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INTRODUCTION

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The ecosystems of the Colorado River Delta Region (Sykes 1937), from California's Salton Sea to the delta of the Colorado River in Sonora and Baja California, Mexico, are characterized by abundant and species-rich avifaunas, a history of massive natural and anthropogenic environmental changes, and intense scientific and political discourse regarding the region's near and long-term future. Given today's imperiled status of the ecosystems of the Salton Sink (the below-sea-level basin within which the Sea lies) and Colorado River Delta, and the recent focus on the maintenance and enhancement of natural resource values in this broad region, current and historical biological data are an especially valuable commodity. As few published accounts of recent faunal investigations exist for this area, we recognized the need for such baseline documentation. Hence, our objectives for this volume were (1) to organize into a single publication a series of contributions that not only complement recent efforts to establish baseline data on the Sea's avifauna (Shuford et al. 1999, 2000; Patten et al. 2003) but also impart additional depth and long-term perspective to these works, and (2) to emphasize the continued importance of the Salton Sink to avian populations and its connectivity to important avian habitats throughout the Colorado River Delta Region, the arid West, and the larger Pacific Flyway.

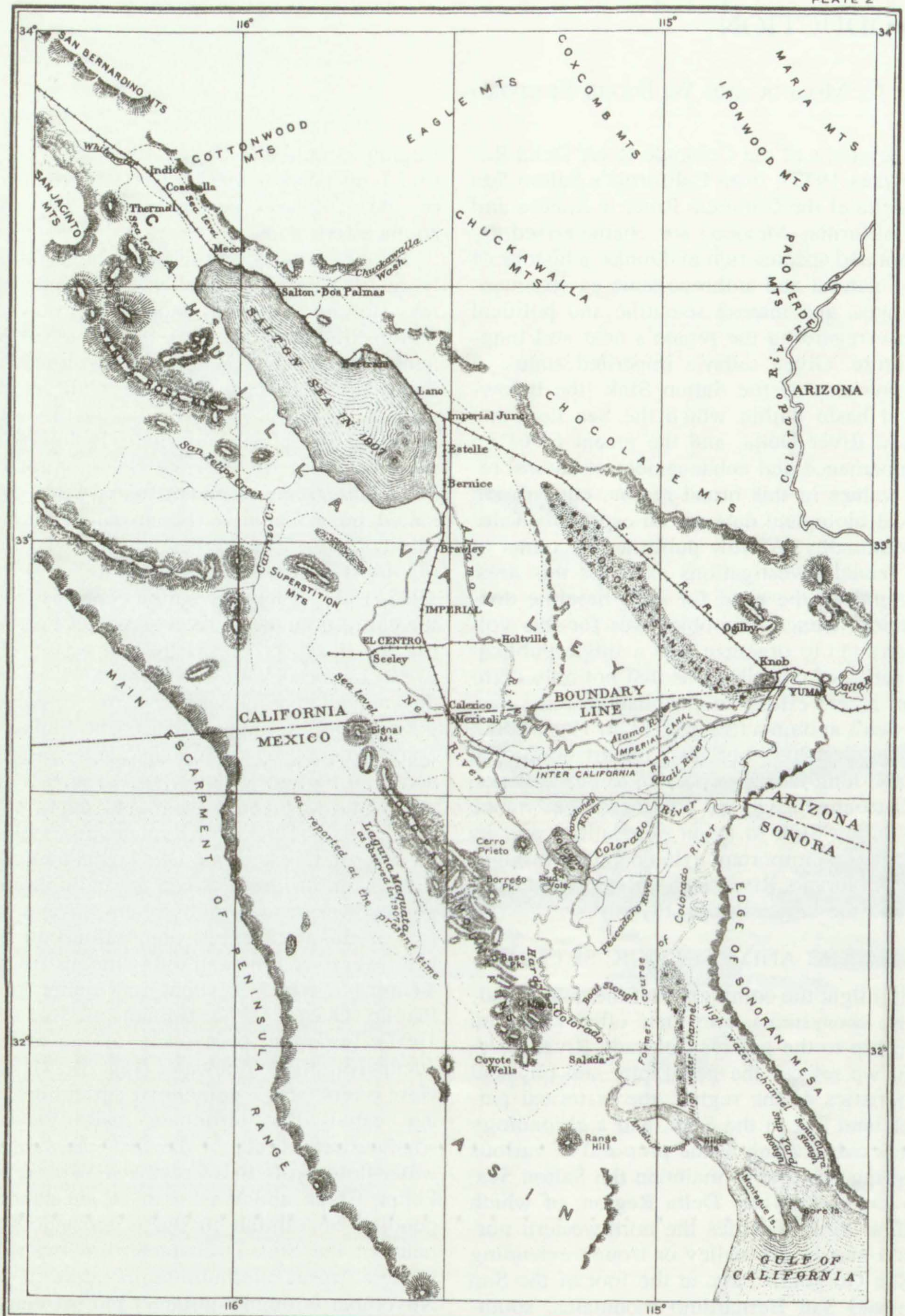
GEOGRAPHIC AND ECOLOGIC SETTING

To highlight the complexity of the unique Salton Sink ecosystems, and their often forgotten relationship to the greater Colorado River Delta Region, we review the geography and physical characteristics of the region, the historical patterns of land use in the Sink, and a chronology of events culminating in the proposal of various engineering projects to maintain the Salton Sea.

The Colorado River Delta Region, of which the Salton Sink occupies the northwestern portion, is a narrow rift valley or trough extending from San Gorgonio Pass, at the foot of the San Jacinto and San Bernardino mountains, southward to the mouth of the Colorado River and into the Gulf of California (Fig. 1). It is bordered on the west by the peninsular ranges of southern California and northern Baja California, and on the east by the Little San Bernardino, Orocopia, and Chocolate mountains of California and the Gran Desierto (or Sonoran Mesa) in northwestern Sonora, Mexico. The Colorado River Delta Region occupies an area of some 8612 km^2 (3325 mi^2; Sykes 1937). Here the main course of the Colorado River follows the region's southeastern flank.

