

# A BRIEF HISTORY OF DISCOVERY IN THE GULF OF CALIFORNIA

Richard C. Brusca Vers. 5 December 2013

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## FIRST DISCOVERIES

Native Americans have probably visited and lived along the shores of the Sea of Cortez for the past 10,000 to 13,000 years. Here they found an abundance of shellfish and finfish, easily harvested during the twice-daily low tides, and sea turtles they captured in shallow waters or on the beach during their nesting. Even in the arid Northern Gulf region they found pure fresh water in the Colorado, Sonoyta and Concepción Rivers, and in the pozos (artesian springs) that welled up through cracks in the soil all along the NW coast of Sonora, fed by ground water originating perhaps as far away as modern-day Arizona. Along the coast of the Gran Desierto de Altar of Sonora, many of these pozos are surrounded by large beds of crystallized salt, a commodity that further enhanced the value of their visits. There is good evidence that the Seri people (*Comcáac*) of San Esteban Island, and native people of the Baja California peninsula, even ate sea lions.



**Salina Grande, on the upper Sonoran coast; a huge salt flat in which are found artesian springs (pozos)**

Eleven thousand years ago, in a period of cooler climate, native people looking north from the shores of the upper Gulf would have seen piñon pine-juniper woodlands and Joshua trees (*Yucca brevifolia*) on the Tinajas Altas Mountains, 30 miles northwest of the desert landscape of El Pinacate. [Endnote 1] In the lowlands, Mojave Desert species were replaced by Sonoran Desert species around 10,000 years ago. Ancient shell middens (at least 2,000 years in age, and probably much older) inform us that native people exploited coastal shellfish for food and jewelry, some of which was traded far and wide, reaching northern Arizona and California with regularity, and even traveling as far inland as Colorado and Oklahoma. [Endnote 2]



**Native American Midden at Estero Morua, near Puerto Peñasco, Sonora**

To these first collectors of the upper Gulf's rich biodiversity, the northern coast of Sonora must have been important beyond imagination. There was reliable freshwater, a predictable and virtually inexhaustible food supply, and shells and salt for trading. And the seafood varied through the year, due to the high seasonal turnover of coastal life in the subtropical upper Gulf.

While Native Americans were exploring and living in the northern Gulf of California, and before the first Europeans ever laid eyes on this region, the Old World had

generated many chapters of history. The Roman Empire flourished and died; the Dark Ages came and went; epidemics of the plague, syphilis, and St. Vitus' dance ravaged Europe; alchemists searched in vain for the Philosopher's Stone and the Elixir of Life; the great cities of Europe were founded; Jesus, Mohammed, and Attila the Hun lived and died; the fields of mathematics, medicine, and astronomy were developed; China invented newspapers, porcelain, and gunpowder; India invented chess and the decimal system; Notre Dame and St. Peter's cathedrals were built; Chaucer, Dante, Leonardo da Vinci, Michelangelo, Botticelli, Hieronymus Bosch, Marco Polo, Copernicus, and Martin Luther enlightened humankind; the Inquisition cast its dark shadow; Ferdinand and Isabella of Spain had enough faith in a young Italian explorer named Christopher Columbus to finance his four voyages of discovery to the New World; and the pocket handkerchief was invented. [Endnote 3] In the New World, the Aztec, Toltec, Olmec, Maya, and Inca civilizations rose and fell, only the Maya surviving today with any semblance of their ancient culture. All of this, before any but Native American eyes were cast upon the Sea of Cortez.

## EUROPEANS IN THE GULF REGION

The Spaniards began their exploration of the Gulf of California just 13 years after Hernán Cortés marched into the great Aztec city of Tenochtitlán (in November of 1519). Cortés sent exploring ships to the Gulf in 1532 and 1533 and, although both expeditions met with disaster, the second returned with reports of natives wearing pearl ornaments. This singular report of pearls from the southern Gulf influenced European exploration in the region for the next 150 years. It was the search for pearls, and belief in a sea passage through North America to connect the Atlantic and Pacific Oceans (the fabled "Strait of Anián"), that drove Cortés to two more explorations of the Pacific coast, including a failed attempt to colonize Baja California in 1535

(the same year the first Spanish Viceroy, Antonio de Mendoza, arrived in Mexico). In addition, before Cortés, an influential tale of adventure titled *Las Sergas de Esplandián* ("The Exploits of Esplandián") described California as a "golden island, not far from the Garden of Eden, peopled by black, golden-armed women of Amazonian strength and courage."

Although Cortés laid this romantic legend to rest in 1535 when he crossed from mainland Mexico to southern Baja California, he never saw the Northern Gulf. Instead, he assigned to his deputy, Francisco de Ulloa, the sailing expedition that reached the uppermost Gulf (on September 27, 1539), and Ulloa was the first European to set eyes on this region. Ulloa first named the Gulf "El Mar Vermejo" (the Vermilion Sea), after the color of the water, from suspended sediments discharged from the Colorado River. Shortly thereafter, Ulloa seems to have come to his political senses and changed this to Mar de Cortés. [Endnote 4] Ulloa and Francisco Preciado, who accompanied him, both left written records of their discovery of the delta and peninsular nature of Baja California. They saw not another living soul in the delta region, and Ulloa wrote, "I do not believe that such a land can be inhabited."

Ulloa's expedition comprised three ships—the Trinidad, Santa Agueda, and Santo Tomás—the last being lost early in the voyage. Ulloa was clearly an over-achiever, and he actually sailed the entire coast of the Baja peninsula, thus becoming the first European to prove that it was not an island. By 1539 Ulloa rounded Cabo San Lucas and entered the Pacific, and in December of that year he made it to Bahía Magdalena where he was wounded in a fight with Indians. He made landfall on Isla Cedros in January of 1540, naming this large island in honor of the junipers (and pines) on the highest crests, but his destiny after that remains a mystery. Presumably, he died and his ship went down in the

rugged waters of the northwestern coast of Baja California.

As fate would have it, Ulloa's discovery that Baja was not an island did not reach most European cartographers (or was obscured by misunderstanding), and Baja California continued to be depicted as an island on most the early maps of North America. However, Domingo del Castillo's map of 1541 used Ulloa's information, showing the Colorado River and Punta Eugenio (where the map ended), and was the first map to use the name "California." [Endnote 5] From 1620 through the early 1700s various maps appeared showing California as either a peninsula or an island. For the most part, the Dutch geographers got it right. Some cartographers offered maps in either style, so consumers could choose for themselves what to believe! In 1746, the Jesuit Provincial Escobar sent Father Fernando Consag to map the northern Gulf, and it was the results of this expedition, when sent to Spain, that finally led King Ferdinand VIII to issue a formal decree that California was a peninsula, and not an island. A Jesuit map of 1767 incorporates the findings of Kino, Ugarte, and Consag.

The same year that Ulloa sailed into the northern Gulf, the Viceroy of New Spain, Antonio de Mendoza, sent Fray Marcos de Niza on an overland expedition to the region. The very next year (1540), prompted by de Niza's and Ulloa's reports, Mendoza sent Hernándo de Alarcón to the head of the Gulf, in support of the land expedition of Francisco Vásquez de Coronado. Both the Alarcón-Coronado Expedition and the de Niza expedition explored well beyond the head of the Gulf. Alarcón not only reached the Colorado River Delta, but he traveled upriver in longboats as far as the Gila River, reconfirming the peninsular character of Baja California. Alarcón's discoveries also seem to have eluded most of the cartographers of the sixteenth century. [Endnote 6] At the same time that Alarcón

was exploring the delta region, the first European visited the Pinacate – the Spanish explorer Melchior Díaz. If Díaz had climbed to the top of the Sierra Pinacate in 1540, and the temptation to do so would have been strong (it's the highest point in the region), he too might have realized that Baja was not an island. There seems to be no record of such a sighting; however, Díaz did reach the Colorado River where he found a cached letter left by Alarcón noted he had passed that way. Judging from Díaz's notes, he probably discovered the Cerro Prieto hot springs during his journey.

In 1591 missionaries of the Society of Jesus (Jesuits) entered Sinaloa and began their northward advance. For the next 177 years this Catholic Order dominated most of the exploration and documentation of the Gulf of California and surrounding territory, until the order was expelled from the Spanish colonies in 1767. Father Eusebio Francisco Kino arrived in Mexico from Spain in 1681. He tried to missionize Baja California without success, and then moved on to Sonora. His work represented the final phase of missionization in northwestern Mexico. His northernmost settlement was San Javier del Bac, near Tucson. Today one can view the skeletal remains of Father Kino at the handsome domed crypt in the town of Magdalena de Kino, near the church of Santa Maria Magdalena. Although there is some evidence that Kino himself might have established a chapel at this site (perhaps in the 1690s), the existing church dates to 1830s and has been reworked several times.

