defend them just keep reproducing, while the others play a game of waiting their chance. Infrequent perturbations, such as anomalously warm surface waters that are symptomatic of pauses or prolonged diminishment of upwelling, or inadequate prey resources during the non-breeding periods, leads to skipping or even mortality of established breeders, providing a major opportunity in some years for 'floating' individuals to move into vacated burrows. These 'floaters' are essentially marine creatures 100% of their time, other than very brief land visits for prospecting. For example, Cassin's Auklets *Ptychoramphus aleuticus* on the Farallon Islands show incredible spikes in the proportion of new recruits following mass mortality events of breeding adults from localized marine heatwaves and/or El Niño conditions (Johns *et al*. 2021).

In addition to competition for nesting habitat, the incredible availability of forage species in the California Current and other EBCs, by being the target of both resident and visiting seabirds, leads to trophic competition. The two numerically dominant avian species in the California Current are the year-round resident Common (California) Murre *Uria aalge* (*californica*) and the seasonal, non-breeding resident Sooty Shearwater *Ardenna grisea* (Leirness *et al*. 2021, Russell *et al*. 2023). The murre, a deep diver that can exploit the entire water column of the continental shelf, occurs year-round close to the coast out toward the shelf break, mostly in the main central upwelling region, which lies between Cabo Blanco, Oregon, and Point Conception, California (Checkley & Barth 2009). The Sooty Shearwater, a shallow diver, spends the majority of its year, from about April through September, mainly in waters of the outer shelf and slope in the central upwelling region. During a month on either side, they are either moving toward or away from Southern Hemisphere breeding locations (Spear & Ainley 1999, Schaffer *et al*. 2006). The sheer numbers and density of murres inshore appears to be a factor relegating the shearwater, foraging on the same prey, to more offshore continental shelf/slope waters (Ainley *et al*. 2009).

The California Current, through its physiographic, climatic, and oceanographic characteristics, also illustrates a curious, though typical phenomenon of breeding seabird species being associated with respective islands only for the breeding season and then escaping the less-productive period to spend most of their year at sea elsewhere. It could well be a pattern exhibited by various species in all EBCs, as well as many other regions (e.g., all the New Zealand-breeding species that head for the Peru Current; Spear & Ainley 2008). This is best demonstrated by the well-studied, cavity-nesting Pigeon Guillemot *Cepphus columba* (Johns & Warzybok 2022). In the California Current region, this species' breeding population is dominated by that at the Farallon Islands, with scattered, much smaller nesting assemblages along the coast northward and slightly southward (Edwins 2020). Based on biologging and some at-sea information, central California-nesting guillemots spend three-fifths of their year in waters off British Columbia and Southeast Alaska, making a mad dash to central California only for nesting before making a mad dash back. Even at the colony during the nesting period, guillemots spend only 25% of the total daylight hours of the incubation and nestling-feeding period on land; the on-land connection increases somewhat because most sit by nest cavities at night (Johns & Warzybok 2022) seemingly to ward off competing, cavity-nesting auklets that are nocturnally active on land (Ainley & Boekelheide 1990). They make the temporary journey to central California conceivably to take advantage of an amazing abundance of mid-water dwelling juvenile rockfish *Sebastes* spp., these rockfish being among the 'foraging currency of choice' to most central California Current predators during the spring and summer (Lenarz 1980, Adams *et al*. 2017). These rockfish dominate the Pigeon Guillemot breeding season diet when the resource is available, which is most years (Ainley *et al*. 1995, Johns *et al*. 2020). While at-sea data during winter are sparse, the addition of biologging results suggest that the southward, nesting season movement would be considered 'partial migration' (Lambert & Fort 2022) since the pre-breeders likely remain in Pacific Northwest waters.