The present day Salton Sea, a large saline lake lying between the Coachella and Imperial valleys (the northern and southern portions of the Salton Sink, respectively), is the largest permanent water body found in the Colorado River Delta Region, apart from the Gulf itself. The path of the Colorado River has historically meandered, and at various times it flowed northwestward directly into the Salton Sink (Sykes 1937), creating a large ephemeral body of water called Lake Cahuilla (Patten and Patten-Smith *this volume*). The highest surface elevation of the most recent lake was about −60.7 m in 1905–1907, when the Salton Sink last received the entire flow of the river as winter floods overran the banks of the earthen diversion channel to the Imperial Valley (Sykes 1937); its present day elevation is about −69.2 m (Imperial Irrigation District, unpubl. data). The Salton Sea is approximately 56 km in length and nearly 24 km across at its widest point, with a surface area of about 984 km^2 and a maximum depth of about 15.2 m (U.S. Bureau of Reclamation 1997). Water level in this terminal lake is maintained today by an equilibrium between agricultural and municipal wastewater inflows and an evaporation rate of about 1.8 m per year. Salinity of the Sea has risen over time and today ranges from 38 to 44 mg l^{-1}, which is about 25% saltier than the Pacific Ocean (U.S. Bureau of Reclamation 1997). Important permanent inflows to the Sea occur from the Whitewater (Fig. 2), Alamo, and New rivers, and a number of agricultural drainage canals that terminate mainly along the southeastern border of the Sea. Seasonal freshwater flows from Salt Creek and, especially, San Felipe Creek and Wash can be substantial, depending on rainfall in the watershed. The climate of the Sink is characterized by mild dry winters (mean minimum temperature of 7°C for November through February) and extremely hot, dry summers (mean maximum temperature of 40°C, June through September; http://www.wrcc.dri.edu). Annual precipitation (measured at Imperial, 30 km south of the Sea) averages about 7.5 cm and occurs mainly from August through March. An extensive system of irrigation canals allows intensive flood-irrigated agriculture to be practiced year round.

