Chapter 27
Integration of Resident Fisherfolk Communities in Marine Protected Areas by Social Micro-entrepreneurships of Mariculture: A Case Study at La Paz Bay, South Baja California, Mexico

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Abstract The global deterioration of vital ecosystems and natural resources has compelled to constantly redefine alternative futures. The creation of protected areas (PAs) is considered among the best prescriptions to rise environmental conservation insofar as multiple-objective established in the nations' policies allows resident communities to access productive opportunities through social micro-entrepreneurships (SMEs). Although implementing PAs assumes conversion-diversification processes designed for unique socio-ecologic timelines and components by case, it is recognized that SMEs of ecotourism, small-scale farms, and a rational exploitation of local natural resources are inherent vocational assets that improve PA profitability. The integration of rural/coastal groups in PA management by productive SMEs is analyzed in this chapter. We discuss the development and outcomes of this model applied in the real conditions of a marine-coastal PA (MPA) in La Paz Bay, Baja California Sur, Mexico, the "Balandra-Merito" coastal lagoon system. Here, the model comprises small-scale mariculture and coastal fisherfolk actors determined by the historical context of a case study. Using the narrative visualization approach, we review the extension (capacity-building) programs in which the roles of technologies and knowledge-holders signify decisive influences on the configuration of SMEs into or around protected areas. Prospects to make Balandra-Merito MPA more cost-effective are examined.

Keywords Coastal fisherfolks · Protected areas · Profitable conservation · Mariculture · Social micro-entrepreneurships

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27.1 Framework of the Case Study

The global socioeconomic model has laid heavy footprints on almost every ecosystem and natural resource, with evidences of fast deterioration in the last 30 or 40 years at such an extended rate that great awareness about the present widespread crisis has been rising alerts to what it may come in the near future. Many summits, conventions, and other global reunions assembled principally from the 1980s and on keep searching for alternatives to regulate the consumption/waste model based on the overexploitation of natural resources, and thus the character of sustainable goals is in constant redefinition from shorter to longer intervals (2050 so far), in parallel to progressively complex socio-ecological scenarios. For example, 20 strategic goals, the Aichi targets, with biodiversity conservation as foremost aim, were supposed to be achieved by 2020. We are there now, and it seems the compromises comply just partially.

Because of many reasons, the social dimension in the first place, marine coastal areas have received systematic attention in finding better strategies for the management stewardship of fundamental ecosystems and natural resources, particularly in developing countries. For instance, the United Nations Ocean Conference (New York, June 2017)[1] set forth a factsheet that summarized the ocean's role in human societies, and vice versa, to 51 points classified in 14 sectors (main roles) where tropical coastal zones are highlighted in a substantial proportion: demography; sustainable livelihoods; food security and health; conditions of small-scale fisheries and coastal fisherfolks, similarly in rural-inland areas; effects of diverse forms of tourism and land-based activities such as urban, agriculture, industries, ports, etc.; status of mangroves, coral reefs, and coastal biodiversity in general; physical alterations on coastlines; threats from sea-level rise and extreme weather events; issues of displacement; and vulnerability at large. It is no surprise to observe the increasing global move to create marine-coastal protected areas (MPAs henceforth) and/or special measures on the utilization of vital ecosystems and key species.

There is, however, a situation of balance in the perception of the holistic effects that PAs generate in terms of advantages and disadvantages in real conditions that can be as specific and different as a single case study (Du et al. 2015; Oldekop et al. 2016; Le Gouvello et al. 2017). Although the IUCN categories system is the global standard for PA governance adopted in practically every nation owning these natural assets, the configuration of virtual actions (e.g., planning stage and forecasts) or adjustment of these actions to the current management framework (administrative, productive, extractions, research, capacity-building, etc.) should find alignments on a wide array of components (actors and their institutions, development trend adopted, cultural/psychological constellations, ecological-biogeographic contour, timeline construction, etc.) and of terminology in consequence, that vary at national and local scale (e.g., reserves, no-take zones, refuges, sanctuaries, parks, or a

[1] https://www.un.org/sustainabledevelopment/wp-content/uploads/2017/05/Ocean-fact-sheet-package.pdf Accessed 4 December 2019.