Aside from his missionary work, Kino's other great contribution was his exploratory and cartography skills. He re-discovered that Baja California was a peninsula, and not an island (Francisco Ulloa had discovered this in 1539, Melchior Díaz proved it again in 1540, and Juan de Oñate again in 1604, but their writings went largely unnoticed). His maps of northwestern Mexico and southwestern USA (the Pimería Alta region) were the most accurate made

to date, and they can still be used with good precision. His expeditions to the Lower Colorado River and the Sierra Pinacate relied on the springs at Quitobaquito (now in Organ Pipe Cactus National Monument), as well as other, smaller springs and tinajas that his Indian guides led him to. He made four expeditions into the Pinacates: October 1698, March and April 1701, and November 1706. [Endnote 7]



**Sketch of Padre Eusebio Francisco Kino, by Frances O'Brien**

On his second expedition to the Pinacate, in 1702, from the top of the Sierra Pinacate (named by him Cerro de Santa Clara), Kino followed the horizon with his telescope, tracing the gigantic Bahía Adaír stretching away to the northwest, sinking into a distant haze (at the Colorado River delta), and then rising again as the Sierra San Pedro Mártir in northern Baja California. Although he couldn't be certain, he felt strongly that Lower California must not be an island at all, but a peninsula. Thus grew his passion to find a land route to Lower California, leading to his many expeditions through the Gran Desierto, along the Camino del Diablo, and finally down the Colorado River.

Kino twice traveled to the lowermost Colorado River, in 1701 and 1702. On the first journey he crossed the river 25-30 miles below the Colorado-Gila junction, and on the second he traveled down to tidewater on the river's eastern shore. He was the first European to cross that river, and his 1702 journey gave him certainty that Lower California was not an island, but a peninsula. From these two trips came one

of Kino's most famous maps of the Pimería Alta region and Lower California. Native Americans, of course, had known for thousands of years that Baja was a peninsula and not an island.



**The famous Pinacate beetle, *Eleodes armata*; namesake for the region.**

Nine years later, Padre Kino died in the village known today as Magdalena de Kino. Just before his death, Kino drew a fairly accurate map of the Sea of Cortez that labeled the Baja California peninsula "Penisla de California." Kino's map also showed all the rivers of Sonora and Sinaloa that flowed into the Gulf at that time, although providing names only for three, the Ríos Colorado, Mayo and Fuerte.



**The Sierra Pinacate**

The Papago (Tohono O'odham) village of Sonoydag, along the Río Sonoyta, played



a vital role in Jesuit expeditions. Having reliable water year round, the site became Kino's westernmost mission, Misión San Marcelo, christened in 1698. Kino named the village Sonoyta, a name that stuck. The mission only had one padre, Father Enrique Ruhen, who was killed in the Pima Uprising in 1751. He worked at San Marcelo less than 6 months before meeting his untimely death. His marked grave still exists, about 1 mile east of the center of Sonoyta, where a small chapel has been built to commemorate the Kino mission and Padre Ruhen. The mission itself was abandoned from 1706 to 1743, when it was reopened with a bequest from Don José de la Puente Peña Castrejón y Salzines, Marqués de Villapiente, a Spanish nobleman. But, it never found a Padre to oversee its work, and when Don José died in 1739, he left a bequest and asked that the name be changed to Misión San Miguel de Sonoyta.



**The grave of Padre Enrique Ruhen, the only Jesuite padre ever to staff the Misión San Marcelo**

In 1721 the Jesuit priest, Juan de Ugarte sailed to the head of the Gulf to again reconfirm the peninsular nature of Baja California. Ugarte also explored the coast of Sonora, the island of Tiburón, and the mouth of the Colorado River.

In 1746, another Jesuit, Fernando Consag (a Croatian priest at the San Ignacio Mission from 1734 to 1759) led a flotilla of four canoes, manned by soldiers and mission Indians, from Santa Rosalía to the mouth of the Río Colorado.

Sixty-five years after Kino's death, the United States declared its independence from Britain. At about the same time, Captain Juan Bautista de Anza (the great Basque explorer and defender of the Jesuits; son of Juan Bautista de Anza the elder) passed just north of the Pinacate, making famous the Camino del Diablo trail from Sonoyta to the present-day location of Yuma, on the Colorado River. [Endnote 8] Jesuit fathers had been passing over this trail for 50 years, using O'odham guides, and Father Kino actually left a map of it.

In 1810, the Mexican War of Independence (from Spain) began, and this is the date recognized by Mexico as its official Independence, although it was not until 1821 that the new nation formally declared itself a Republic.

## **THE POST-SPANISH COLONIAL ERA**

Due to the inhospitable terrain and Apache deprivations (which did not end until Geronimo's capture in 1886), few European or U.S. explorers made their way to the Pimería Alta. [Endnote 9] After de Anza's explorations, many decades passed before Europeans began to actually notice the Gulf. [Endnote 10] In 1826, Lieutenant R. W. H. Hardy, a British naval officer, reached the mouth of the Colorado River from Guaymas in a small schooner named the *Bruja*. Hardy recorded the two islands at the mouth of the river, and had his boat grounded for 8 days before retreating back into the Gulf. Frederick Reigen, a Belgian citizen who lived in Mazatlán from 1848 to 1850 and took up collecting molluscs throughout the Gulf, amassing one of the largest amateur collections of sea shells of all time – 14 tons of shells! The Reigen collection found its way to Liverpool, and from there it was partly dispersed. Much of it was published upon by Philip Carpenter (Carpenter 1857; see Hendrickx and Toledano-Granados 1994). [Endnote 11]

Another serious collector of marine life in the region was John Xantus (de Vesey), a controversial Hungarian hired by the U.S.

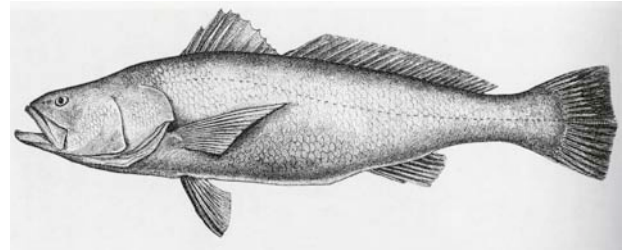
Coast Survey as a tidal observer stationed at the tip of the Baja California peninsula (April 1859 to mid-1861). Most of Xantus' collections are now at the Smithsonian Institution (e.g., Jordan and Gilbert 1882). From 1888 to 1894 the French chemical engineer, Leon Digue, studied natural history while employed by the famous Boleo Mine in Santa Rosalía. Digue made many collections, most of which ended up at the Museum d'Histoire Naturelle in Paris. Ten marine invertebrates from the Gulf have been named in Digue's honor (six crustaceans, three molluscs, and one polychaete), as well as two fish species. Two conspicuous plants that bear his name are the giant barrel cactus of Isla Santa Catalina (*Ferocactus diguetii*) and the bushy ocotillo of the southern Gulf coast (*Fouquieria diguetii*, the palo adán bush).

During the following three decades, a few ichthyologists made collections of fishes at some readily accessible sites, notably Guaymas and Mazatlán, that were reported upon mainly by David Starr Jordan and colleagues (e.g., Evermann and Jenkins 1891, Jordan 1895). Oceanographic data were recorded, and some marine organisms were trawled, by the U.S. Fish Commission steamer *Albatross* in the late 1880s/early 1890s, and again in 1911, and most of



**The hermit crab, *Clibinarius digueti*, named in honor of the French naturalist Leon Digue** these specimens are also at the Smithsonian Institution (e.g. Gilbert 1892). Aside from a brief foray in 1889, the *Albatross* did not work in the northern Gulf. However, from the *Albatross* expedition

came the original description of a legendary fish, the totoaba (*Totoaba macdonaldi*), described by C. H. Gilbert, Chief Naturalist on board the ship. The chief invertebrate biologist on the *Albatross* expeditions was Paul Bartsch.



**The endangered totoaba, *Totoaba macdonaldi* (illustration by Alex Kerstitch)**

In 1852, the Colorado Steam Navigation Company was formed to carry people and goods up the Colorado River from the Sea of Cortez. Prior to this, Yuma was supplied by mule train from San Diego. The Colorado River steamboat business lasted, in one form or another, for about 25 years. [Endnote 12]

Daniel Trembly MacDougal (first Director of Tucson's Desert Botanical Laboratory, then of the Carnegie institution of Washington D.C.) and his party explored the Pinacate area in 1907, but only one member of the group reached the Gulf coast, the "official geographer" Godfrey Sykes (Hornaday 1908). Sykes was a trained civil engineer, hydrologist, and geographer. Shortly after the MacDougal expedition, in 1909-1910, Carl Lumholtz explored the Pinacate and the entire upper Gulf coast of Sonora (See his book, *New Trails in Mexico*, 1912). Lumholtz not only spent time on the shores of the upper Gulf, he visited the coastal pozos and salinas, writing, "Judging from the extraordinary springs I encountered on the shore of the salt deposit, Salina Grande, near the coast, there must be a large sheet of fresh water underneath most of that western coastal desert." The "sheet of water" Lumholtz referred to is a shallow water table that probably originates with the Colorado River, flowing underground along the Cerro Prieto Fault Line. The water could also come from

the Cabeza Prieta National Wildlife Refuge (just north of the U.S.-Mexico border) and the westernmost region of the El Pinacate Biosphere Reserve (Sonora). With a Cucupá Indian guide, Lumholtz traveled southeast from the Colorado River, skirting the marshes "on the edge of a great playa ... on the eastern limit of the delta," to eventually reach the small springs at El Doctor, just north of the modern town El Golfo de Santa Clara. The "playa" Lumholtz referred to was no doubt the Santa Clara depression, which today supports the Ciénega Santa Clara, the largest remnant wetland of the Colorado River Delta (12,000 hectares), recreated in recent times by diversion of agriculture wastewater from the United States. Lumholtz eventually arrived on the beach at what is today El Golfo de Santa Clara, finding it littered with giant branches and trunks of cottonwood and willow from the once great Colorado River marshland. Lumholtz's travel log notes that "the upper part of the Gulf abounds in fish," which he and his party, on occasion, took in great numbers by tossing sticks of dynamite into the water from the shoreline!