PLATE 2



Compiled by G. Sykes

MAP OF THE DESERT OF THE COLORADO

FIGURE 1. Map of the Colorado River Delta Region adapted from that compiled by G. Sykes in MacDougal (1914) depicting the extent of the Salton Trough.

FIGURE 2. Aerial view of the west (foreground) and east levees of the Whitewater River delta at the north end of the Salton Sea. Photo by K. C. Molina, January 1993.

The initial fish fauna of the Salton Sea consisted of freshwater species present in the Colorado River drainage, such as carp (*Cyprinus carpio*) and striped mullet (*Mugil cephalus*), which were introduced during the filling of the basin in 1905–1907 (Walker et al. 1961). Although a variety of species of game fish were released into the Sea beginning in 1929 in an effort to establish a sportfishery, the present day fish community was largely a result of introductions of three marine species, orangemouth corvina (*Cynoscion xanthulus*), bairdiella (*Bairdiella icistius*), and sargo (*Anisotremus davidsoni*), made by the California Department of Fish and Game in 1950 and 1951 (Walker et al. 1961), and later of tilapia (*Oreochromis mossambicus*; Riedel et al. 2002).

Because of the Salton Sea's challenging environment with its wide annual range in water temperature, seasonal anoxia in deeper waters, and the odd chemical composition of its marine-like waters, the invertebrate fauna of the Salton Sea is limited to a few numerically important species (Linsley and Carpelan 1961). These are the pileworm *Neanthes succinea,* the copepod *Cyclops dimorphus,* and the barnacle *Balanus amphitrite. Neanthes,* believed introduced in 1930 along with other faunal introductions by California Fish and Game, was the most important prey of carnivorous fish. *Cyclops* was probably an important food source, especially in summer and fall, for filter feeders such as young bairdiella. The larval stage of *Balanus,* although prevalent, was probably not an important food source for fish (Linsley and Carpelan 1961). A 1999 investigation of invertebrate fauna (Detwiler et al. 2002) found *Neanthes* and *Balanus* to still predominate. These authors reported two amphipods (*Gammarus mucronatus* and *Corophium louisianum*) and the polychaete *Streblospio benedicti* to also be numerous; all were thought to be established after 1956.

Several other important permanent wetlands are associated with the Salton Sea. The Finney-Ramer Unit of the Imperial Wildlife Area (Fig. 3), containing recreation lakes north of Brawley, and the Wister Unit along the southeastern shore are managed by the California Department of Fish and Game. The key components of wildlife habitat at the Sonny Bono Salton Sea National Wildlife Refuge include the Hazard Unit (Fig. 4) and impoundments at Units 1 and 2 (Fig. 5). Fig Lagoon, near Seeley, is managed by the Imperial Irrigation District. Several experimental projects in various stages of development along the New River (Miller 2002) provide riparian

FIGURE 3. Heronry, comprised of mainly Cattle Egrets, at Finney Lake of the Imperial Wildlife Area. Photo by A. Small, May 1992.

and additional wetland habitats in the Imperial Valley, as do a number of seasonal wetlands on private lands.