generic "conservation area"). Likewise, there are different interpretations about what is and how to apply multipurpose or multiple-use objectives in PA and dilemmas on conservation and production (e.g., Agardy et al. 2011; Bottema and Bush 2012; Oldekop et al. 2016; Du et al. 2015; Le Gouvello et al. 2017), which addresses to insights necessarily related to management and planning methods that connect in particular way to a "tropical" stereotype, the said Third World developing countries, more so if rural or coastal communities are involved (Agardy et al. 2011; Bennett and Dearden 2014a; Segi 2014; Du et al. 2015). In the practice, implementing PAs (what and how will be protected, by whom, reasons/aims, benefits and target recipients, and other criteria) entails that the "willingness," a common guideline in research surveys of perception/acceptance, should be more properly defined as the attempt to convince proud and distrustful people to appropriate a proposal and of skeptical decision-makers in facilitating the process (e.g., Perkins et al. 2002; Brugère et al. 2008; Awortwi 2012; Cundill et al. 2017).

Certainly the IUCN categories encourage community-based management through social micro-entrepreneurships (SMEs hereafter),[2] but lessons learned in real conditions reveal that the concept of multiple objective alluded to those categories delivers few and narrow windows to accommodate local communities with productive activities into or on the periphery of PAs. The initiatives aiming at the protection of a given area or resource have to deem the presence of resident communities whose livelihoods rely on the exploitation of those native resources aimed to protect (fisheries, wood, recollection, soils of artisanal mining, etc.), and/or they have farms (agriculture and terrestrial and/or aquatic commercial livestock), and/or work on ecotourism (freelance or employed by private enterprises),[3] or other income-producing activities derived from regional/local assets, even hunting and leisure/sport fishery. Evidence shows that tourism-oriented SMEs have been the preferred choice to realize profitable community-based actions in continental and coastal PAs. This image is the mainstream projection of (tropical) PAs in the tourism market. On the other hand, the IUCN system allows farming modalities into PAs if explicit benchmarks are fulfilled within two compartments: restoration-restocking and countless modalities of small-scale production.[4] Therefore, a direct

[2]Community-based social micro-entrepreneurship (SME). See Brugère et al. (2008), Berkes and Davidson-Hunt (2010), and Davidson-Hunt et al. (2012), among others.

[3]Community-based tourism (tourism-oriented SMEs) is inherent to low-impact sustainable tourism in many forms (ecotourism, geotourism, ethnic/cultural tourism, pearling tourism, adventure, gastronomic, health, etc.), and there are different definitions for each (see Boley et al. 2016). In this chapter the reference to ecotourism is used in generalized term, unless it is specified where necessary.

[4]It is common to find productive SMEs doing husbandry of local species into or around PAs with different degrees of protection. Examples of rustic cultivation technologies include medicinal, ornamental, and "organic" plants; honey; cheese and other milk by-products—goats, cattle; leather from animal breeding, even alligators; pet breeding (iguanas, turtles, aquarium fish, etc.); and diverse gastronomic products that include marine and freshwater aquaculture, besides nacre and pearl-bearing mollusks like naiads, abalone, and pearl oysters (Monteforte and Cariño 2011; Bennett and Dearden 2014b p. 98). Browse the Internet.

deduction that emerges from conveying profitable conservation and community-based SMEs of ecotourism and/or cultivation of target species (plant or animal) integrated to PAs management would lean to underscore biogeographic interactions which, in terms of the geographic distribution of PAs (e.g., type of ecosystem and species), are concentrated on certain kinds of biodiversity (e.g., Agardy et al. 2011; Monteforte and Cariño 2011; Hjalager and Johansen 2013; Slater et al. 2013; Hill 2017; Le Gouvello et al. 2017). In addition, the scope to implement ecotourism and/or farmer SME models in real conditions, rather than being theoretical, depends on strategies specially devised to meet socio-ecological and cultural profiles prevailing in a focus case, where multifaceted dynamics of ecosystem-based factors and case-based indicators vary even within a locality and over time (e.g., Bondad-Reantaso et al. 2009; Slater et al. 2013; Le Gouvello et al. 2017). Overarching distinctions linked to regional/local geographical features of marine coastal and continental PAs stand out in the first place. Although both domains equally share the sense of iconic value (cf. natural asset, emblematic belonging, or marketable attribute) ascribed to a set of ecosystems and species biogeographically determined therein, those such dynamics take place in totally different spaces; obviously the separation is blurry in most MPAs. It also applies to cultivation modalities with a set of commercial species that ultimately can propel gastronomic tourism (Hjalager and Johansen 2013; Slater et al. 2013) and/or added value from ornamental marine species, seaweeds, and pearl oysters (Ferse et al. 2012, Monteforte and Cariño 2013, 2018, Bennett and Dearden 2014b p. 98, Le Gouvello et al. 2017, among others).