Lumholtz spent considerable time with the Tohono O'odham people and talked with leaders of their salt expeditions – a trek that used to take them from as far away as the Gila River in Arizona to the pozos, salinas, and shores of the upper Gulf. Lumholtz met "El Doctor Pancho," one of the last surviving Sand Papago (Areneños), who was then living in the O'odham settlement at Quitobaquito. The Sand Papagos were a hardy lot, living a nomadic lifestyle in the Gran Desierto. However, having a reliable supply of fresh water from the scattered but known pozos and tinajas, and access to the rich biodiversity of the upper Gulf, suggests that their life might not have been so difficult. In addition to fish and crustaceans, they are known to have taken sea lions and sea turtles along the coast, as well as foraging on small game and insects, and on many coastal and inland plants of the region, including the fabled "sand food," or

"root of the sands" (*Pholisma* [= *Ammoboma*] *sonorae*). Early on, the



**El Doctor wetlands**



**Ciénega Santa Clara**

O'odham harvested salt from the upper Gulf's coastal salinas and traded it in Tucson to both Europeans and Pima Indians. The salt trek also had a religious purpose. Lumholtz's description of the sacred salt trek includes this colorful passage: "The party travels very silently, only elderly men who have undertaken the journey before talk, and nobody turns around either on the journey out or on the return. No member of the expedition can scratch himself unless he uses for the purpose a special implement made from a twig of the greasewood." [Endnote 13]

Not long after Lumholtz explored the upper Gulf, another famous explorer, American Ronald L. Ives, began to



adventure into northwestern Mexico. Ives was fascinated by historical cartography and spent many years reconstructing the day by day details of Kino's travels.

[Endnote 14]



**Sand dunes of Gran Desierto; spring blooms**

Aldo Leopold and his brother explored the Colorado River delta by canoe. Leopold's often cited description of that journey was published as a short essay in *A Sand County Almanac and Sketches Here and There* (1949). He wrote, "On the map the Delta was bisected by the river, but in fact the river was nowhere and everywhere, for he [the river] could not decide which of a hundred green lagoons offered the most pleasant and least speedy path to the Gulf. So he traveled them all, and so did we. He divided and rejoined, he twisted and turned, he meandered in awesome jungles, he all but ran in circles, he dallied with lovely groves, he got lost and was glad of it, and so were we." And, "Often we came upon a bobcat, flattened to some half-immersed driftwood log, paw poised for mullet. Families of raccoons waded the shallows, munching water beetles. Coyotes watched us from inland knolls, waiting to resume their breakfast of mesquite beans..." The lush cottonwood forests and wetlands of the delta seen by the Leopold brothers began a slow, sad death once construction of Hoover Dam was completed in 1935, creating a chokehold on the mighty Colorado River. Within a few decades the bobcat, beaver, mountain lion, deer, jaguar, an unknown freshwater fish fauna, and most of the rest of this rich ecosystem were gone.

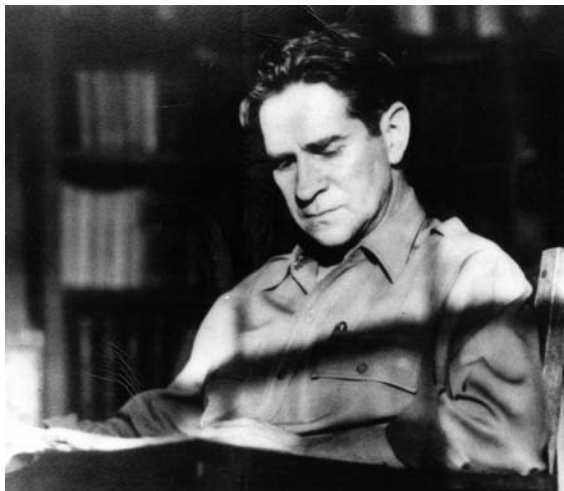
One of the earliest American "oceanographic" expeditions to the Sea of Cortez was William Beebe's 1936 expedition under the auspices of the New York Zoological Society – the "Zaca," or "Templeton Crocker" Expedition (Zaca was the ship, Templeton Crocker her owner). The Zaca Expedition was, as typical of Beebe's expeditions, weak on science and heavy on Beebe's own brand of machismo. Beebe's narrative of the journey (*The Zaca Venture*, 1938) makes better reading for testosterone-laden sport fishermen than for those with a sincere interest in natural history. Nevertheless, the expedition produced a large number of specimens that provided a source of taxonomic research material for several decades (published upon by Jocelyn Crane, Steve Glassell, Fenner Chace, Aaron Treadwell, Elisabeth Deichmann, Fred Ziesenhenne, Martin Burkenroad, and others). Unlike most expeditions, Beebe made the decision to concentrate collecting efforts at just three localities: Bahía Santa Inez, Cabo San Lucas and the adjoining Arena and Gorda Banks, and Clarion Island. Thus, the Zaca never reached the northern Gulf. However, Beebe culled some cogent information about the Sea of Cortez in 1936. His interviews with Mexican fishermen in Baja California indicated that upwards of 20 million tuna and skipjack were being caught annually along the coast of northwestern Mexico, with no apparent diminution in their numbers over the years – testimony to the highly productive waters of the region. They also encountered Japanese fishing boats in the Gulf, probably some of the first Japanese penetrations into this Sea, establishing a pattern that has persisted, episodically, ever since. Although Beebe was well aware of the beauty and diversity of life in the Sea of Cortez, he had an exploitive view of nature, and some of the most descriptive passages in his account describe shooting sharks and manta rays for sport (with rifles and pistols) from the deck of the Zaca. The last line of his book reads, "At my next formal dinner, when the guests are absorbed in the delicacy of their



green turtle soup, I will rejoice in the memory of the brooding turtles of Clarion Island." [Endnote 15]

### **JOHN STEINBECK AND ED RICKETTS VISIT THE SEA OF CORTEZ**

In 1940, four years after the *Zaca* Expedition, modern marine biology in the Gulf of California had its birth with the remarkable pioneering expedition of Ed Ricketts and John Steinbeck aboard the *Western Flyer*, a purse seiner out of Monterey, California. [Endnote 16] The biology (and philosophy) of that amazing voyage is chronicled in their 1941 book, *Sea of Cortez. A Leisurely Journal of Travel and Research* (also see Astro and Hayashi 1971, Hedgpeth 1978, Brusca 1993, Beegel et al. 1997, Rodger 2002). It was this expedition that first documented, in an organized way, the coastal marine life of the Gulf. Using funds from Steinbeck's successful writing career, he and Ricketts chartered the *Western Flyer* for a six-week expedition to the Gulf. [Endnote 17] The Ricketts-Steinbeck Expedition's northernmost collecting sites were in the Midriff Islands, at Puerto Refugio on Isla Ángel de la Guarda, and Red Bluff Point on Isla Tiburón, barely "touching down" in the northern Gulf. [Endnote 18]



**Ed Ricketts**

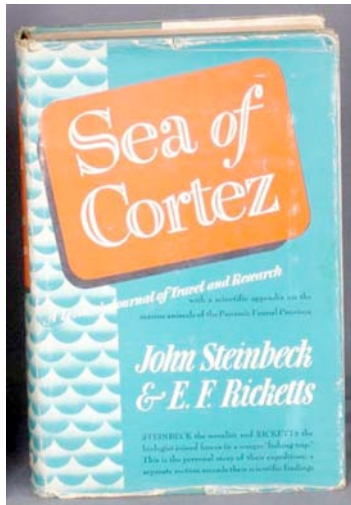
The landmark Ricketts-Steinbeck voyage to the Sea of Cortez had a profound impact

on their lives and, in stark contrast to Beebe's writing, on the American environmental consciousness, and it brought an awareness of the Sea of Cortez to both the public and the scientific world. Their expedition collected at 24 sites and captured approximately 500 species of marine invertebrates, 93 of which have found their way to the Smithsonian Institution and are today available in the collections of the National Museum of Natural History. For more than 30 years, their expedition report was the only place one could turn for a synoptic view of life in the Sea of Cortez. [Endnote 19]

### **SINCE STEINBECK AND RICKETTS**

Expeditions from Scripps Institution of Oceanography, the University of California at Los Angeles, Stanford University, the California Academy of Sciences (beginning as early as 1888), and the University of Southern California's Allan Hancock Foundation in the 1940s and 1950s ushered in an era of organized research effort in the Gulf. The expeditions and taxonomic publications of the once glorious but now defunct Allan Hancock Foundation stand above all others in documenting the biodiversity of the Gulf (Brusca 1980a). Between 1942 and 1983, the Allan Hancock Foundation publications on Pacific marine life produced an astonishing 22,469 pages of primarily invertebrate taxonomic text that stand as a watershed in marine biodiversity research (U.S.C. Press 1985).

