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Elva Escobar Briones
Universidad Nacional Autónoma de México

Raymundo Lecuanda
Universidad Nacional Autónoma de México

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ESTACIÓN DE INVESTIGACIONES MARINAS EL CARMEN UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

ELVA ESCOBAR BRIONES AND RAYMUNDO LECUANDA

BACKGROUND AND SETTING FOR THE CREATION OF UNAM'S FIELD STATION IN CIUDAD DEL CARMEN

The Estación de Investigaciones Marinas El Carmen (the Station of Marine Research in Ciudad del Carmen) is a subunit of the Instituto de Ciencias del Mar y Limnología (Institute of Marine Sciences and Limnology [ICML]) of the Universidad Nacional Autónoma de México (UNAM) (Fig. 1). The station is located on Isla del Carmen, the barrier island of Terminos Lagoon, State of Campeche, in the southern Gulf of Mexico. The station, since its origin, has been a major landmark for the development of scientific projects by UNAM research centers and institutes in collaboration with many other national and oceanographic institutions.

Strategic regional relevance.—To describe the relevance of the station it is useful to compare its origin to the local, regional, and international events of the time, since oceanographic knowledge evolved regionally and globally (Table 1). For almost 40 years the region's development was economically linked to the marine ecosystems but without scientific or technical support and with no guidance for better management of coastal environments. The region of Campeche and the city of Ciudad del Carmen are related to the country's economy through two main productive activities, shrimp fishery and oil production. These two activities link the regional population growth to the coastal sea and its resources and to recent sedimentary environments. From the fishery side, Ciudad del Carmen was selected because the landings in Campeche accounted in the 1960–70s for one-third of all Gulf finfish production and half of all shrimp landings. Although several coastal ecological factors determine the biological productivity of the Gulf fisheries, the most important production mechanisms underlying these fisheries was thought to be the combination of estuaries and lagoons with coastal vegetation (mangroves, submerged vegetation), which provide the ideal habitat as refuge, breeding grounds, and nurseries (Soberón-Chávez and Yáñez-Arancibia, 1985). Ciudad del Carmen, which is located next to Laguna de Términos, provided these condi-

tions. The extraction of shrimp through artisanal and offshore fisheries had been a major source of income and development of infrastructure in Ciudad del Carmen from 1945 until the mid 1970s. Shipyards, canneries, and freezing industries flourished through at least three decades. On the other hand, the early exploratory work for oil started in the late 1950s and continued into the late 1960s (Table 1). In spite of Isla del Carmen's isolation from the continent and its distance from Mexico City, it grew as a strategic economic location until the middle of the 20th century; however, it lacked the support of scientific research. Biological and general geological knowledge was needed to help understand the interaction between Laguna de Términos and the Bay of Campeche and guarantee the persistence of their natural resources.

The concept of a "natural laboratory" for the study of different aspects of sedimentology and oceanography in which the effects of various factors can be isolated had been applied in the Gulf of California in the early 1960s (van Andel and Shor, 1964) and was an applicable concept for the new laboratory in the southern Gulf of Mexico. The large variations in many factors controlling sedimentation plus the nearly landlocked character of Laguna de Términos and its well-defined water circulation made Ciudad del Carmen an ideal place.

The studies of modern sediments along the northwestern margin of the Gulf of Mexico were carried out at the same time under the auspices of the American Petroleum Institute (API) in the 1950s by a group of marine geologists at Scripps Institution of Oceanography and the newly founded department at the Agricultural and Mechanical College of Texas, now known as Texas A&M University (Table 1). These studies, also known as API Project 51, were the pioneering effort in basin-wide sedimentology and ecology directed by Prof. Francis P. Shepard (Shepard et al. 1960) (Table 1) and carried out by a renowned group of scientists of the time that set the stage and contributed with the essential elements for subsequent work in deltas and shorelines around the world. API Project 51 was an important trigger in creating a station of marine research in Ciudad del Carmen and generating knowledge of recent sedimentary

Fig. 1. Timeline of the subunit that originated from the Institute of Biology and Geology.

environments that would help in understanding the unexplored continental shelf, ecosystems, and their resources (Fig. 2).