Another point of view to integrate resident communities in their inland or marine PA concerns the premise that conversion-diversification processes should not beget tangible changes to entrenched livelihoods (Bondad-Reantaso et al. 2009; Slater et al. 2013; Bennett and Dearden 2014a; Cundill et al. 2017). In approach to MPAs, these processes have to focus in coastal fisherfolk groups often organized in cooperatives or similar associations, considering that the regulations in many MPAs may restrain artisanal fisheries as well as certain modalities of mariculture or commercial species. Resident fisherfolk represent one of the major conflictual issues in MPAs since they often feel the proposals about conservation and protection as a threat of privatization and exclusion (e.g., Cárdenas and Ostrom 2004; Leopold et al. 2013; Bennett and Dearden 2014a; Segi 2014; Bennett et al. 2015; Hill 2017; Woodhouse et al. 2018). Contrary cases do happen when the locals undertake the initiative to create their PA and regulate the extractions of resources and/or access to the site ecosystems. In any event, the participants into collective initiatives aimed to conservation programs should have to believe on it as a potential instrument to obtain some benefit (abstract, material, economic) from the trade-off (Cárdenas and Ostrom 2004; Awortwi 2012; Bennett and Dearden 2014a; Cundill et al. 2017). Taking in consideration the MPAs' own natural vocations to develop mariculture ventures, fisherfolk should become primary actors to organize the management policies for the area, whether planned or in course. The IUCN system advises a zoning approach (e.g., buffer and core or nucleus zones and a peripheral strip) as the best practice guide to organize multiple-objective PAs, each type of zone has different objectives, and some allow for greater utilization of resources than others.

In MPAs, this implies tridimensional zoning in order to cover the water column and the seabed. There are open-ocean PAs as well though not yet formal because industrial fisheries introduce a different outlook (Bennett et al. 2015; Briscoe et al. 2016) and some consider that islands are oceanic.

This chapter subscribes to coastal planning practices in rapidly changing sceneries where decision-makers at the moment almost always worsen the troubles already accumulated over time, often to alert states, or introduce new ones. Due to the growing pressure from development models at different scales, a question is reiterated in forums, workshops, and case studies: What to do with fisherfolk communities? Or rather, what could motivate them to participate in conversion/diversification processes related (or not) to MPAs?

With that in mind, a case study is examined alongside four main components that regularly concur in PAs where private or communitarian farms existed before and had to be adjusted (e.g., modify the technology and/or change to small-scale) or were closed or are part of the planned perspective. These components are the following: (1) availability and access to certified technologies (mariculture in the case) adequately designed for (2) target groups (fisherfolk herein) and for (3) the prevailing factors of governance on the PA case study (MPA, this study) that includes the attitude of different stakeholders (e.g., national/international agencies, academic institutes, civil organizations and their sponsors, commercial and entrepreneurial sectors, special interest groups, and other leading persons) and, finally, (4) a timeline review at conversion and diversification processes of target groups upon technology-based SMEs, like coastal fisherfolks with small-scale mariculture of which the literature contains hundreds, maybe thousands, of examples (many with gender orientation) investigated in tropical coasts (e.g., Brugère et al. 2001; Bondad-Reantaso et al. 2009; Slater et al. 2013; Ateweberhan et al. 2018), which comprise pearl oysters (see Monteforte and Cariño 2013) and ornamental marine species (Ferse et al. 2012).