As soon as the Arizona-Sonora Desert Museum was founded (1952) it began research and conservation work in the Sea of Cortez. Early on, Museum Trustee Joseph Wood Krutch and Associate Director Lewis Wayne Walker conducted surveys of the islands of the Midriff region. Much of their work was funded (between 1958 and 1972) by the Belvedere Scientific Fund of San Francisco, through the personal interest of Kenneth Bechtel. Through perseverance and political savvy, Lew Walker and Mexican mammalogist Bernardo Villa managed to convince



President Lopez Mateos to protect the critically important seabird breeding island of Isla Rasa (in 1964), the first protected area to be established in the Gulf. [Endnote 20] From 1960 to 1969 the San Diego Museum of Natural History operated the Vermilion Sea Field Station at Bahía de los Angeles, and in 1962 it undertook a major expedition in the Gulf (funded, again, by the Belvedere Fund).



**Elegant tern nesting area on Isla Rasa**

However, despite all this previous work, when I arrived in the Gulf in 1969 the only synoptic compilation of information on marine invertebrates was the Ricketts and Steinbeck volume (1941), and there were no keys to assist one in identifying the invertebrates of the region. I realized this after I began a two-year residence in Mexico working for the University of Arizona's once powerful (but now moribund) Marine Biology Program. I quickly discovered that if I wanted students to know

what they were looking at in Gulf tidepools, I would have to write the keys myself. Thus it came to be that, in 1969, I gave up my lifestyle of chasing waves and Grateful Dead concerts in California and moved to Puerto Peñasco to live on the shores of the Sea of Cortez for two years. There, I designed and built a small marine lab for the University of Arizona, made countless field trips throughout the Gulf, and shipped specimens of invertebrates to specialists around the world. Out of that emerged the first edition of my "Gulf Handbook" (*Common Intertidal Invertebrates of the Gulf of California*; Brusca 1973; second edition 1980b). Much of those two years was spent exploring the shores of the Gulf with J. Laurens Barnard, a good friend and mentor who, at that time, was on loan from the Smithsonian Institution to the University of Arizona (Brusca 1993).

Since the first edition of my "Gulf Handbook," knowledge of the upper Gulf and its biodiversity has increased substantially through research by scientists at the University of Arizona, Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Universidad de Sonora (UNISON), Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)-Campus Guaymas, Universidad Autónoma de Baja California Sur (UABCS), Centro de Investigaciones Biológicas del Noroeste (CIBNOR), Centro de Investigación en Alimentación y Desarrollo (CIAD), and the Facultad de Ciencias of the Universidad Nacional Autónoma de México (UNAM) as well as its Instituto de Ciencias del Mar y Limnología's (ICML-UNAM) Mazatlán field station and Instituto de Biología (IB-UNAM). This body of work has resulted in many publications describing the fauna and environment of the region, much of it cataloged in Schwartzlose et al. (1992), Brusca (2010), Brusca et al. (2001, 2004), Thomson et al. (2000), and elsewhere. Today, early 6,000 species of animals (macrofauna) are known from the Sea of Cortez. However, compared with much of the world's coastline, exploration

and documentation of the biodiversity of the Sea of Cortez is still in its early stages, and I estimate that about half of its fauna remains undescribed, while the natural history of most species is still unknown.

## ENDNOTES

**Endnote 1.** The name “Pinacate” derives from *pinacatl*, of the Aztec Nahuatl language, which means “beetle.” In the Gran Desierto there is a large black beetle, the “Pinacate beetle” (*Eleodes armata*), that when threatened sticks its hind-end vertically into the air and emits a foul odor. This may be the only geographic region in the world named after a beetle!

El Pinacate is the largest lava desert in North America. At its heart are the remains of the Santa Clara Shield Volcano, now rising as the twin Pinacate (4235 ft) and Carnegie (4000 ft) Peaks of what is now called Sierra Pinacate. They rise from a desert floor of ~900 ft elevation. Ives (1964) considered the Batamote Hills and Punta Peñasco flows as the outermost (and oldest) activities of the Santa Clara Volcano, but others have disagreed (regarding these as unrelated events). Ives claimed the Batamote Hills comprised ~10 sq mi of old basalt from the Santa Clara event activity, parts of which are dominated by columnar cliffs resembling those of the Palisades of the Hudson, or the Devil’s Postpile formation.

The first extended exploration of the Pinacates in modern times was that of the MacDougal-Hornaday party of 1907, which led to the construction of Godfrey Sykes famous map. From this came the first English-language descriptions of the craters (Hornaday 1908), although Kino, Manje and Salvatierra had described them more than 250 years earlier, but gave no names to any of them. Ives (1964) calculated that Kino had, at least, described what today we call Hornaday Peak and MacDougal Crater. In 1909, Carl Lumholtz (assisted by Alberto Celaya) also explored the Pinacate.

According to Ronald Ives (1935), Tohono O’odham legend describes in some detail an eruption of volcanic ash from the summits the Santa Clara Volcano. And in January 1935, violent eruptions, audible 50 miles away, were reported from the region, allegedly from the El Elegante Crater area (this is the only report of an eruption in the Pinacates in recorded history for the region, which dates back to 1540). In 1964 Ives seems to have changed his mind about the location of this eruption, stating the legend probably refers to an ash eruption at Cerro Colorado, which took place between 250 and 1000 years ago (he considered this the youngest of the major cones in the Pinacate region).

**Endnote 2.** Ancient peoples who exploited the northern Gulf’s rich coastal biodiversity left behind huge piles of shells and other “kitchen refuse,” or middens. Some of these shell middens are miles across, and some have depths of more than one meter. Estero Morua, near the town of Puerto Peñasco, is encircled by nearly continuous shell middens covering about 60 percent of its shoreline, each midden containing tens of thousands of mollusc shells (comprising more than 30 species) and pottery from at least three distinct cultures. I have radiocarbon-dated (C-14) two food shells (*Carditamera* [= *Cardita*] *affinis* and *Phyllonotus* [= *Hexaplex*] *erythrostomus*) from Estero Morua middens at calibrated ages (Stuiver and Reimer, 1993, Radiocarbon 35: 215-230) of 1,969 YrBP (radiocarbon age 2,010 ±55) and 2,024 YrBP (radiocarbon age 2,075 ±40) (radiocarbon dates determined by the University of Arizona/National Science Foundation Accelerator Mass Spectrometry Laboratory). The only remains from crab dining at Estero Morua seem to be the large claws (pincers, or chelipeds) of the blue crab, *Callinectes bellicosus*; no remains of carapaces or the smaller walking legs have been found. This suggests that the diners might have been ecologically aware, and instead of killing the entire crab they simply



broke off the claws, which would grow back, thereby avoiding possible population declines in the estero. (Or, perhaps breaking off the claws was simply the quickest and easiest way to consume this crustacean's meat!) In the past, Estero Morua received freshwater via its eastern arm from the Río Sonoyta, although this river has not reached the Gulf of California except during flood years since before the turn of the last century (a turn-of-the-century map of the River can be found in Hornaday 1908). In addition to shellfish, the kitchen middens of Estero Morua reveal that native people were also consuming sea turtles, rabbits, and fish from the estero and outer coast tidepools.

**Endnote 3.** On October 19, 1469, in Valladolid, Isabella, the future Queen of Castille, married Ferdinand, who would become the King of Aragon, thus laying the foundation for the emergence of Spain as a unified nation and setting the stage for the country's future greatness. By 1479 Ferdinand and Isabella were firmly in control of the monarchy of a unified Spain. There had been a long-standing campaign to rid Spain of the Muslim influence emanating out of the Kingdom of Granada. When the watershed year of 1492 dawned, the armies of Isabella and Ferdinand conquered Granada and forced the last Muslim foothold from the Iberian Peninsula. In that same year, Christopher Columbus whose explorations had been sponsored by Isabella, landed in the islands of the Caribbean. Isabella died in 1504, at the age of 53, but she had begun the era that was to see Spain become the most powerful nation in Europe, if not the world. Just 3 years after Isabella's death, the first printed map with the name "America" on it appeared in Europe, created by Martin Waldseemüller (it was also the first published map to show the Pacific Ocean as a separate body of water).