The national setting.—In 1968 the eyes of the world and the country were focused on the Mexico City Olympic Games, which became a significant catalyst for change in the country

(Table 1). The Olympic Games stimulated a wide range of improvements, among which were the government developing an infrastructure for investment in science and exploring partnerships in the public-private sector, a mixed economic model. The story of the marine research station in Ciudad del Carmen is a good example of success wrapped in a world of

TABLE 1. Chronological history of regional, national, and international landmarks in oceanography that define the national setting of marine sciences at UNAM and that led to the development of ICML and Estación de Investigaciones Marinas El Carmen.

Development and administration Estación de Investigaciones Marinas El Carmen	Year	Landmarks in regional and international oceanography that defines the nacional setting of marine sciences at UNAM
	1929	Creation of the Institutes of Geology and Biology at UNAM
	1939	Creation of the Hydrobiology Laboratory at the I. of Biology <i>Ricketts, E.R. & J. Calvin. Between Pacific Tides. Stanford University Press, 322pp.</i>
	1940	
	41	<i>John Steinbeck & Ed Ricketts.- 1941. The Sea of Cortez. A leisurely journal of travel and research. Paul P. Appel, Publisher, Mamaronneck, New York, 598 pp</i>
	42	<i>Sverdrup and Fleming published "The Ocean"</i>
	45	creation FAO
	46	Recent sedimentary environments major interest in marine science
	48	American Society of Limnology and Oceanography <i>Shepard, F.P. Submarine Geology. Harper & Brothers Pu. 348pp</i>
	1950	
	51	Creation API Program 51
	54	<i>Galtsoff, P.S. Gulf of Mexico: Its origin, waters and marine life. Fishery Bulletin of the Fish and Wildlife Service, V. 55 604pp</i>
	55	Physical Oceanography & Marine Geophysics I. Geophysiscs UNAM Servicio Mareográfico Nacional
	56	First Conference on the Law of the Sea First issue Limnology and Oceanography
	57	Tideland controversy <i>Vityaz reported a depth of 11,034 m</i> <i>Hedgpeh, J.W. Treatise on Marine Ecology and Paleoeecology. VI Ecology. The Geological Society of America, Memoir 67, 1296pp.</i>
	58	Treaties: Territorial Sea and Contiguous Zone, Continental Shelf High Seas, Fishing & Conservation Living Resources High Seas I. Geology initiates collaboration with Scripps Institution of Oceanography
	59	Department of Oceanography and Meteorology Texas A & M specialty in ocean engineering, tight link with SIO
	1960	
		A.P.I. Project 51 Texas won 3 leagues Gulfward extension into the sea Bathyscaphe Trieste reached bottom Mariana Trench <i>Phleger, F.B. Ecology and Distribution of Recent Foraminifera. The John Hopkins Press 297pp</i>
	61	1st Congreso de Oceanografía, Acapulco 1st generation graduated in Marine Sciences C. Marinas UABC
	62	Rachel Carson.- <i>Silent Spings</i>
	63	Yañez, C.A. Batimetría, salinidad, temperatura y distribución de los sedimentos recientes de la Laguna de Términos Campeche. I.Geología UNAM. Boletín número 67 parte 1 47pp

TABLE 1. Continued.

