BOOK REVIEW

Island Biogeography in the Sea of Cortez. Case, Ted J. and Martin L. Cody, eds. 1983. University of California Press, 2120 Berkeley Way, Berkeley, CA 94720. xii + 508 pp., 72 line drawings, 11 halftones, 33 tables. $55.00.

The birth of this volume was a symposium on the same subject at the University of California, Los Angeles, in 1977. That this title has come along so many years later is a blessing, presumably to be attributed to the editors. For once the papers from a symposium have been rewritten, reviewed and assembled with the idea that a collaboration can be coherent and cohesive. One would not expect 15 writers to agree on everything; they certainly do not. But at least they are discussing the same region and addressing some of the same issues.

Individual writers were given the choice between using "Sea of Cortez" and "Gulf of California" (so the reviewer gets his choice, too). Whichever name is used, the body of water is the 1070 km-long, 100 to 200 km-wide division between the peninsula of Baja California and mainland Mexico. The specific focus was the islands, of which there are about 25 major ones, including 67 km-long Angel de la Guarda (elevation 1315 m) and Tiburón with an area of 1,000 km^2, and about 10 very small islets.

These desert islands are, on relative terms, some of the most pristine in the world. The species of plants and vertebrates present on the various islands are now reasonably well known, partly through the efforts of the authors. Many gaps remain (and are freely admitted), and with basic inventories only just completed, one can imagine the potential for the study of the biology of individual species and of community ecology. Discussions of invertebrates are not included.

Two chapters deal with birds. Chapter 8 (pp. 210-245) by Martin L. Cody is on the land birds. Cody begins the chapter with a discussion of the potential sources of the island avifaunas, especially the Sonoran desert which borders the Gulf of California. The Sonoran desert as a whole does not have a particularly distinct avifauna; most species occur widely in other deserts or other habitats. The "Gilded" Flicker is the closest to being typical of the region and endemic. Because the islands are low and dry, montane colonists need not apply, and the nearby montane regions come in for only limited discussions. Also included is a brief but adequate discussion of patterns of (primarily) subspecific differentiation along Baja, as well as other oddities of the peninsular avifauna.

To provide comparative data for his investigations of the islands, Cody did some basic census work on the mainland (the species lists are in the appendices). Seven sites are in the typical desert habitats around the northern and central Gulf, and four in the thorn scrub of the summer rain region on both sides of the mouth of the Gulf.

Not surprisingly, the birds of the islands are drawn from the surrounding deserts. No species are endemic to the islands, and only a few weakly differentiated races are unique to the islands. It is always interesting to see which species are absent: Greater Roadrunner is not a surprise, but the absence of Cactus Wren from all but one of the cactus-rich islands is startling. Perusal of the species lists reveals other interesting occurrences — for instance, Great Horned Owl, which has not colonized the Channel Islands of California, is present on 10 of the large islands.

Much of the purpose of this volume is to discuss island biogeography, and Cody devotes most of his chapter to a discussion of the observed patterns. While I am not facile with the mathematical models of this discipline, most of Cody's conclusions seemed reasonable. A latitudinal change in the species composition is related to the brushier thorn scrub habitats of the southern islands and adjacent source areas. The richest island, Tiburón, is the largest, lies only 2 km from the mainland, and was formerly connected by a landbridge (current channel depth: 3 fathoms).

Cody found that 79% of the variability in bird species could be attributed to the area of the island. Distance from shore (never too far in the Gulf anyway) and the former

presence of a landbridge were relatively unimportant. For a given size of island, the species present are quite predictable. As island size increases, there are changes in hydrology and thereby floristic diversity, which is in turn related to an increased number of bird species present; Cody attempts, with mixed success, to develop a stadial model for this relationship. Species present on small islands are also present on large islands; the presence of a habitat is more important than the presence (or absence) of other species. Undoubtedly extinctions occur from time to time, but in most cases there is probably rapid replacement by the same species. It is also important to realize that in this desert avifauna, few taxonomically closely related species act as substitutes; there are few "either/or" situations, although obviously some reductions occur in groups such as wrens and thrashers from mainland to island sites.