The present study is located in La Paz Bay, Baja California Sur (BCS), México, into a coastal lagoon system locally known as “Balandra” which owns the label of MPA since 2012 as Area of Protection of Flora and Fauna (DOF 2012). Actually, the MPA extends southward to El Merito and Falsa Bay coastal lagoons and comprises the adjacent marine area (Fig. 27.1). This chapter addresses a narrative visualization approach (Ma et al. 2011; Dahlstrom 2014) to explain the historic role of the main factors that led to the current scenery in this MPA and their decisive influence in making La Paz an important hub of mariculture science and technology. This attribute should be applied in the implementation of fisherfolk-based mariculture SMEs as a profitable alternative to achieve better management of this site, which could be replicated in other MPAs that have good conditions to ensure this type of models be successful. Ultimately, the analysis would be useful elsewhere to motivate capacity-building programs and conservation policies by linking beneficiaries, professional experts, and stakeholders by effective actions in that direction.

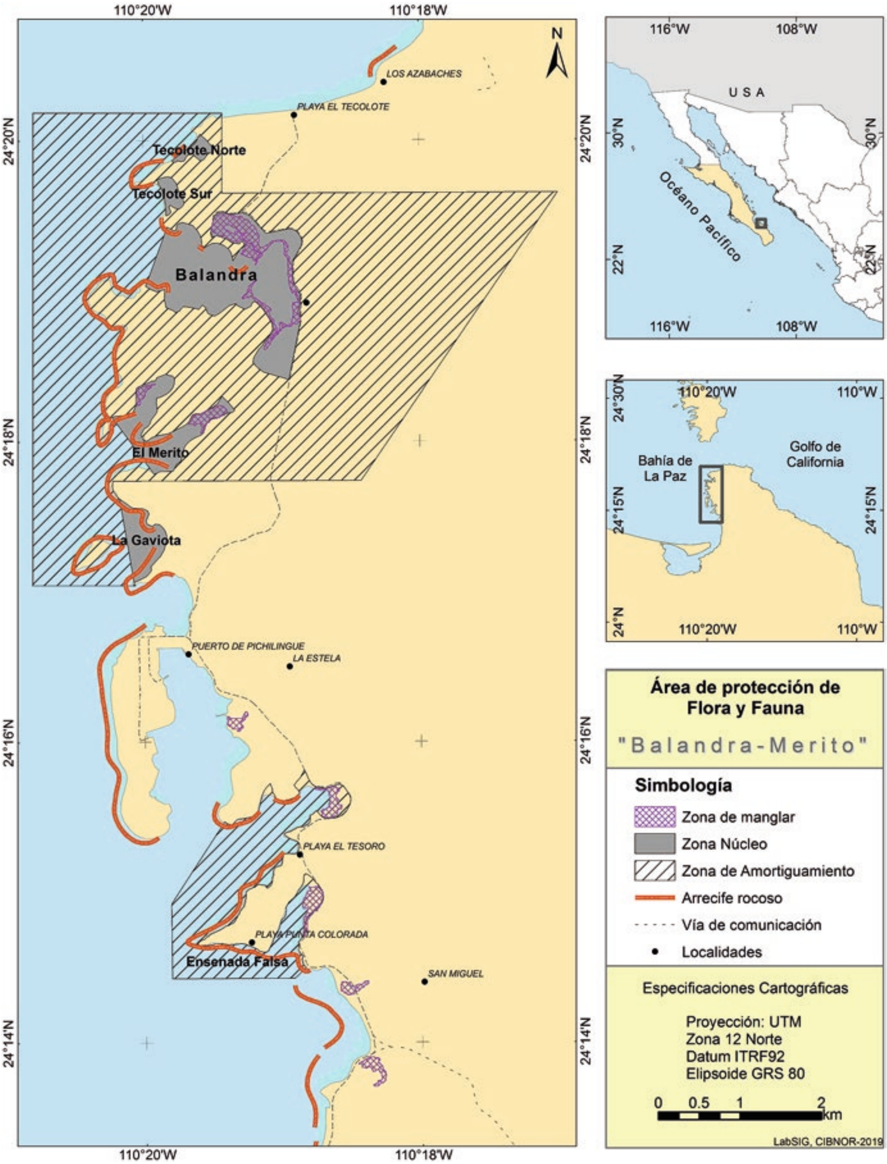

Fig. 27.1 Geographic location of the Marine Protected Area Balandra-Merito and delimitations of the zones at La Paz Bay, Baja California Sur, Mexico. Elaborated by the Laboratory of Geographic Information Systems and the Department of Extension and Scientific Diffusion (CIBNOR)