	64	2nd Congreso de Oceanografía Ensenada creation of national academic groups and associations Conference on Estuaries, Jeckyll Island, Georgia 31 March- April 3
	65	Dep. Micropaleontología y Ciencias Marinas, I Geology UNAM
	66	A firm foundation in ocean acoustics Recognition of seafloor structures
	67	Departamento de Ciencias Marinas, I. Biology UNAM <i>Arvid Pardo: Who Will Control the Seabed?</i> , 47 FOREIGN AFF.123 International Symposium of Coastal Lagoons, Mexico City. <i>Lauff, G.H. Estuaries. AAAS Publication 83, 757pp</i> 3rd Congreso Nacional de Oceanografía, Campeche
Creation Playa Norte	68	The Games of the XIX Olympiad <i>Ad hoc</i> Seabed Committee became permanent, membership 91 countries
	69	Yucatan Shelf Studies Publication BP Logan Apollo 11 landed first humans on Earth's Moon <i>Ayala-Castañares, A. & F.B. Phleger. Lagunas costeras. In Simposio Memoir of the Internacional Symposium of Coastal Lagoons UNAM-UNESCO 686pp</i>
R Lecuanda, (oceanology) first director, 1970-1973 First meteorological station continuous recordings in the Southern Gulf of Mexico Dormitories built for students in Playa Norte	1970	The POLYGON experiment: mesoscale eddies landmark physical oceanography
	72	
	73	Creation Center of Marine Sciences and Limnology at UNAM Start third United Nations Convention on the Law of the Sea
A Toledano, (mollusk specialist) second director, 1974-1976	74	Anales del Centro de Ciencias del Mar y Limnología
	75	Ships Pueblo and Mayaguez seized by North Korea and Cambodia
	76	Creation graduate program Marine Sciences and Limnology UNAM Exclusive Economic Zone adopted in Mexico February 6
R Cruz, (marine geologist) third director, 1977-1979	77	Discovery hydrothermal vents Mid-Ocean Ridge eastern Pacific
	78	Coastal Zone Color Scanner aboard Nimbus 7 satellite
	79	Ixtoc oil spill
Construction Estero Pargo R Román, (crustacean bilogist) fourth director, 1980- 1983	1980	Arrival UNAM's R/V El Puma
	81	Creation Instituto de Ciencias del Mar y Limnología at UNAM Anales del Instituto de Ciencias del Mar y Limnología
	82	Arrival UNAM's R/V Justo Sierra United Nations Convention on the Law of the Sea

TABLE 1. Continued.

F Vera, (limnology) fifth director, 1984-1996 Setting of waterlab in Laguna del Vapor	83	Methane seep communities discovered Eastern Gulf of Mexico Initiates Ocean Drilling Program
	84	Discovery chemosynthetic communities Central Gulf of Mexico
	88	IPCCUN General Assembly Resolution 43/53
	1990	
	92	ASLO's Limnology and Oceanography bulletin
	93	Convention on Biological Diversity
	94	International Seabed Authority headquarters in Kingston, Jamaica
	95	Ocean Planet Smithsonian Institution traveling exhibition
	97	The SeaStar spacecraft carries SeaWiFS Adoption of the Kyoto Protocol
	99	FAO action plan on fishery, sharks and marine birds
G. Nuñez (organic chemistry), sixth director, 2009-	2000	Initiates CoML Mexico-U.S. delimitation treaty outer limits of Mexico's continental shelf western Gulf of Mexico
	02	Food world summit
	03	Discovery of the asphalt volcano in the deep sea Gulf of Mexico Initiates Integrated Ocean Drilling Program
	04	ICML expansion to new building UNAM's main campus Laguna de Términos named a Ramsar Priority Wetland
	07	UN Commission Limits Continental Shelf accepted limits W Gulf Mexico IPCC Nobel Prize
	09	2nd unmanned descent Mariana Trench with Nereus depth 10,916 m
	2010	Deep Sea Horizon oil spill ASLO Limnology and Oceanography: Fluids and Environments
Creation Unidad de Vinculación y Educación del Sureste UNAM		

turmoil, where some countries—i.e., the United Kingdom and Germany—experienced similar transformations and trends toward collaboration without undergoing the difficulty of widespread worker and student movements that France and Mexico experienced in 1968.

The scientific vision.—Little is known on how much UNAM through the Institutes of Geology and Biology followed the API Project 51 ideas; however, a group of scientists of the Institute of Geology took the lead in the study of recent sediments, choosing Laguna de Términos as the first area of investigation. This produced the special publication of the Institute of Geology, Bulletin 67 (Table 1) (Salas 1963a, b), which in turn resulted in the 1962 Oceanography and Marine Geology Symposium (Table 1), which set the baseline for sedimentology in Laguna de Términos. There

were many advantages to setting the marine research station in Ciudad del Carmen. The results could be compared with information from similar environments in the Gulf of Mexico (highly saline Laguna Madre of South Texas to low-salinity bays east of Galveston) to results from the API Project 51 (Table 1) allowing generalizations, and results from Laguna de Términos and the nearby coastal zone were of interest to the industry. Research in the nearby coastal zone gradually moved offshore in the following decades to investigate the processes of continental shelves and slopes.