Important avian habitats in the Salton Sink are not limited to the Sea or its associated wetlands. Water was first diverted from the Colorado River to farmland in the Imperial Valley in 1901, and by 1927 it was being delivered to about 1575 km^2 of cropland (http://www.iid.com/aboutiid/history-how.html; Imperial Irrigation District, unpubl. data). Today an average of nearly 1900 km^2 of land in the Imperial Valley alone are irrigated annually (http://www.iid.com/water/irr-agriculture.html). Although the extent of irrigated agriculture has leveled off in recent decades, agricultural practices have intensified with more multi-cropping on the same land in a single year (C. Sidhu, Imperial Irrigation District, pers. comm.). Because of the great extent of flood-irrigated land combined with the high rates of crop turnover, particularly in the Imperial Valley, a large and varied array of feeding and resting habitats are nearly continuously available to many waterbird and shorebird species. Some of these, such as the Cattle Egret (*Bubulcus ibis*), White-faced Ibis (*Plegadis chihi*), Long-billed Curlew (*Numenius americanus*), and Ring-billed Gull (*Larus delawarensis*), congregate in these flooded fields in large numbers. Agricultural lands, especially in the Imperial Valley, support significant populations of several species that have declined elsewhere in the state. For example, a substantial proportion of California's wintering population of the Mountain Plover (*Charadrius montanus*), representing 30–50% of this species' global population, finds sustenance in the many disked, burned, and grazed fields that are readily available in the valley (Wunder and Knopf 2003, Shuford et al. *this volume*). Resident Burrowing Owls (*Athene cunicularia*), exploiting the vast network of earthen drainage canals and abundant food supplies, also reach high densities here (DeSante et al. *this volume*). Although the extensive irrigated agriculture in the Imperial Valley appears to have benefited many species of birds for many decades, conversion to cropland has probably displaced some landbirds that once occupied and depended upon the sparse alkali scrublands in this area.

Some native mesquite (*Prosopis* spp.) woodland was present in the wetter and more alkaline portions of the Sink, particularly to the north between the towns of Indio and Mecca (MacDougal 1914). Mesquite was apparently never widespread or extensive prior to the conversion of land to agriculture or urban development, and

FIGURE 4. A freshwater impoundment of the Hazard Unit near the southeast shore of the Sea where gulls, terns, skimmers, and shorebirds loaf and feed. Photo by K. C. Molina, July 1997.

only a few remnant patches remain (Patten et al. 2003). Riparian habitat, now almost exclusively dominated by exotic *Tamarix*, exists in the Imperial Wildlife Area, and along extensive reaches of the New, Alamo, and Whitewater rivers, where it is highly degraded by channel maintenance activities; small bosques of mesquite, willow (*Salix*), and cottonwood (*Populus*) are established and managed on some state and federal refuge lands (K. Molina, pers. obs.) as well as in some parks in Brawley near the New River (Patten et al. 2003).

South of the Imperial Valley in the northeastern corner of Baja California and adjacent Sonora, Mexico, lies the Mexicali Valley. Together these two valleys form a nearly contiguous swath of highly productive farmland. Although its avifauna and habitats are less well known than those north of the border, the Mexicali Valley region has recently received increasing attention (Patten et al. 1993, 2001; Hinojosa-Huerta et al. 2001, 2002, *this volume*; Anderson et al. 2003). The Río Colorado corridor (Fig. 6) snakes southward to the Delta along the valley's eastern border. Although degraded by reduced instream flows as a result of upstream diversions and dominated in most areas by exotic *Tamarix*, the river provides expanses of important riparian habitat, including significant stands of mature cottonwood/willow gallery forest (Cohen et al. 2003, Hinojosa-Huerta et al. *this volume*). The Río Hardy drainage (Fig. 7) and the wetlands associated with it along the valley's western border in Baja California are generally supported by agricultural return flows and are largely vegetated by *Tamarix* and other salt-tolerant species (Hinojosa-Huerta et al. *this volume*). The extensive marshes of the Ciénega de Santa Clara, maintained by agricultural drain flows from Arizona, and the pocket wetlands near El Doctor (Fig. 8), formed by a series of artesian wells or pozos along the escarpment of the Gran Desierto south of the Ciénega, provide a variety of permanent or near-permanent wetland and riparian habitats along the delta's eastern edge in Sonora (Glenn et al. 1996). The ponds at the Campo Geotérmico Cerro Prieto (Fig. 9), at the head of the Río Hardy drainage, and Isla Montague, at the mouth of the Río Colorado, provide important nesting habitat for colonial breeding waterbirds and other taxa such as the Large-billed Savannah Sparrow (*Passerculus sandwichensis rostratus*; Palacios and Mellink 1992, 1993; Peresbarbosa-Rosa and Mellink 1994, Molina and Garrett 2001).