27.2 Description of the Study Area

Numerous legal instruments—laws, decrees, secretarial agreements, and official standards—regulate coastal and marine issues in Mexico (Fraga and Jesus 2008; Havard et al. 2015). Among the most important laws pertaining to the rights to exploit natural resources for any purpose is the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA). It defines the tools of the national environment policy within the logic of a sustainable management of natural resources so that economic benefits could be obtained while preserving the ecosystem (Fraga and Jesus 2008). In addition to the LGEEPA, a considerable number of legal instruments focus in conservation and use of the biological diversity (Table 27.1). Likewise, La Paz Bay is a Marine Site Priority declared by the National Commission of Biodiversity (CONABIO); the Espiritu Santo archipelago is a National Park and belongs to the World Natural Heritage (UNESCO) stated for the Gulf of California islands, and Balandra-Merito and Falsa Bay coastal lagoons zones encompass an Area of Protection of Flora and Fauna (Fig. 27.1). These lagoons host wetland scrubs-mangrove ecosystems under Ramsar status; besides, the character of arid mangrove represents eminent importance as a relict ecosystem (Arreola-Lizárraga et al. 2004; Adame et al. 2018). The statement applies to the madreporian corals forming the typical rock-coralline ecosystem present along the BCS east coast, specially thriving in Loreto and Cabo Pulmo national parks. There are more labels related to the study area:

- Ensenada de La Paz (Fig. 27.2) is a Conservation Area for Birds (1998), and its wetland-mangrove ecosystem is Ramsar. There are initiatives to create in this singular Ensenada a refuge or sanctuary dedicated to dolphins that are common dwellers in the channels and deep areas there inside (deep, 6–10 m at most).
- Several resident and migrant marine species present in La Paz Bay are under special protection (NOM-059-SEMARNAT); therefore also their territories are fairly protected (turtles, birds, marine mammals, and some species with commercial value).
- There are social initiatives to protect La Paz Bay cultural heritage, like the remains of Indian groups, Pericúes and Guaycuras, in El Conchalito (south coast of Ensenada de La Paz, nearby the downtown), and the Compañia Criadora de Concha y Perla (CCCP) founded by Gaston Vives in Espiritu Santo island (Cariño 1998; Cariño and Monteforte 1999). Some local sectors wish the original CCCP installations be restored as a museum. Other initiatives aim to restrain transit (off-road vehicles), sand extraction, or residential buildings in sand dune ecosystems that are the dominant morphology of La Paz Bay continental coastline (Fig. 27.2).

Table 27.1 Main legal instruments that regulate conservation and use biological diversity in Mexico

Environmental regulations	Management/production sector
General Wildlife Law (LGVS) Federal Fisheries Law (LFP) General Law for Sustainable Fisheries and Aquaculture (LGPAS) General Law for Sustainable Forestry Development (LGDFS) Official Mexican Standard (NOM), for instance, NOM-059-Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT)-2001 lists threatened and endangered species and NOM-022-SEMARNAT-2003 regulates conservation, sustainable use, and restoration of coastal wetlands located in mangrove areas General Law of National Property (LGBN), which incorporates legislation on coastal areas (such as beaches), the 20 m federal maritime-terrestrial zone (ZOFEMAT) and reclaimed land Federal Tourism Law (LFT) regulates all tourism activities Federal Sea Law (LFM), the General Health Law (LGS), and the National Waters Law (LAN) control ocean pollution Ports Law (LP) and the Navigation Law (LN) regulate marine transportation, prohibiting all vessels from contaminating the country's waters	Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA). Mainly intermedia of financial functions in regard of productive projects Nacional Commission of Fisheries and Aquaculture (CONAPESCA), attached to SAGARPA. Concessions, permits, liaison agents with the productive sector (cooperatives) Secretariat of Environment and Natural Resources (SEMARNAT). Coordinates environmental management in Mexico, e.g., evaluation of reports of environmental impact assessments, management of PAs, etc. National Commission of Protected Areas (CONANP), subscribed to SEMARNAT. Vigilance, management, administration of PAs (regional) Federal Attorney for Environmental Protection (PROFEPA). Law enforcement of environmental protection Other entities related to quality and health controls on the products (e.g., cultivation) and the environment Trend toward scientific-technologic parks to promote private investment (national and foreign) in the sector of primary production such as aquaculture. This trend involves technologies that usually are in the hands of academic institutions housing their park