National policy requirements.—The discovery of oil in a large scale in the southern Gulf of Mexico in the early 1970s, in what was called “the oil boom of the Southeast,” generated the prompt establishment and growth of the oil industry off Campeche. The development and trends of the

Fig. 2. Eastern view of newly constructed Estación de Investigaciones Marinas El Carmen in Playa Norte ca. 1969. Image from the Ayala Collection. Courtesy G. Nuñez Nogueira.

regional oil industry saw substantive changes in the productive, demographic model and development that persists today. The research supporting the oil industry developed with the strategic participation of UNAM, the National Polytechnic Institute, and the Mexican Institute of Petroleum. These institutions supported, in different stages (exploratory: environment faunal inventories in the late 1950s and early 1960s), the oil-specific exploration needs of the Mexican state-owned petroleum company, *Petróleos Mexicanos*. In a second stage, the research institutions played an important role during the oil boom with the Cantarell reservoir and in evaluating the environmental effects of the Ixtoc I oil spill and helping control the spill (Table 1).

International partnership programs.—Among the institutions that we have collaborated with, the following stood out for their insight in comparing coastal environments: the Department of Oceanography and Coastal Sciences and the Coastal Ecology Institute from the School of the Coast and Environment at Louisiana State University, the Virginia Institute of Marine Science from the College of William and Mary, the Center for Ecological and Environmental Studies at the University of Maryland, the Department of Biology of East Carolina University, and the Station Marine d'Endoume in Marseille, France. These partnerships and others were relevant in the exchange of ideas and students and in refreshing the scope of the station.

THE CREATION OF THE ESTACIÓN DE INVESTIGACIONES MARINAS “EL CARMEN”

El Diario de Campeche (*Diario de Yucatán*) newspaper published a note on 13 June 1968 reporting on the creation of the Estación de Biología Marítima in Ciudad del Carmen (*El Diario de Yucatán*, 1968). The note mentioned that Dr. Agustín Ayala-Castañares, director of the Institute of Biology, met with the governor of the State of Campeche, Mr. Carlos Sansores Pérez; the Rector of Universidad del Carmen, Dr. Sebastián Rodríguez Ramos; and Ing. Ricardo Monges López, in representation of UNAM, in early June of 1968 in Ciudad del Carmen. The meeting objective was to discuss establishing a center for marine biology (Fig. 3). The center would be financially supported by a three party partnership effort among the state government, the Universidad del Carmen, and UNAM. The location, Isla Aguada or Puerto Real, east of Ciudad del Carmen, had been selected based on “a strategic site with specific hydrographic conditions” according to experts’ knowledge. The state government would cover the cost of the buildings and would benefit in years to come in the “intensive” extraction of fishery resources leading to an increase in the number of shipyards and in the derived fishing industry.

This historical meeting would be the start of a long journey in the consolidation of UNAM’s marine station in Ciudad del Carmen, which was established as a station of the Institute of Biology at Playa Norte in the years 1968–70 and named

Fig. 3. Meeting of the rectors of UNAM, Pablo González Casanova (sitting center on the right) and the University of Ciudad del Carmen (sitting center to the left) with the Municipal president (sitting to the far left), the governor of Campeche (sitting to the right) and the director of the Institute of Biology, Dr. Agustín Ayala Castañares (back) in Ciudad del Carmen on the occasion of the inaugural ceremony of Playa Norte. Standing at the back are UNAM's rector, Mr. Raymundo Lecuanda, first director of the Estación de Investigaciones Marinas El Carmen, and Dr. Antonio García Cubas, researcher and head of the collection of mollusks in the main campus ca. 1970. Courtesy R. Lecuanda.

Estación de Investigaciones Marinas “El Carmen” (Rectoría Asuntos Generales, n.d.). The original name was changed in support of what would better describe the activities to be carried out (Ayala-Castañares, 1969b). Most probably the name on the plate on the Playa Norte facilities (Fig. 4) was related to an academic/administrative status. To inaugurate the station, specialized furniture was needed, and notes exist of this administrative process (Ayala-Castañares, 1969a, 1970b). Diverse dates are recorded as the dates when the station was inaugurated, 5 Aug. 1969 (Ayala-Castañares, n.d.), 7 Aug. 1969 (Ayala-Castañares, 1969a), and Feb. 1970 (Ayala-Castañares, 1970a); the inaugural plate set at the entrance in the buildings of Playa Norte sets the date as 1967–73 (Fig. 4).