FIGURE 5. Nesting islets in the freshwater impoundment (Rock Hill ponds) of the Sonny Bono Salton Sea National Wildlife Refuge headquarters. Photo by K. L. Garrett, July 2001.

ENVIRONMENTAL ISSUES AND THE RESTORATION PROCESS

The Salton Sea lies within a closed basin and receives large inputs of agricultural and municipal wastewater heavily laden with salts and nutrients. Because of the Sea's high evaporation rates, which effectively concentrate dissolved substances, issues of water quality have long been of concern. The Sea's continued and permanent existence as a repository for agricultural drainage is mandated by federal decrees enacted in 1924 and 1928, and by a State of California statute in 1968 (Salton Sea Authority and U.S. Bureau of Reclamation 1998). The agricultural industry of the Coachella and Imperial valleys, valued at over $1 billion annually (www.iid.com/water/irr-agriculture.html; Salton Sea Authority and U.S. Bureau of Reclamation 1998), is dependent on its ability to sequester agricultural drainage and discharge it to the Salton Sea (Salton Sea Authority and U.S. Bureau of Reclamation 1998). Feasibility studies focusing on the control of salinity and surface elevation began in the 1960s (Salton Sea Authority and U.S. Bureau of Reclamation 1998), but the lake's rising surface elevation and apparent stabilization of salinity, at least for the time being, allayed concerns and postponed further efforts (U.S. Bureau of Reclamation 2003). Water quality again became a concern when apparent declines in the Salton Sea's introduced sportfishery in the 1980s stimulated the establishment in 1988 of the Salton Sea Task Force, a public entity representing county governments and water districts (Salton Sea Authority and U.S. Bureau of Reclamation 1998). In response to the enactment of Public Law 102-575 in 1992 directing the Bureau of Reclamation to conduct studies of salinity control, the agency adopted a set of five goals to serve as criteria against which potentially suitable restoration projects would be evaluated (Salton Sea Science Subcommittee 2000, U.S. Bureau of Reclamation 2003). These criteria, some potentially at odds with others, were to (1) maintain the Sea as a repository for agricultural discharge, (2) reduce and control salinity and lake surface elevation, (3) provide endangered species habitat, (4) enhance the fisheries, and (5) protect human recreational values—hence, the genesis of the present-day Salton Sea Restoration Project. In 1993 the Salton Sea Authority, composed of county, water district, and tribal representation, was created as the local co-lead agency to act in tandem with the Bureau of Reclamation on a restoration project for the Sea. The Salton Sea Project Draft Evaluation of Salinity

FIGURE 6. Mature cottonwood-willow gallery forest (background) along stretch of the Río Colorado south of Carranza (= Ledon), Baja California. Photo by K. L. Garrett, June 1998.

and Elevation Management Alternatives was released in 1996 (Salton Sea Authority 1996), although its public distribution was limited and it did not garner widespread attention. These alternatives, mostly centered on the construction of diked impoundments within the Sea to sequester and remove salts from the remainder of the Sea, lacked consideration of water quality issues other than salinity, such as eutrophication and potential selenium, heavy metal, and organochlorine contamination. They also inadequately addressed the proposed projects' impacts to wildlife from potential loss and degradation of significant habitats as a result of surface elevation declines and increased development and recreational use at the Sea.

The Salton Sea Reclamation Act, enacted by Congress in 1998, directed the Department of the Interior to complete studies of restoration options complying fully with the five criteria set forth by the Bureau of Reclamation in 1992 (U.S. Bureau of Reclamation 2003). During this process the agency was to consider all options under a scenario of reduced inflows to the Salton Sea. Moreover, the Act explicitly deemed ineligible projects that relied on additional supplies of water from the Colorado River. This stipulation reflected a provision of previous legal compacts and federal court decisions that limited the beneficial use of Colorado River water to domestic and irrigation purposes (U.S. Bureau of Reclamation 2003).