A couple pages of discussion of migrant landbirds contribute little. Appendix 8.8 gives a number of records island by island for migrants and wintering species. Although the records increase substantially the meager amount published previously, Cody does not indicate which were recorded in spring or fall, a fact of considerable importance, given the different routes some species take coming and going. Black-lored and white-lored White-crowned Sparrows can be easily separated as adults; such information would provide preliminary sorting of the populations of that species. The presence of wintering Savannah Sparrows in the intertidal zone is nice, but are they small-billed or large-billed salt marsh forms, or pale interior birds? Migration was not the main focus of the author, nor has he had the chance to do extensive field work on all the islands; the subject of trans-gulf migration (both directions in both seasons) of landbirds is an exciting field deserving much study.

There are other quibbles. I am uncomfortable with statements such as the one that Xantus' Hummingbird complements "Costa's hummingbird in a role comparable to that of the black-chinned hummingbird elsewhere." Some of the range maps (e.g. Xantus' Hummingbird and Bendire's Thrasher) seem a bit generous. However, the factual basis is sufficiently solid, and most of the conclusions have been erected on firm scaffolding. This interesting and thought provoking article should leave most readers much better informed about the biogeography of the entire region.

Chapter 9 (pp. 246-264) by Daniel Anderson is about the seabirds. To some extent it does not fit into the rest of the book. Seabirds are extremely mobile animals which seek oceanic islands for refuge and often to avoid the dangers of the mainland. Thus, many of the central concerns of island biogeographers expressed in other chapters simply do not apply. However, the seabirds are a conspicuous and well publicized part of the gulf biota, and the chapter is a welcome one.

Anderson briefly considers biogeography. Considering the Gulf of California as a region, only 1 of the 14 breeding seabirds is endemic: the Yellow-footed Gull. If the region on the western side of Baja is included, the figure becomes 4 of 14: Heermann's Gull, Elegant Tern and Craveri's Murrelet are added to the total. Even so, the percentage of endemism is substantially less than that of the San Diego province/California region. In terms of origin, Anderson calculates that 73% of the breeding birds of the Gulf of California have a southern, warm water origin, whereas 27% are of northerly, cold water affinities. Many of the breeding species largely leave the Gulf after breeding, including post-breeding dispersal north along the Pacific Coast and migration south to wintering grounds.

Anderson reviews methods of feeding, the typically estuarine species which breed on island shorelines, and the characters that make islands suitable breeding sites. He also points toward some basic subjects still in need of study, such as the degree of competition between Black and Least storm-petrels, or Royal and Elegant terns, and the adaptations of some nesting species to desert conditions. Three appendices summarize characteristic feeding areas and methods, food, nesting substrate, general range in the Gulf and the number of islands used for breeding, and general population estimates, and present an assessment of the importance of the Gulf as a breeding

ground for a given species and/or race. I found the estimates of population size particularly interesting, and some of Anderson's information on these topics will prove useful to conservationists wishing to extend the limited protection now received by the islands in the Gulf.

Anderson's chapter is mostly a review, although his field work has added to what was known. Clearly much remains to be learned about seabirds in this region. I was somewhat frustrated by this chapter, partly because a number of topics were only mentioned in passing. The statement that "In fact, I have studied at least six seabird species that freely migrate across the peninsula (Anderson, field notes)" leaves me climbing up the wall — which ones? Elegant Tern has not been conclusively recorded in the interior of the southwestern U.S., and yet is common in the northern Gulf; I have always wondered if the birds breeding on Isla Rasa reached California via Cabo San Lucas or by hopping Baja California. Also, the importance of the Gulf as a wintering ground for many waterbirds and as a corridor for migration deserved more attention. Although some of these topics are only distantly related to island biogeography, they are related to the Gulf as a whole, and I suspect that the author knows a great deal about these subjects, subjects which arouse the curiosity of many.

In addition to the two chapters on birds, there are ten other chapters on which I shall comment briefly. I wish to stress that the subject of the title, the islands of the Gulf, may seem limiting because few people will actually visit the islands. However, biogeography must deal with the source areas, which principally include Baja California, Sonora, Sinaloa and the Sonoran desert portions of the United States. Many of the chapters serve to introduce these vast and fascinating areas in as much detail as the islands themselves.

Chapter 1 by George E. Lindsay is a brief history of the scientific exploration of the region and introduces the reader to some of the major figures and important institutions. A "recommended reading" section might have been a nice touch and a good way to pick the most important titles from the extensive bibliographies presented later.