In 1973, when the Center of Marine Sciences and Limnology (Centro de Ciencias del Mar y Limnología, CCML) originated from the Institute of Biology (Fig. 1; Table 1), the station in Ciudad del Carmen became one of the CCML

subunits. A new laboratory and housing complex was built in Estero Pargo shortly before the Center of Marine Sciences and Limnology evolved into the current institute in the early 1980s.

Objectives and mission.—The objectives and mission of Estación de Investigaciones Marinas “El Carmen” was described in the note of Diario de Campeche; “to encourage scientific based knowledge for fishery in the large scale in the region.” Today it follows ICML’s objective to carry out scientific research in marine sciences and limnology that contributes to the knowledge, preservation, and management of ecosystems and their resources and to prepare highly qualified human resources in all four areas of oceanography (geology, physics, chemistry, and biology) and limnology.

Setting the stages of advancement of knowledge.—The Playa Norte station was the consequence of

Fig. 4. Inaugural plate of Estación de Investigaciones Marinas El Carmen on buildings of Playa Norte 1970 (image from the Ayala Collection. Courtesy G. Nuñez Nogueira [left]). The inaugural day and Dr. Ricard Monges López, founder of the School of Sciences at UNAM presenting the plate to guests during the ceremony. Courtesy R. Lecuanda.

research work carried out since 1958 starting with the bathymetry of Laguna de Términos (Table 1). This was the original construction with an area of 1,190 m² that included housing facilities, laboratory space, and offices. Because Laguna de Términos was a very economically important coastal location, the biological studies carried out on fishing resources in the early 1970s were supported by a fixed fund that allowed administrative independence from the distant Mexico City (Ayala-Castañares, 1969a). The first supported research project at the Playa Norte location was on sandflies and was carried out by Dr. Carlos Márquez Mayaudón and his students. Financed projects were devoted to understanding the diversity of hydrological conditions, the diversity of fish (Andrés Resendiz), polychaetes, crustaceans (Alejandro Villalobos), and plankton. Playa Norte was the first location to store meteorological data with a state of the art meteorological station (Fig. 5). For almost a decade it hosted scientists and students from the Institute of Biology and the Center of Marine Sciences and Limnology at UNAM as well as from different U.S. universities fostering studies on coastal ecosystems. The graduate program in Marine Sciences and Limnology started in 1976, and several student thesis projects were carried out in Laguna de Términos. Playa Norte was an excellent ground for experimental work that examined the physiological constraints of the development stages of the main shrimp and crab species and evaluated the potential of shrimp culture (Fig. 6).

Estero Pargo location.—When Playa Norte proved to be too limited in space for the large number of visiting scientists studying fishery and energy resources, the university acquired more land and

built additional infrastructure in Estero Pargo (Fig. 7), which at first had an area of 2,000 m² and by 1980 had a total of 6,000 m², which was built in two additional stages. Laguna de Términos and its highly diverse habitats (sea-grass beds, mangrove forests, sand bars, tidal flats) were the location of studies for the production and evaluation of shrimp harvests in Campeche during 1980–90. The value of the mangrove systems and the seagrass beds as nursery habitats for the offshore fisheries was recognized. Several trophic studies and modeling efforts focused on the mangrove–shrimp production linkages. Researchers suggested that mangrove reduction had had a deleterious effect on the shrimp industry and the Campeche economy. Additionally, the expansion of Ciudad del Carmen since the 1970s and the land claim by migrants led to mangrove deforestation in Laguna de Términos between 1980 and 1990. Aquaculture provided a research option to address the problems caused by damaged mangrove–shrimp production linkages. The concern that the lucrative shrimp aquaculture activities encroached on the mangrove areas meant that the resulting losses would be observed in losses in revenue of the shrimp fishery. Many of the results from the different studies in Laguna de Términos appear in the early publications of the *Anales del Centro de Ciencias del Mar y Limnología*, and the later *Anales del Instituto de Ciencias del Mar y Limnología*. The first references on oil pollution in coastal environments in the Campeche region were published in 1979 (Vásquez-Botello 1979a, b).

Major marine research science programs and results (1980s–2010).—The station since the creation of ICML: Since its beginning, the station at El

Fig. 5. Explanation of the first meteorological station in the southern Gulf of Mexico, 1970. Courtesy R. Lecuanda.

Fig. 6. Tanks for experimental shrimp culture in Playa Norte. Courtesy Carlos Rosas, Facultad de Ciencias in Sisal, UNAM.