Modified from Fraga and Jesus (2008) and Havard et al. (2015)

27.2.1 La Paz Bay Presentation

La Paz Bay and islands close by (Cerralvo, Espiritu Santo archipelago, San Francisquito and San José) are placed on the southeast of Baja California Sur (BCS) (Figs. 27.1 and 27.2) facing the Gulf of California. The Bay is about 83 km on the NW-SE axis and 35 km on the NE-SW axis (2600 km^2). The aerial view shows that landscapes of dunes and sandy beaches of smooth slope are the dominant landscape along the continental coast. There are discontinuous bands of rock-and-boulder beaches and rocky-coralline reefs (Fig. 27.2) better developed on the southeast coast from La Paz city to the boundary of Balandra, around Espíritu Santo archipelago, and on the north entrance of the Bay (El Portugués and Punta del Mechudo area). Rocky-coralline reefs represent biodiversity centers in the Bay; they stretch down like cliffs of different inclination on the range of 8–15 m of depth in general and to 25–30 m of depth in some places such as the Balandra-Merito MPA zone and west face of Espiritu Santo.

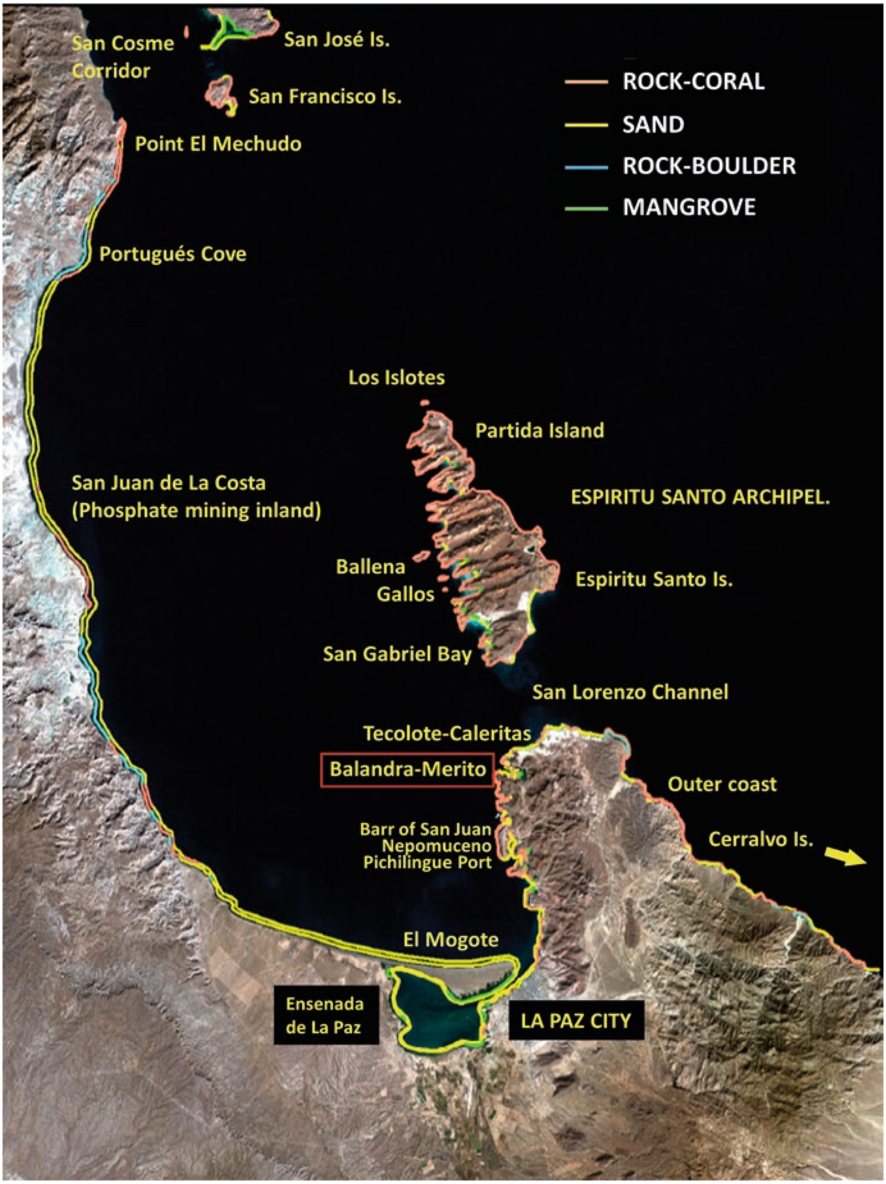

Fig. 27.2 Representative types of coastline around La Paz Bay and islands close by, with reference points mentioned in the text. (Modified from Google Earth. Author's work)

Small colonies of mangrove and wetland vegetation (some barely one or two square meters) are found into many small bays and coves or compose larger extensions in coastal lagoons (Fig. 27.2). Over time, a narrow sand bar called El Mogote enclosed a shallow coastal lagoon (Ensenada de La Paz) with marginal wetlands and branched channels barely 12–14 m of depth in the deepest points.

La Paz Bay contains the largest and deepest water body enclosure around the Gulf of California. The seafloor topography resembles an elongated funnel with its vertex, the Alfonso Basin, placed at 420 m of depth and a slope mounting to shallow flats of less than 20 m of depth along 60–65 km toward La Paz city coastline (Fig. 27.3). This shape was formed by water current regimes that alternate a dominant vector entering the northern mouth (San Cosme Corridor, 300–350 m depth) with tidal exchange through San Lorenzo channel, which is as shallow as 20 m of depth, while the outer border of the Bay rapidly falls to more than 2000 m of depth in a short distance toward the Gulf of California. Therefore, La Paz Bay behaves like a trap of water bodies and sediments that have been transported by the southward dominant current from as far