**Endnote 4.** The first name given to the Gulf of California was Mar Bermejo (= Vermillion Sea in English), by Ulloa in 1539. Soon thereafter, the name was changed to Mar

de Cortés (probably by Ulloa himself). Other Spaniards applied a variety of additional names to the region, and by 1602 names such as Mar Rojo, Mar Roxo, Mar de la California, and Mar de la California Mediterraneo had all appeared on the scene. Kino himself used at least six different names on his maps of the region, between 1683 and 1710. However, by 1800 all names other than Golfo de California, Mar de Cortés, and Mar Bermejo had fallen out of favor. The "z" spelling (*i.e.*, Sea of Cortez) first appeared in the mid-1700s in the French literature, presumably as a phonic transliteration of the "és" ending. The "Cortez" spelling appeared in America as early as 1870, and it been increasing in popularity and use in recent decades. (Hernán Cortés probably never spelled his own name with a "z," although he did use several variations of his given name, *e.g.* Hernán, Hernando, Fernando).

**Endnote 5.** The earliest map to show Baja California as a peninsula might have been the "chart series" of Battista Agnese (1538-1548), probably capitalizing on Ulloa's 1539 discovery. It was also correctly depicted on Sebastian Cabot's 1544 map, and of course the superlative maps of Mercator (1569) and Ortelius (1570: *Theatrum Orbis Terrarum*). However, the majority of the European maps produced before the early 17th century still depicted Baja California as an island, and it may have been the work of the Jesuit priest Eusebio Kino that finally laid the issue to rest for European cartographers.

The discovery of the Baja peninsula is often credited to Hernán Cortés himself. However, reports of the peninsula also came from a group of mutineers who murdered their captain and took over the exploring vessel La Concepción, which Hernán Cortés had dispatched in late 1533 (the second expedition Cortés sent into the Gulf). Fortún Jiménez was the leader, and he, along with 20 of his companions, were killed by natives at a place they named Santa Cruz, later to be renamed La Paz.

The survivors told tales of pearls, quickly spurring Cortés himself to establish a colony at Santa Cruz (on 3 May 1535) that lasted less than two years and brought back only a few pearls of inferior quality for all their efforts.

It is worth noting that pearls played an important role in driving colonization of the entire New World, not just Mexico. In the 16<sup>th</sup> century, “pearl grounds” were discovered in many areas of Central and South America. Letters written by Columbus talking about pearls (especially during the third voyage, 1548) circulated in Europe, and the pearls he returned with drove demand for further exploration. The southern Caribbean region came to known as the “Pearl Coast,” and especially rich pearl beds were discovered in Colombia, Venezuela and the Lesser Antilles. Vasco Núñez de Balboa was the first to discover pearl grounds in Pacific Panama, in the islands he named “Archipelago de las Perlas” (the “Pearl Islands” on modern maps).

Pearl beds everywhere, including in the Sea of Cortez, were found simply by searching for piles of empty shells on the coast, left behind by Native Americans who were more interested in consuming the meat of the bivalve than in harvesting the pearls they produced. The newly discovered pearl beds were heavily harvested and quickly destroyed. By the latter part of the 16<sup>th</sup> century, both the “Pearl Coast” of the Caribbean and the Pearl Islands of Pacific Panama were largely depleted. Over-harvesting, coupled with falling prices of pearls in Europe in the 17<sup>th</sup> century, eventually led to the collapse of the New World pearl-fishing industry.

Early in the 20<sup>th</sup> century, pearl shell harvesting (for mother-of-pearl) in Pacific Panama experienced a revival, and it provided a steady livelihood to numerous communities scattered across the Pearl Islands, and other islands in the Gulf of Chiriquí. However, by mid-century the bivalves (*Pinctada mazatlanica*) had once

again been depleted and the industry collapsed.

There have been many hypotheses on the origin of the name California, probably first employed in the Ulloa voyage of 1539-1540, and first appearing on a map of Castillo's in 1541. The best explanations of the name are probably those of H. H. Bancroft (1884) and C. E. Chapman (1921), both of whom accept the ideas of Edward Everett Hale (1862). Hale found his inspiration in a novel of chivalry called *Las Sergas de Esplandian* (*The Deeds of Esplandian*), written by Garcí Ordóñez de Montalvo. The book was based on an earlier series of books titled *Amadis of Gaul*, written around 1400 by the Portuguese Vasco de Lobeira. Lobeira's 4-part novel had been widely translated and read throughout Europe during a period when such romantic novels of chivalry strongly influenced Europeans emerging out of medieval times. The *Amadis* and *Sergas* books were popular and apparently widely available in Spain just after the discovery of the Americas by Columbus. In the *Sergas* novel, Esplandian was the son of the hero, Amadis, and both were with the Christian Emperor during a siege of Constantinople by the forces of paganism. Fighting beside the pagan Turks was a band of Amazon warriors led by their queen, Caláfia. These Amazons were from “an island of bold rocks and crags located on the right hand of the Indies” that abounded with gold. Caláfia, wishing to perform some grand deeds, unilaterally attacked the Christians at Constantinople. But, alas, she fell in love and married Esplandian's cousin, became a Christian, and the Island of Caláfia was thereafter no longer populated by women alone. Hale's hypothesis is that this sordid story suggested to the Spaniards, who thought they were near the “right hand of the Indies” upon discovering a large island that consisted of bold and craggy rocks with rich pearl beds and rumors of gold (perhaps Isla Cedros, off the west coast of southernmost Baja California), would naturally assume it to be the Island of Caláfia.

**Endnote 6.** The Viceroy of New Spain (Mexico), Antonio de Mendoza, was responsible for much of the earliest exploration of the Californias. Explorations in New Spain by Álvaro Nuñez Cabeza de Vaca (1528-1536) had brought reports of populous towns and precious metals (playing into the legend of the fabulous Seven Cities of Cíbola). Thus, Mendoza, in 1539, sent a reconnaissance party, including Esteván, or Estevanico (a north African slave who had been with Cabeza de Vaca), the Franciscan friar Marcos de Niza, and several hundred native people who followed the Indian road to Sinaloa. There, Marcos heard tales of the “Seven Cities of Cíbola,” to the north. Esteván crossed the deserts with an advance party to reach the Cíbola pueblos, where he was killed by the Zuni. Marcos almost certainly did not get even within distant sight of the place, which nevertheless he described as a beautiful and gigantic city (“bigger than the city of Mexico”) with natives wearing turquoise and pearl oyster shells. Encouraged by this report, Mendoza ordered the 30-year old governor of the frontier province of New Galicia, Francisco Vásquez de Coronado, north in 1540, accompanied by 330 Spaniards and more than a thousand Indians. So large a force was slow on the move and difficult to feed, and Coronado soon split the expedition into several groups. Hernando de Alarcón (a political rival of Cortés) took three vessels along the coast with supplies, reaching the mouth of Colorado River and journeying up it a distance of 85 leagues (about 250 miles), well past the junction of the Colorado and Gila Rivers. Meanwhile, the main force headed overland for the fabled Seven Cities. However, the cities of Cíbola proved a sad disappointment -- there were only six, and they were small Zuni Indian villages, not cities. Coronado’s expedition was viewed as a failure and he died in obscurity in 1554. However, exploring parties sent out to the east and west of the main force had some good fortune. One led by López de Cárdenas in search of a river route to the

Pacific, came to the Grand Canyon, the first Europeans to see it (and also the last for more than 200 years). Another group, under Melchor Díaz, reached the Lower Colorado River at Yuma, and crossed into California for a few days.

Viceroy Mendoza, in 1542, also sent the great navigator Juan Rodríguez Cabrillo to explore the west coast of California, instructing him to take two ships north of Punta Eugenio to see what lay beyond Ulloa’s explorations of the outer coast. By September of that year, Cabrillo had discovered San Diego Bay, and from there he continued north as far as Cape Mendocino (named after Mendoza, of course).

Pirate raids by Dutch and English freebooters out of Bahías Pichilique and Ventana (near the modern Bay of La Paz) during the wars of the Reformation led Sebastián Vizcaíno to the region in 1596, lured by stories of pearls. Vizcaíno went to great lengths to successfully win a permit from the Viceroy of Mexico to visit Lower California, and in return, to please the Crown, he established settlements in the region—but his attempt to colonize Santa Cruz, which he renamed La Paz, also failed.