Fig. 7. Setting of the Estación de Investigaciones Marinas El Carmen in Estero Pargo ca. 1974. Image from the Ayala Collection. Courtesy G. Nuñez Nogueira.

Carmen has held only few permanent staff members, mostly administrative support staff (Ayala-Castañares, 1969a). The scientists and students traveled to the station and carried out field or experimental work, returning after a few days or weeks to the headquarters in Mexico City. The setting in Playa Norte had more limited space and less direct access to Laguna de Términos. In contrast, the new setting in Estero Pargo (Table 1; Fig. 7) had direct access to the estuary, to the mangrove forests, and to the submerged aquatic vegetation and the delta. For this reason the station is equipped with a dock and pulleys to assist the scientists and students in guiding boats in the water, storage rooms for engines, vests and sampling gear, laboratories for the postprocessing of samples, housing facilities to host up to 20 scientists, equipment, vans, and administrators and staff to assist during the sampling campaign.

Some research projects in collaboration with the University of Louisiana required building a house on poles in Laguna del Vapor, a smaller freshwater lagoon west of Laguna de Términos (Table 1). This allowed long-term observations in the site, facilitating access to the seagrass beds and protection against mosquitoes.

In the year 1972 the graduate program started by offering a master's of science degree and a Ph.D. in marine biology. This was a joint effort between the School of Sciences and the Depart-

ment of Marine Sciences and Limnology of the Institute of Biology at UNAM with the participation of the Institutes of Geophysics and Geology. The program evolved into a self-sustaining and multidisciplinary graduate program in Marine Sciences and Limnology by 1976 (Table 1). This resulted in a large number of theses derived from research in Laguna de Términos (Fig. 8).

The department grew larger and stronger, and by 1973 it separated into a self-sufficient Center for Marine Sciences and Limnology (Table 1), integrating an interdisciplinary effort among scientists of different disciplines to interact in joint aquatic programs (coastal lagoons, marine resources, pollution, and environmental characterization). By 1979 the center had 2,155 m² in the main campus; the stations of El Carmen, Mazatlán in the Eastern Tropical Pacific, and Puerto Morelos in the northern Caribbean tripled this area. The Estación de Investigaciones Marinas "El Carmen" was a turning point in coastal sciences in Mexico as recorded from the significant number of papers published in *Anales del Centro de Ciencias del Mar y Limnología* (1974 to 1980) and its special publications, and in *Anales del Instituto de Ciencias del Mar y Limnología* (1981 to 1996). The station in Ciudad del Carmen provided a substantial advance in the interdisciplinary approach to marine sciences research from Laguna de Términos and the coastal and offshore area in the southwestern Gulf of Mexico

Fig. 8. Number of student theses on Laguna de Términos carried out at Estación El Carmen at all three levels: bachelor of sciences, master's degree, and Ph.D. degree.

that have been summed in the reference catalog published in 1990 (Lara-Domínguez et al., 1990), in addition to those searched by the Earth Sciences Library at UNAM. The number of publications in this peer-reviewed journal displayed substantial growth from 1974 on (Fig. 9), and publications continued growing after 1982 with the arrival of the research vessel B/O *Justo Sierra* from UNAM (Table 1), which extended the scope of the papers and integrated information from Laguna de Términos and other coastal lagoons in the region with the natural resources offshore and with the Bay of Campeche.

Collaborative programs and future research programs.—Since its creation, the Estación de Investigaciones Marinas El Carmen has collaborated extensively within the following other centers and institutions of UNAM, with the local University del Carmen, with the national universities, i.e., Universidad Autónoma Metropolitana (UAM), and with diverse international universities within the Gulf region, i.e., the ecological study of Términos Lagoon and adjacent areas in Campeche with Louisiana State University, and overseas, i.e., universities in France. The Estación de Investigaciones Marinas El Carmen has also collaborated with international groups in the region, i.e., Organization of American States (OAS) with the biotic resources project in coastal lagoons, mangroves, and adjacent areas of Latin

America with the participation of regional universities from Costa Rica, Dominican Republic, and El Salvador among others (UNAM, 1987). These and diverse partnerships with the environmental ministries and nongovernmental organizations were crucial in issuing the Laguna de Términos Protection Act in 1994. Since 2004 Laguna de Términos has been considered a “Priority Wetland” within the Ramsar Convention classification and included among the 15 natural areas of exceptional value. Like many other wetlands, Laguna de Términos is subject to diverse pressures and offers with potential for international collaboration in issues related to ocean–land interaction. Among the major ongoing programs is the Joint Environmental Study of Terminos Lagoon, directed by the Institute de Recherche pour le development in collaboration with UAM-Iztapalapa in which UNAM participates.