In the 1990s the Salton Sea seemed to be experiencing a surge in the frequency and size of mortality events involving fish and birds, indicating an ecosystem increasingly under stress (Friend 2002). Historically, periodic fish die-offs at the Sea had been poorly documented. Most were attributed to anoxic conditions associated with high ambient temperatures and high nutrient loading stimulating seasonal algal blooms (U.S. Fish and Wildlife Service 1997). In 1992, an estimated 150,000 dead Eared Grebes (*Podiceps nigricollis*) littered the Sea's shores and shallow bays; the cause of this mass mortality has never been completely understood and will likely remain unresolved (Meteyer et al. *this volume*). Such large die-offs are not novel as grebe mass mortalities not associated with adverse weather conditions, but rather with disease or unknown causes, have been documented elsewhere in western North America since 1880 (Jehl 1996). However, in 1996 the loss of over 15,000 pelicans and other waterbirds was attributed to a particular strain of avian botulism not previously known to involve piscivorous birds

FIGURE 7. Stretch of the Río Hardy corridor in Baja California vegetated with *Tamarix* and the common reed, *Phragmites*. Photo by K. L. Garrett, September 1996.

(Rocke et al. *this volume*). Intense mass media interest in the bird die-offs fueled predictions of the Sea's imminent collapse and stimulated increasingly frequent and strident public outcries for immediate actions to "fix" the ailing body of water. Such media coverage also served to polarize public opinion, with equally strident voices proposing that the Sea be simply allowed to dry up or that the waters now nourishing the Sea be redirected to the more deserving "natural" wetland habitats of the Colorado River Delta. Paradoxically, during the late 1990s, tilapia populations in the Salton Sea exploded to form one of the most highly productive fisheries described for the species (Costa-Pierce and Riedel 2000), although an apparent reversal of this boom began around 2000 (Riedel et al. 2002).

As a result of Congress's 1998 enactment of the Salton Sea Reclamation Act, the Salton Sea Science Subcommittee was established in 1999 (and later became the Salton Sea Science Office). This entity was charged with facilitating baseline studies of the physical and biological characteristics of the Sea, identifying data gaps, and coordinating all scientific endeavors undertaken on behalf of the Restoration Plan, including scientific review of all proposed restoration alternatives (Salton Sea Science Subcommittee 2000). The results of many of these reconnaissance studies were published in 2002 in volume 473 of the journal *Hydrobiologia*. Two such investigations (Schroeder et al. 2002, Vogl and Henry 2002) indicated that past suspicions regarding high contamination loads of pesticides and selenium in the water column and in sediments of the Sea were largely unsupported. The efforts of the Science Office continue to the present and have been broadened recently to include consideration and study of issues such as eutrophication, salt precipitation, fugitive dust generation, and potential actions for their remediation.

Any such project to maintain the Salton Sea will necessarily be of massive proportion and require long-term monitoring. Although an initial Environmental Impact Statement and Report has been completed, a preferred project alternative was not identified (Salton Sea Authority and U.S. Bureau of Reclamation 2000). The environmental assessment process continues with more detailed analyses of potential alternatives and the refinement of their designs (U.S. Bureau of Reclamation 2003). Although the state legislature has approved funds for a project feasibility study, funding for project construction and

FIGURE 8. Pozos or artesian wells near El Doctor, supporting native wetland and riparian vegetation, along the escarpment of the Sonoran Mesa. K. L. Garrett, October 1997.

an adaptive monitoring program has yet to be appropriated.