Chapter 2 is on the geology of the islands. By Gordon Gastil, John Minch and Richard P. Phillips, this chapter is not too technical and provides an overview of the formation of the entire Gulf. Two tables give the principal rocks, probable ages and origins, areas, distances to the nearest land, and depths of the intervening channels for all the islands.

Linda Yvonne Maluf wrote the chapter on physical oceanography. A number of figures help present a clear picture of the bottom of the Gulf, tides, salinity, water temperature, currents and dispersal of sediments. I particularly enjoyed this chapter; for instance, I was intrigued by the fact that the evaporation from the Gulf is greater than the inflow of fresh water.

Plants are the subject of Chapter 4 by Martin Cody, Reid Moran and Henry Thompson. A long chapter, the first parts add to the preceding chapter by giving valuable information on the physical setting, including temperature and rainfall. Other topics include the phytogeographic regions around the Gulf, the paleohistory of those regions, plant communities on the islands, and all the subjects of concern to an island biogeographer in relation to those communities. A final section considers in detail the ecology of a few major families (e.g. cacti). For this very poor botanist, the chapter was still readable and interesting.

Chapter 5 is on the rocky-shore fishes. I hadn't thought about the island biogeography of salt-water, inshore fishes before, so I cooked up a few quick theories. Donald Thomson and Matthew R. Gilligan wrecked them in the course of an educational chapter on fish.

Reptiles are the subject of Chapter 6 (Robert W. Murphy: Origins and Evolution) and Chapter 7 (Ted J. Case: Ecology). Chapter 10 by Timothy E. Lawlor is on the mammals. The result of their work is 103 pages of information on the distribution and ecology of these vertebrates, obviously more than can be easily summarized. I will

confine myself to saying that it is interesting to consider the many differences between birds and other groups of organisms in relation to island biogeography. For instance, the former presence of a landbridge often has much greater lingering effects on a reptile or mammal fauna than it has on the more vagile bird and plant communities.

In Chapter 11 Conrad Bahre discusses the human impact on the Midriff islands. I felt that the author, by sticking closely to a thoroughly collected assortment of facts, leaned too far backward from making even some tentative conclusions about the effect humans have had. Still, Bahre presents much of interest on the diet of the Seri Indians, mining of guano, and hunting of sea turtles, and provides a good reminder that this region, particularly its fisheries, will come under increasing pressure as the population of northwestern Mexico continues to grow rapidly.

Chapter 12 by Case and Cody concludes and summarizes the preceding chapters; it also might be the best chapter to read first. For those with little knowledge of the principles of island biogeography, there is an extended introduction. I don't think any punch lines would be spoiled by reading the conclusions first, and the conclusions might make the individual chapters more instructive by providing a framework on which to hang the more isolated facts and inferences. If you are looking for some real conclusions, well, "there is no unanimous support for the equilibrium theory." Still, this volume conveys the usefulness and excitement of island biogeography, and suggests that although no laws are carved in stone, there is much order in a seemingly random world.

The 157 pages of appendices present two basic types of information: details to support statements by the authors and detailed lists of the flora and fauna of the islands. These lists are very dry, but will undoubtedly be an essential reference for those visiting the islands or starting research projects.

Although this book was easy to read and attractive, I feel that the technical editing was a bit lax. In the bird chapters I found a number of lapses, such as "Gilded Woodpecker" and "black-throated hummingbird;" in another case, a more serious error was "black-chinned sparrow" (p. 239) where "black-throated" was meant. I was particularly struck by the number of maps, figures and tables which had errors (misspelled names of islands, switched captions) or omissions (unexplained symbols). While not of epidemic proportion, and generally detectable and correctable, the errors do leave me hoping that the appendices were very carefully checked.

The book has one serious problem: a 500-page, hardcover volume without color art or photographs seems very expensive at $55. This volume is an absolute must for regional libraries and institutions in the Southwest and for serious research libraries around the world. It will be valued by people studying this region, planning extensive visits, or studying the biology of islands. But for the less affluent who wish, as the dust cover suggests, to vicariously explore this region, I would suggest visiting the first refuge of the vicarious explorer: the library.

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