The recent reactivation of Estación de Investigaciones Marinas El Carmen includes plans for a new stage in the development of the station with the new Linkage and Education Unit (Unidad de Vinculación y Educación del Sureste Maestro Justo Sierra Méndez, Table 1; Robles 2010) that will provide a base of support and services for the ongoing research programs related to Laguna de Términos and the coastal and offshore areas in the Bay of Campeche. The Southeastern Linkage and Education Unit will

Fig. 9. Papers published on Laguna de Términos and on the immediate coastal and offshore marine environment in the Campeche Bay in *Anales del Centro de Ciencias del Mar y Limnología* (1974–80) and in *Anales del Instituto de Ciencias del Mar y Limnología* (1981–96).

replace the old edifices in Playa Norte and will operate in collaboration with diverse UNAM centers, schools, and institutions of the State of Campeche to address science and technology priorities in the region with local industry and international research groups with the aim of consolidating an interdisciplinary research pole in the southern Gulf of Mexico.

Today the station is a service unit in support of research carried out by ICML and by other UNAM schools, centers, and institutes. It provides academic support to local institutions (Universidad Autónoma de Campeche, Centro de Ecología, Pesquerías y Oceanografía del Golfo de México [EPOMEX]) and other national universities. The station in Ciudad del Carmen is supported by UNAM's central administration with two full-time researchers and three technicians in 2009 to promote ongoing scientific projects and encourage academic growth; it depends on additional financial support from the dean's office for the acquisition of new equipment.

What is the relevance of Estación de Investigaciones Marinas El Carmen?—The station was created to fill gaps in scientific knowledge and to support

economic growth and development based on shrimp fishery and oil and gas exploitation in the southern Gulf of Mexico. These two issues required a better understanding of the environment and sustainable use of the natural resources and ecosystem services in the region in the late sixties and early seventies. The growth and development of the island and the region have offered great potential for interdisciplinary studies. These have evolved with regional and international collaboration during the past four decades.

Owing to its location, the station may be an excellent place for visiting scientists to study climate change and sea-level rise, coastal erosion, acidification, pollution, hypoxia events, land–sea interactions, and biodiversity of the major habitats along a gradient from rivers to the sea. Most of these issues can integrate social, economic, and environmental assessments, across ecosystem components and activity sectors. These are relevant to the station in its involvement with regional and national development through providing important support for the application of holistic ocean management, including the human dimension, education, and sustainability. Another need is the setting of a natural long-term

ecological research observatory that can better inform decision making and help in precise forecasts in the region.

Acknowledgments.—Each time we asked for information from Ciudad del Carmen, we were offered the best information everyone had at hand. We are grateful to many colleagues for this positive assistance. Historical images of Playa Norte and Estero Pargo were provided by G. Núñez Noqueira, Estación de Investigaciones Marinas El Carmen. Information was recovered at the Hemeroteca Nacional located at UNAM that holds, in an organized and systematic fashion, the history of the university and records of the process of its creation. S. Armendariz helped with reference searches available at the Biblioteca Conjunta de Ciencias de la Tierra (BCCT) at UNAM. R. Gio, Ciudad Universitaria, presented a brief account of the individuals involved in the creation of the Estación de Investigaciones Marinas El Carmen; R. Román Contreras assisted in the timeline succession of heads of the station; Dr. A. Laguarda Figueras helped with valuable oral and written information from the period 1970–77 when he was the Director of the Center of Marine Sciences and Limnology. Valuable comments on a first draft were provided by A. Gracia Gasca.

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- Universidad Nacional Autónoma de México, Instituto de Ciencias del Mar y Limnología, A.P. 70-305 Ciudad Universitaria, 04510 México, D.F. Send reprint requests to EEB.*
- [R]evolutionary ideas originate in the minds of men and not in institutions, no matter where. Munk and Day (2008).