Adding considerably to the significant challenges inherent in the restoration of the Salton Sea is the impending allocation of a greater proportion of Colorado River water to urban uses. These water transfers, along with reductions in the total allotment of Colorado River to California, will necessitate stark conservation measures by agricultural users and will greatly reduce freshwater inflows to the Salton Sea. These diminished flows may make any proposed engineering project to sustain the present extent of the Salton Sea a financial impossibility. Similarly, adequate freshwater flows to the Colorado River Delta lack long-term assurances. Massive human population growth expected to continue on both sides of the border will present ever-greater challenges for the sustainability of the region's wildlife habitat. Interestingly, several of the most recently proposed restoration options for the Salton Sea include desalinization of the New, Alamo, and Whitewater rivers, an engineering component whose cost until recently was considered prohibitive. Ironically, however, these plans propose to export any of the freshwater produced by this technology to urban centers (Salton Sea Authority 2003), and it is unclear how much will be returned to sustain aquatic habitats at the Sea. Ultimately, an innovative interpretation of laws governing the "beneficial uses" of water in the region and the acquisition of long-term water leases (Cohen et al. 2003, Gold 2003) dedicating freshwater flows to the Sea and Delta will be necessary to help ensure that the needs of wildlife and wetland habitats are accommodated.

One of the initial obstacles to a more complete understanding of the significance of the Salton Sea's aquatic and agricultural habitats to wildlife stems from the negative connotation society attaches to artificial features that serve as wildlife habitat. Artificial habitats are sometimes viewed as less valuable than pristine or near pristine habitats. However, most of California's natural wetlands have been highly modified by human development, existing now in various stages of impairment or having been lost completely (Dahl et al. 1991). When faced with the pervasive loss and degradation of wildlife habitats in our increasingly urbanized landscape, a society that espouses the value of wildlife may not have the luxury of distinguishing between natural and pristine wetlands, and those that are highly modified yet still function effectively as wildlife habitat such as those of the Salton Sink.

FIGURE 9. The impoundments and nesting islets of Campo Geotérmico Cerro Prieto, Baja California. K. L. Garrett, September 1996.

Unlike many other saline bodies of water in the arid West that dried up almost entirely (e.g., Owens Lake) or have fluctuated greatly in their water volume (Jehl 1994), the Salton Sea has persisted over the last century as a large, intact lake. In fact, one consistent goal reflected in any of the various plans to restore the Sea has been to stabilize its surface elevation and curb its encroachment onto private property. While it is unlikely that the Sea will ever again experience flood flows directly from the Colorado River as it last did in 1905–1907, its designation as a repository for agricultural drainage in a region with an economy that will likely continue to be dominated by irrigated agriculture ensures that some form of the Salton Sea will continue to occupy the Salton Sink for some time to come.

The bird life of the Salton Sea has inspired awe since its formation, as indicated by Grinnell's observation on his inaugural visit to the Sea in 1908, when he wrote:

"As we neared the Island, a curious frosted patch became conspicuous on the highest hill. This soon proved to be a great colony of American White Pelicans . . . The sight of the great white birds rising in masses from their nesting grounds was exciting in the extreme; for I had never seen this species under such circumstances before. They wheeled in great circles overhead, crossing and re-crossing over their breeding grounds, or glided out to sea in intersecting V's. When flapping, their wings gave out a loud swish, and the many at once produced a roar" . . . (Grinnell 1908, pp. 186–187).

Despite the well-publicized bird mortalities in recent years, today's visitor to the Salton Sea can still marvel at the sight of huge masses of pelicans wheeling overhead, loafing at the river mouths, or feeding in innumerable groups dotting the Sea's surface during the non-breeding season, when as many as 20,000 individuals typically have been recorded there. Similarly, one can be overwhelmed by thousands of Western Sandpipers (*Calidris mauri*) probing into the rich organic mud along the southeastern shoreline, or revel in wave after wave of White-faced Ibis undulating across the darkening sky as they pile into their nighttime roosts about the Imperial Valley.