**Endnote 7.** On Kino’s first Pinacate expedition, he saw the confluence of the Gila and Colorado Rivers (visible from the top of Sierra Pinacate, or Volcán Santa Clara, as he named it). On his second and third expeditions, he saw the land connection between Baja and the mainland, realizing the peninsular nature of the former; on these trips he also reached the Sea of Cortez, on the coast of Sonora. On his fourth expedition, he took “official witnesses” to the top of Sierra Pinacate, to prove to them the peninsular nature of Baja California. Kino was 61 years of age on this fourth expedition to the Pinacates. In Kino’s *Historical Memoir, 1683-1711*, he states, “In the year 1698...on the very high hill, or ancient volcano, of Santa Clara, I descried most plainly both with a telescope and



without a telescope the junction of these lands of New Spain with those of California, the head of this Sea of California and the land passage which was there is thirty-five degrees latitude. At that time, however, I did not recognize it as such..." It took several more years for Kino to be fully convinced of the reality of his discovery. It was not until 1747, after the voyage of Father Fernando Consag through the northern Gulf of California, that Spanish authorities publicly declared California part of the North American mainland.

Eusebio Francisca Kino (born E. F. Chini) was born in what today is northernmost Italy, in the village of Segno. As a member of the Jesuit order, he made more than 40 journeys on horseback and on foot through the Pimería Alta (essentially northern Sonora and southern Arizona) under orders from Spain. The name Pimería Alta referred to the "upper" or northern region of inhabitation of New Spain, primarily inhabited by the northern Pima Indians (Pimans) which included the Papago – known since 1986 by their native name, the Tohono O'odham. It was Kino who gave the famous Santa Catalina Mountains of Tucson their name, in honor of the feast day of Saint Catherine.

When Father Kino first began his work in Sonora (in 1687) the region now recognized as Sonora/southern Arizona was a province known as *Nueva Andalucía*. The Baja California peninsula was firmly occupied by the Jesuits under Juan María Salvatierra, who first landed at Loreto in 1697 (the site of the first Jesuit colony on the peninsula). Eventually, the Jesuits established 15 missions in Baja California, five of which had vineyards and produced wine. It could be said that the export trade of California wine was first established by the Jesuits, for in 1707 Father Ugarte produced more wine than he could use at his northern mission in of Vigge Biaundo, and began exporting it to Mexico in exchange for other goods! However, the Jesuits never really became self-sufficient in Lower California, and they

relied heavily on supply ships coming from Sonora throughout their stay on the peninsula.

The Jesuits remained in Baja California until 1768, when the region was turned over to the Franciscans, who pushed north under the leadership of Junipero Serra to build 21 new missions in Alto California, from San Diego to Sonoma. But it was the Jesuits who provided the most detailed written accounts of the region. For that matter, most of what we know about the early history of the Pimería Alta region, and northwest Mexico in general, comes from the writings of the Jesuits in the area. In fact, it was a Jesuit scholar (Joseph de Acosta) who, in 1590, was the first to propose a land bridge between the Old World and the New World, in either the extreme north or south (Huddleston 1967). It took another 150 years before Vitus Bering (in 1741) demonstrated that the "bridge" was in the north, by showing how close Asia and America actually were to one another. And it took almost another hundred years before Gallatin (1836) provided his influential argument that all American Indian languages had a "uniformity of character indicating a common origin" in Asian languages, and later (1845) that the "similarity of physical types" further corroborated an ancient Asian connection. Gallatin's work set the stage for what remains today the prevailing view of the Western Hemisphere being peopled from north to south, by way of the Bering land bridge (which was in place until about 11,000 years ago).

Prior to 1821, scholars in the U.S. had little firsthand information about the American Southwest, and virtually none about the Pimería Alta region. It was not until the independence of Mexico (from Spain) in 1821, and the opening of the Santa Fe Trail, that U.S. researchers began to explore the southwest. The history of Mexico prior to this time was based largely on Francisco Javier Clavigero's classic *History of Mexico*, published first in Italian (1780) after the

expulsion of the Jesuits from New Spain, and later in English (1787). Clavigero, a Mexican Creole who entered the Jesuit order in 1748, was the most influential Mexican historian of the eighteenth century. However, his history essentially ignored the Pimería Alta region, concentrating on the Mexican highlands and barely touching on Baja California. He had no personal knowledge of the California's and depended on the reports by refugees among his fellow Jesuits for his information about Baja California. Clavigero derived the Indians of eastern North America from northern Europe, and those in South America from Africa by way of an alleged, now-submerged, connection between Africa and Brazil! The same can be said of the series of great books by Alexander von Humboldt in the early nineteenth century, whose detailed history of prequest Mexico was based primarily on Clavigero's work.

Fifty-six years after Kino's death, the Jesuits paid the price of their success and were expelled from the New World (indeed, from all Spanish lands) by order of King Carlos III of Spain (1767) – over 10,000 Jesuits. In most of the region known today as Arizona, the task of rounding up the Jesuits fell to Culiacán-born Bernardo de Urrea, Captain of the Altar Presidio. Urrea appointed Andrés Grijalva to manage the missions along the Santa Cruz River as he removed the Jesuits. In the Pimería Alta, the Jesuits were officially replaced by the Franciscans in 1768. Whereas the Jesuits were successful entrepreneurial farmers and ranchers, the Franciscans were more focused on devotional missionary work. The Franciscans never rose to the challenge of the Baja missionary work, and they relinquished the peninsula to the Dominicans in 1773. In the Pimería Alta, however, they maintained their missionary work for over 50 years, and during that time sent missions to the coast of Alta California, founding San Francisco in the 1770s (hence the city's name). Father Francisco Garcés founded the northernmost mission in the American southwest, San Xavier del Bac (in

Tucson), dedicated in 1797 and built at the site of Kino's original missionary outpost on the banks of the Santa Cruz River. Father Junípero Serra replaced the Jesuits at Loreto (Baja California), and later went on to build a string of missions in Alta California. The demise of the Franciscan's work in the region began in the late 1820s, when Spaniards born on the Iberian Peninsula were expelled from Mexico. By the time of the Gadsen Purchase in 1854, most of the Spanish mission churches were badly deteriorated or in ruins.

The Jesuit and Franciscan missionaries who traveled the shores of the Sea of Cortez also left us a legacy in place names, and a tour around the region today is a veritable calendar of Catholic saints. At times the list of saints must have simply been insufficient, and the catholic explorers yielded to such names as Todos Santos, Las Virgenes, and Los Frailes (the rocks at land's end, Cabo San Lucas).

The Dominicans were some of the first to undertake real “scientific” expeditions in Baja California. One of their earliest scientific expeditions was led by José Longinos Martínez, a member of the Royal Scientific Expedition to New Spain (1785-1803) who undertook the overland journey from Cabo San Lucas to Monterey (in Alta California) in 1792. Martínez was a first-class naturalist but, although he had a military escort on his expedition, he traveled without scientific colleagues (Simpson 1961).

**Endnote 8.** Juan Bautista de Anza was born (1736) in Fronteras, Sonora (of Basque parents) but was actually raised on the Divisadero Ranch in the San Luis Valley south of Tumacacori, after his father (Juan Bautista de Anza, the elder) was killed by Apaches in 1740. For many years, de Anza served as Captain of the Tubac Presidio and military governor of the region.

**Endnote 9.** G. P. Davis, Jr. (1982) described an American trapper, James Ohio

Pattie, who, while camped in a cottonwood forest on the Colorado River south of Yuma in 1827, watched a jaguar enter his camp and eat his dry beaver skins -- clear testimony to the diversity of the upper delta ecosystem at that time. In 1830, Pattie (and his father) made several trips to the west coast of Mexico via the Gila River and down the Colorado River, through the uppermost Gulf of California, then across the deserts of Baja California and on into California. Pattie's writings describe a rich and abundant river where they trapped beavers "almost as fast as we could wish. We sometimes brought in 60 in a morning." Pattie might have been the first person to describe the famous tidal bore of the Colorado, when it washed away his camp—"We, landsmen from the interior, and unaccustomed to such movements of the water, stood contemplating with astonishment the rush of the tide coming in from the sea, in conflict with the current of the river." Peter Skene Ogden, an adventurous Canadian fur trapper with Hudson's Bay Company, also visited the delta in 1829/1830.

It was not until 1915, with the completion of the "Ocean to Ocean Bridge" at Yuma, that a highway finally spanned the lower Colorado River. Not far from the junction of Gila and Colorado Rivers are two granitic hills that rise above the surrounding floodplain. This was the only place where travelers could easily cross the lower Colorado (the famous "Yuma Crossing") prior to bridge construction. It is the site where Juan Bautista de Anza, the 49ers, the first southern railroad, and first southern highway all crossed the river. It is also the area where the first military post was established on the Lower Colorado River, in support of the increasing numbers of emigrants crossing to California.