Why do the guillemots not remain year-round in the central California Current? While it could be that they are avoiding stormy conditions (literature summarized by Johns & Warzybok 2022), Common Murres remain to weather the storms. Alternatively, by departing, the guillemots avoid trophic interference competition with the incredibly abundant and dense murre, which does occupy the autumn-winter habitat that the guillemots would otherwise use, i.e. the shallower waters along the California-Oregon coast (*c.f.* Edwins 2020, Ainley *et al*. 2021). The guillemots would lose the competition, as the abundant murres take both mid-water and benthic prey (Ainley *et al*. 2021). On Southeast Farallon Island there are about 4 500 breeding guillemots (an atypically large concentration for the species), using all available cavities, competing with three other cavity-nesting alcid species (Ainley & Boekelheide 1990). That compares to (currently) 300 000 murres in surrounding waters, but likely double that population exists considering the other murre nesting locations elsewhere in the Gulf of the Farallones (Johns *et al*. 2020). Before the arrival of Europeans, the central California murre population numbered in the several millions (Ainley *et al*. 2021), but no doubt, limited by cavity availability, the guillemot nesting population likely was little different than now. No wonder the guillemots 'figured out' that escape to the north was their best option. There are relatively few murres frequenting the waters from central Oregon to Southeast Alaska at any time of year (Ainley *et al*. 2021).

Somewhat similar in pattern, but even more extreme, are the movements of the less well-known Scripps Murrelets *Synthliboramphus scrippsi* and Guadalupe Murrelets *S. hypoleucas*. They nest in small cavities, sometimes under bushes if available, on offshore islands in Southern California and Baja California for only the few weeks of laying and incubation, vacating these islands with their newly hatched chicks only a few days old in tow on a journey north to British Columbia (Drost & Lewis 2020, Nettleship & Kirwan 2020). They are at sea for almost the whole year. Perhaps the same can be said of the dark-rumped storm petrels that also nest on Southern California/Baja California islands and which associate with those islands and surrounding waters only for nesting. Though

the period of colony visits is much longer than the murrelets, they then go southward, spending most of their year at sea in the Gulf of Panama and northern Peru Current during that region's most productive season (Spear & Ainley 2007).

Viewing seabirds in the way we have pictured them, using the California Current as the backdrop, is very different from the almost exclusive colony-based view in the mindset of the majority of seabird biologists. Seabirds are marine creatures, and viewing them as such may better facilitate their conservation given that commercial fishing, i.e., an activity at sea, has hugely decimated their food supply and subsequently their numbers (Palescny *et al*. 2015, Grémillet *et al*. 2018). Considering the vast number of individuals not engaged in breeding activities (juveniles, pre-breeders, floaters, and skippers) and which occupy the realm beyond the gaze of our binoculars and scopes, we biologists, managers, and conservationists must account for the total population when making assessments on the fragility and resiliency of seabird species in the process of devising management strategies. Cases in point include a positive one, management of the California Current's marine resources resulting in the recovery of seabird populations (https://baynature.org/2019/06/14/how-people-saved-the-seabirds-of-the-california-current/), but for the Benguela Current a negative one. To save the African Penguin *Spheniscus demersus* from going extinct in the wild, protection of colony foraging areas has proved effective toward improvement of breeding productivity (Pichegru *et al*. 2010, 2012), but better management of trophic resources for non-breeding penguins outside of these reserves is also required to conserve this seabird (Sherley *et al*. 2017).

Simply put, focusing on parameters measured at the colonies is not enough to paint an adequate picture of the threats faced and resources required of seabirds throughout the entire year, and throughout the lives of these truly sea-going birds. Although great strides have been made in the age of miniature biologging devices that have provided new perspectives on the at-sea movement and behavior of seabirds, these devices are typically deployed on breeding individuals from the colony. As seabird researchers, we should strive to seek funding and to innovate in ways that allow us to measure and quantify the at-sea behavior of juveniles and non-breeders as well, as these individuals represent the future reproductive contributions to populations. That includes being sea-going ourselves, more so than we have been of late, to provide an ecological and marine community context to the single-species efforts prominent these days. We argue that shifting one's mindset away from the colony-centric view of seabirds most familiar to the human experience may lead to more informed questions, with study designs that incorporate the non-breeding aspects of a population and annual cycle that are generally written off as nuances when making inferences.

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