GENESIS OF THIS VOLUME

The first stirring of interest for this volume began in 1997, when the Western Field Ornithologists (WFO) convened its 22nd stated meeting in late August in the Imperial Valley. In recognition that the basic status and distribution of birds at the Salton Sea were now fairly well known, but that very little had been published since the earliest explorations of the region, the meeting presented a symposium addressing the current state of knowledge of the Sea's avifauna. Because it was unclear whether the final project alternatives identified in 1997 (U.S. Bureau of Reclamation 1997) would adequately protect the Sea's wildlife, in March 1998 WFO ratified a resolution entitled "The Salton Sea as Significant Wildlife Habitat." This resolution supported "rehabilitation and conservation efforts at the Salton Sea that are responsive to the needs of wildlife and based on sound and thorough biological data; that recognize the importance of freshwater, delta, brackish, saline, and agricultural habitats; that improve water quality and guarantee continued adequate sources of freshwater; and that seek to minimize threats to wildlife potentially resulting from urban and recreational development" (Garrett 1998). In April 1998, four major ornithological societies—the American Ornithologists' Union, Cooper Ornithological Society, Wilson Ornithological Society, and the Association of Field Ornithologists—adopted a similar resolution for the Salton Sea at the North American Ornithological Conference in St. Louis, Missouri. This joint resolution noted a "lack of consensus on what is meant by restoring the Salton Sea" and supported "an approach that allows sufficient time to study the situation, including all feasible options, that any additional research funds are added to agency core budgets, that no money be spent on 'emergency action' before a full environmental impact statement is completed, including studies of the impacts of brine or salt disposal from all pumped water, and that the implementation of whatever action be recommended must meet all environmental laws, including the National Environmental Policy Act and the Clean Water Act, and that judicial review of proposed actions be allowed without restraint" (AOU 1999).

With concern by ornithologists for the Salton Sea's avifauna and habitats increasing in the years following the WFO symposium in 1997, the Cooper Ornithological Society convened its 70th annual meeting in April 2000 in Riverside, California, which included a symposium entitled "The Ecology and Conservation of the Avifauna of the Salton Trough." Recognizing the strategic role the Salton Sea plays in avian migration systems of western North America and, in particular, its importance as a component of wildlife habitat in the Colorado River Delta region (Shuford et al. 2002), the conveners sought to broaden the scope of the previous WFO symposium and invited the participation of Mexican ornithologists working in the Delta region. The symposium, organized by Michael A. Patten, featured 14 presentations, including two pertaining to the Mexican portion of the Colorado River Delta region. It served as the basis for the collection of papers appearing in this volume.

We begin this symposium volume with two introductory papers that trace the development of knowledge of the avifauna of the Salton Sea region: Patten and Smith-Patten describe what is known of the Salton Sea avifauna prior to modern exploration by reviewing zooarchaeological data as well as the physical history of the Salton Sink, and Garrett et al. highlight the history of ornithological exploration around the Sea. We then present contributions that focus on the patterns of occurrence at the Salton Sea of several important avian groups, including migratory shorebirds (Shuford et al.), waterbirds (Warnock et al.), waterfowl (Barnum and Johnson), subtropical waterbirds (Patten et al.), and migratory passerines (Flannery et al.). Patten et al. detail avian range expansions and population changes in the Sink over the last 50 years, and Hinojosa-Huerta et al. describe the waterbird communities of the Colorado River Delta. Two papers describe the colonial breeding avifauna, concentrating on larids (Molina) and cormorants, ibis and ardeids (Molina and Sturm), and two others treat the status and distribution (DeSante et al.) and ecology (Rosenberg and Haley) of Burrowing Owls. Two papers focus on avian mortality: Meteyer et al. detail the investigation of the die-off of Eared Grebes in 1992, and Rocke et al. describe the losses of pelicans and other piscivorous birds to Type C botulism. Finally, Shuford and Molina bring avian research in the region into the context of conservation biology by stressing the need for scientists to engage more directly in political and regulatory processes.

Regardless of the "unnatural" water sources that sustain it, the Salton Sea has long served as a complex mosaic of important avian habitats and a necessary link in the migratory pathways of birds along the Pacific Flyway (Shuford et al. 2002), and it continues to do so today. It is our hope that the papers in this volume will not only augment the published record of avian biology of the Salton Sea and the greater Colorado River Delta region but will also underscore the interconnectedness of these areas, highlight the complexities of the threats they face, and above all stimulate further study, innovative dialogue, and action to preserve these internationally important bird habitats.

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