**Endnote 10.** The first European-planned scientific expedition to the west coast of North America was probably the 1769 French-Spanish expedition to San José del Cabo, at the very tip of the Baja peninsula,

to record the transit of Venus (Nunis 1982). For the Western world, the transit of Venus across the face of the Sun on June 3, 1769, was the premier astronomical event of the eighteenth century (and only the third time it had been documented in the scientific world). It provided an opportunity to accurately determine the sun's distance from the earth and thus the spatial scale of the entire solar system. The Jesuit-schooled Frenchman l'Abbé Jean-Baptiste Chappe d'Auteroche led the scientific party, giving his life at the primitive observatory and mission in San José del Cabo when, despite the threat of a local plague of "epidemic distemper" (typhus), he insisted on remaining at the mission to complete his astronomical observations. The French plan supplanted a British plan to send the brilliant Jesuit scientist Roger Joseph Boscovich; a plan that was thwarted by the 1767 expulsion of all Jesuits from Spanish lands. The Chappe Expedition sailed from Europe to Vera Cruz, from where they used mules to make a 27-day trek, with all their supplies and astronomical instruments, across central Mexico to San Blas (Nayarit). From San Blas, they sailed to Cabo San Lucas (another 30-day leg). At Cabo San Lucas the party was hosted by the Franciscan Father Juan Morán, assigned by Father Serra to the Mission San José del Cabo. Adding more romance to the story was the serendipitous presence of a well-educated Mexican-born Spanish engineer named Don Joaquín Velásquez Cárdenas de León. Cárdenas was born near Mexico City, but in 1769 he was living in a mining camp just 55 miles north of San José del Cabo. Cárdenas took it upon himself to make an independent observation of the transit, sending his observations to Chappe's group the day after the transit occurred, adding important corroboration to the observations.

**Endnote 11.** One of the earliest terrestrial biological collecting expeditions made to northern Baja California was by I. G. Voznesenskii, out of a Russian colony at Sitka (Alaska). Ships from the colony



visited Isla Carmen to obtain salt for the preservation of furs. In 1842, Voznesenskii, a preparator from the Zoological Museum of the Imperial Academy of Sciences in Saint Petersburg, sailed to Isla Carmen and the nearby areas of Loreto and Puerto Escondido, amassing a collection of 360 land plant specimens. Voznesenskii continued to explore Baja California for ten years. Today, Voznesenskii's plant collections reside in the Komarov Botanical Institute of the Academy of Sciences, Saint Petersburg (formerly known as Leningrad).

In 1850 the *H.M.S. Herald* surveyed the Gulf of California, but the expedition's botanist, Berthold Seeman, left the ship in Mazatlán to cross the Sierra Madre to Durango. In 1867 William Gabb made an overland expedition from Cabo San Lucas to San Diego on what was to become known as the J. Ross Browne Expedition, even though Browne returned to La Paz from Bahía Magdalena, while Gabb proceeded on.

**Endnote 12.** In 1852, when Capt. George A. Johnson started the Colorado Steam Navigation Company, the U.S. Schooner *Capacity* sailed into the Gulf of California bringing, in sections, a small side-wheel steamer, the *Uncle Sam*, designed to work the river. The *Uncle Sam* was 65 ft long, with a hull depth of 3.5 ft. However, she was never able to navigate up-river as far as Yuma.

The next steamer put into service was the *General Jessup*, another side-wheeler, 104 ft long. She was powered by a 70 horsepower engine and designed to handle a load of 60 tons with a two-foot draft. She reached Camp Yuma in February 1854, this being the first successful and complete voyage by a powered vessel to the mouth of the Gila from the head of the delta. She was to bring military supplies to Ft. Yuma, as well as provisions for the migrants crossing the river region or settling into mining establishments along the lower Colorado. Shortly after the *General Jessup*

began service, the company launched the *Colorado*—later identified as *Colorado No. 1* to distinguish her from a later boat of the same name. She made her first upward voyage to Camp Yuma in May 1854. Next came the stern-wheel surveying boat *Explorer*, with which Lieutenant Joseph C. Ives began mapping the Colorado in the winter of 1857-1858 (see below). She served only one voyage up river and then was sold to a private party.

Several other boats were added to the fleet as the pre-Civil War business was booming. Another stern-wheeler, the *Cocopah*, was launched, followed by the *Colorado No. 2* (built on the river bank opposite Camp Yuma).

Eventually a small shipyard was established in the delta, at a place called "Shipyard Slough," near the Sonoran shore anchorage. It became the ultimate resting place of most of the worn-out river craft. The great tidal range made beaching of old steamers a simple matter, and it also facilitated the operation of a dry dock as required. This whole enterprise was called Puerta Isabel. Although it was in Mexican territory, the Mexican government paid it scant attention.

River traffic further expanded during the early 60s, with most of the freight moving up-river from the delta to Fort Yuma. In 1867, two stern-wheel steamers, the *Esmeralda* and the *Nina Tilden*, were brought in from San Francisco together with two large barges (*White Fawn* and *Black Crook*). A reorganization of the company gave it the new name "Pacific and Colorado Navigation Company."

The last steamer to be built and put into service was the *Gila*, which proved to be very successful and exceptionally fast. The voyage from San Francisco to Yuma, including the up-river segment, took 12 -14 days, and fares were set at \$60 for cabin passage, or \$40 for steerage.

These boats faced many challenges to navigation, not the least of which were the devastating tides that swept up and down the estuary and river, and the tidal bore that came during the spring tides. Many a ship became stranded for various lengths of time due to these factors. In September 1921 a small steamer was capsized and lost (130 dead) due to a gigantic bore. Indians were haired to take soundings on the bow of the boats, by means of a long peeled willow pole. Further, floodwaters were constantly changing the channels. Moving upstream, once the Colorado-Hardy junction was passed, and the zone of willow-cottonwood forests was reached, the banks became higher, the ground firmer, and river conditions were better.

In 1857, Lieutenant Ives, of the Corps of Topographical Engineers, was directed by the Secretary of War to organize an expedition to map the Colorado River below Yuma, and to determine its potential to carry steamboat traffic. Ives ordered an iron-hulled stern-wheeler from a Philadelphia shipbuilder, just 50 ft in length and 3.5 ft in draft, to be built in sections and shipped to san Francisco by way of the recently constructed Panama Railroad; from San Francisco it was shipped aboard the schooner *Monterey* to the mouth of the Colorado River, arriving in November 1857. Assembly was completed by December 30<sup>th</sup> and the little vessel, called the *Explorer*, was launched that night. Fort Yuma was reached by Ives on January 7, 1858, although he had to abandon the boat and come overland the last 50 miles. Ives map from those days of his exploration was the only map of the delta for the next 30 years. The official U.S. government version of Ives 1858 map was issued as U.S. Hydrographic Chart No. 619 (in which Ives work was supplemented by the 1873 reconnaissance of the Narragansett).

At this time, the Gila River still formed the boundary between the U.S. and Mexico, as the Gadsden Purchase agreement had not

yet been signed. The town of Yuma thus lay in Mexican territory.

Yuma was made an official U.S. Port of Entry in 1867. Mexico was always lenient in its attitude toward trade and never established a customhouse at the mouth of the river, or at any other point south of the boundary, though they had every right to.

After ~25 years of successful river service, the overland Southern Pacific railroad was completed and it became possible to deliver freight to Yuma by rail from the Pacific Coast. Around the same time, the Laguna Dam was built, 14 miles above Yuma, further crippling the steamboat business. At that point, the river service ended. Puerta Isabel was dismantled in 1878. A complete list of all the boats working the river during this period can be found in Godfrey Sykes 1937 monograph, "The Colorado Delta" (Amer. Geographical Society, Special Pub. No. 19). An attempt to resurvey the river and delta in 1891 showed that most of the major channels had shifted and changed course, as the delta was want to do.

After river traffic ceased, the delta region once again became *terra incognita*. The only people trafficking the delta area were the Cucupá Indians.

**Endnote 13.** Sonora and the Baja California peninsula have always been "off the radar screen" in Mexico City, due to their remoteness and perceived desolate socioeconomic landscape. Further, for most of Mexico's history the Sierra Madre Occidental Mountains created a barrier between Sonora and the vibrant neighboring state of Chihuahua, and it was not until 1992 when the "Yecora Highway" was finally completed, that a convenient connection between these two states was established. Major chapters in Mexico's history were written during the early years of exploration of Sonora and the Gulf of California, although most of the accounts from northwestern Mexico at the time give no mention to such historic national events

as Father Hidalgo's "Grito" and the start of War of Independence from Spain (1810), General Agustín de Iturbide declaring himself Emperor of Mexico (1822), the first presidential election and adoption of a constitution (1824), the election of Benito Juárez as president (1855), adoption of the second national constitution (1857), the French intervention of 1864-1867, the years of Porfirio Díaz' dictatorship (1876-1910), the start of the Mexican Revolution (1910), and the third constitution (1917).

**Endnote 14.** In 1928, Ronald L. Ives made the first of what would be over a hundred expeditions to northwestern Mexico, exploring the Pinacate region and Gran Desierto, and publishing hundreds of articles on his historical geographic research. In many of his travels he was assisted by Alberto Celaya, known for his skillful guiding of the Lumholtz Pinacates Expedition of 1909-1910 (and later a multi-term *comisario* of the town of Sonoyta). Celaya died in 1962.

Ives took his MSc in Geomorphology from the University of Colorado in 1937. He was inducted into the army and quickly became chief of the meteorology division at Dugway Proving Ground, Utah, in 1943. One of his earliest great adventures took place just before the bombing of Pearl Harbor. He was part of a crew delivering classified equipment to Dutch Harbor, Alaska, when their plane "disintegrated" in midair. The only survivor, he parachuted into the sea and swam to Rat Island (one of the Aleutians) where he lived for 89 days on fish and seaweed until being rescued. When the war was over, he went to Indiana University and earned his PhD in Geography. In 1968 he joined the Geography Department at Northern Arizona University (Flagstaff), and after his retirement he lived in Flagstaff and Tucson, where he died in 1982.

Between 1928 and 1981, Ronald Ives made excursions into northwestern Mexico nearly every year, usually alone and with little food

or water. In all, he published an astonishing 565 articles in journals and magazines.

**Endnote 15.** While docked at Guaymas, Beebe and his crew stayed at the Hotel Playa de Cortés, which continues to delight visitors today. While Beebe was enjoying the Playa de Cortés and shooting manta rays from the deck of *Zaca*, John Steinbeck's fourth novel, *In Dubious Battle*, was published, and Steinbeck had begun work on what was to become his Pulitzer Prize winning novel *Grapes of Wrath* (published in 1939).

**Endnote 16.** 1940 was a watershed year by any measure. World War II had "officially" begun the year before, when Britain and France declared war on Germany, which had already invaded much of Eastern Europe. In one year, Germany overran Norway, Denmark, Holland, Belgium, and Luxembourg. Italy and Japan decided to partner with Hitler, and the Axis was born. By mid-year, Germany's forces had entered Paris and their bombers began assaulting England. In this year too, Franklin D. Roosevelt was re-elected President of the United States for the third term. Ernest Hemingway published *For Whom the Bell Tolls*, Carl Sandberg published *Abraham Lincoln: The War Years*, C. G. Jung published *The Interpretation of Personality*, Charlie Chaplin's classic film *The Great Dictator* premiered, and Walt Disney's *Fantasia* was released. Jack Dempsey retired from the ring. And, John Steinbeck received the Pulitzer Prize for Literature for *The Grapes of Wrath*, which was also released as a movie this same year. The *Grapes of Wrath* still sells about 200,000 copies annually!

**Endnote 17.** Members of the 1940 Expedition were Ed Ricketts, John Steinbeck, Carol Henning (Steinbeck's first of three wives), Hall [Tex] Travis (engineer), Anthony Berry (Captain), Sparky Enea (Cpt. Berry's brother-in-law), and Tiny Colletto (crewman). Spencer Tracy was supposed to join the expedition but got tied up on a

motion picture. Steinbeck paid Berry \$2,500 for the six-week charter of the *Western Flyer*.

**Endnote 18.** The Northern Gulf Region, as it is currently defined, extends from the marine-influenced Colorado River Delta, south to (and including) the Midriff Islands (*las Grandes Islas del Golfo*), the largest being Islas Tiburón and Ángel de la Guarda, and to Bahía San Francisquito (Baja California) and Bahía Kino (Sonora). Within the Northern Gulf is the Upper Gulf of California/Colorado River Delta Biosphere Reserve (the “Upper Gulf”), extending from the delta to a line running from Punta Pelicano, Sonora (= Roca del Toro; the southern margin of Bahía Cholla and the larger Bahía Adair, near Puerto Peñasco), across the Gulf to Punta El Machorro (= Punta San Felipe), at San Felipe, Baja California.

**Endnote 19.** The year before the Ricketts-Steinbeck Expedition, *The Grapes of Wrath* (Steinbeck’s ninth book) was published, igniting a storm of controversy that had been simmering from his earlier novel *In Dubious Battle*. While the literary world hailed it as a grand achievement and called Steinbeck “America’s greatest living writer,” California’s conservative and powerful agricultural community reacted violently. They condemned Steinbeck for his harsh (but realistic) portrayal of corporate farms and the bad living conditions of migrant farmers. They branded Steinbeck an unpatriotic communist. Steinbeck even received death threats, and copies of his book were burned by conservatives across the nation. This public reaction struck Steinbeck deeply and by the spring of 1939, on the brink of despair, he declared an end to his career as a novelist. Marine biology and his friend Ed Ricketts provided a path for Steinbeck to remove himself physically and intellectually from the conflicts that had come to haunt him as a novelist.

Steinbeck grew up in the Salinas Valley of California and early on developed a strong

fascination with the sea. In his youth he took a few classes at Stanford University, including a summer marine biology (1923) course at Hopkins Marine Station, in Monterey, California. In part, it was his love of the sea that drove him to move to Pacific Grove (near Monterey) in 1929, the year his first book, *Cup of Gold*, was published and thus set the stage for his inevitable meeting with renaissance marine biologist Ed Ricketts.

Steinbeck first put his friend Ed Ricketts into his writings in a short story titled *The Snake* (1935). But it was his novel *Cannery Row* (1945), written after Steinbeck had moved to New York and was so shaken by the death of his long-time friend that became the vehicle in grieving Ed’s death and a way to find peace after the turbulent years Steinbeck had endured in California. “Doc” in *Cannery Row* is Steinbeck’s idealized image of Ed Ricketts and the persona through which Steinbeck expresses his own (and presumably Ed’s) philosophy of life, which celebrates the wisdom of experiencing life without preconception and the joy of savoring each moment as it occurs. As a natural follow-up to *Cannery Row*, Steinbeck went full circle with *East of Eden* (1952), also written in New York, which celebrates his own life growing up in the Salinas Valley, his family, and the fundamental human power to choose between good and evil, expressed also through the observation of tidepools in “The Log” portion of *The Sea of Cortez*. Altogether, Steinbeck published more than 30 books and screenplays that were adapted into as many films and TV series that received 29 Academy Award nominations and a Pulitzer Prize – and which eventually won Steinbeck the Nobel Prize for Literature in 1962.

Ed Ricketts owned and operated the Pacific Biological Laboratory, which supplied biological specimens to schools and laboratories throughout the west. Ricketts was a liberal-minded, intellectual existentialist who didn’t hesitate to mix



science and philosophy. He and Steinbeck developed a close friendship based on their shared fascinations of marine biology, literature, philosophy, women, and alcohol. In 1939, Ricketts published his now celebrated text, *Between Pacific Tides*. Ricketts planned a series of four books on marine invertebrates that would cover the entire Pacific coast, from Alaska to Peru (the fourth would be a synthesis on northeastern Pacific littoral ecology). He had already made a collecting trip to Sitka in 1932, leading a party of friends that included Joseph Campbell, the comparative mythologist. Also in 1939, Steinbeck and Ricketts began work on a study of the marine invertebrates of San Francisco Bay. However, that project never came to fruition because the pursuit of a larger goal intervened—the Sea of Cortez.

Ricketts moved from Chicago to Pacific Grove, California, in 1923. He had been a student at the University of Chicago and, although he never completed his undergraduate degree, his courses and conversations with the pioneer ecologist W. C. Allee had imbued in him a view of animal communities that affected forever the way he looked at tidepools and life in general. As Ricketts traveled up and down the Pacific coast collecting tidepool animals for his supply business, an emerging sense of community organization, influenced by Allee's views of ecology, began to permeate his thinking. "Environmentalism," as we know it today, did not exist in the 1930s and 40s, and the field of ecology was still a fairly obscure scientific discipline. Ricketts' views evolved into one of the most pivotal books ever written about ecology and marine biology (*Between Pacific Tides*, 1939). Ricketts applied emerging ecological principles, especially as viewed by Allee, to the study of life in tide pools. He described how environmental conditions could be used to predict the presence of species, and he described how communities of organisms function as wholes. He wrote with an understanding of food webs that was new to most biologists of the time.

Ricketts thus pioneered the concept of community ecology on the Pacific coast of America, bringing it west from his experience with Allee in Chicago (see Allee 1923; Hedgpeth 1978). Although he did not "discover" the phenomenon of intertidal zonation, Ed Ricketts was the first person to codify the concept for a broad region (the Pacific coast of America) and to integrate it with a modern view of ecology. Many of his ideas were liberally borrowed and published upon by "degreed" scientists, such as M. Doty and T. A. Stephenson. More than any other single individual, it was the writings of Ed Ricketts (and stories told about him by Joel Hedgpeth and John Steinbeck) that influenced my own earliest inclinations toward marine biology, invertebrate zoology, and the Sea of Cortez.

At least 3 species of invertebrates from the Sea of Cortez have been named in honor of John Steinbeck, and 5 in honor of Ed Ricketts: *Mysidium rickettsi* (a mysid), *Longiprostatum rickettsi* (a flatworm), *Isometridium rickettsi* (a sea anemone), *Palythoa rickettsi* (a zoanthid), *Adesia rickettsi* (a sea slug).

**Endnote 20.** Upon his death in 1971, Lew Walker's ashes were scattered over Isla Rasa.

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