as the Colorado River (Cadena-Cárdenas et al. 2009; Silverberg et al. 2014). This orientation and its position in respect of oceanic water bodies (Gulf of California and Pacific) impel a dominant yet moderate counterclockwise direction to La Paz Bay water body (Obeso-Nieblas et al. 2002, 2014; Silverberg et al. 2014), thereby the funneled shape of which about 95% of the seabed is sandy and 50% of it is at less than 50 m of depth (López-Cortés et al. 2012), and the hydrographic dynamics toward the southeast area during live tides that improve the primary productivity and nutrient contents (e.g., water exchange, flux of currents at wide depth range, upwellings, revolver-eddies, rip currents in the coves, events of water stratification, etc.) (Obeso-Nieblas et al. 2002, 2014; López-Cortés et al. 2012; Silverberg et al. 2014). However, the overall circulation and water exchange rate within the Bay is slow ("sluggish currents," as Silverberg et al. 2014 wrote down), which means that the water body tends to remain inside for some time. Actually, the maximum normal tidal height range fluctuates between 0 + 2 m and 0 + 2.5 m, in occasion to 0 + 3 m, and the maximum normal in-out water speed in San Lorenzo Channel (live tides) oscillates on 3–4 knots (about 6 km per hour). In steady tide conditions, you can cross with a kayak or swimming. It is approximately 6.5 km on the shortest distance.

La Paz is BCS' state capital city with a population of 280,000 habitants, roughly the 40% of the total state population (719,000). The cities of San José del Cabo and Cabo San Lucas (popularly gathered as Los Cabos) sum 240,000 habitants together. Other relevant concentration cities are Ciudad Insurgentes, Ciudad Constitución, Mulegé, Loreto, Santa Rosalía, Guerrero Negro, San Ignacio, and Todos Santos.

There are 20–24 fisherfolk cooperatives (Cooperative Society of Fishery Production, or SCPP) of different size (some SCPP are formed by 3 or 4 friends or relatives, others are gathered into two or three Federations, and there is an unstable number of fisherfolks registered as "free fishermen"—*pescadores libres*) operating from La Paz over a marine area as extended as their simple equipment (26–28 ft. panga and outboard engine up to 120 HP) lets them draw away the coast (Guzmán-Vizcarra and Ibáñez-Pérez 2018). In fact, the major fishery effort (principally fish) is concentrated outside the Bay, though some product is fished in the interior, mostly bivalves like Catarina scallop, pen-shell, two or three species of

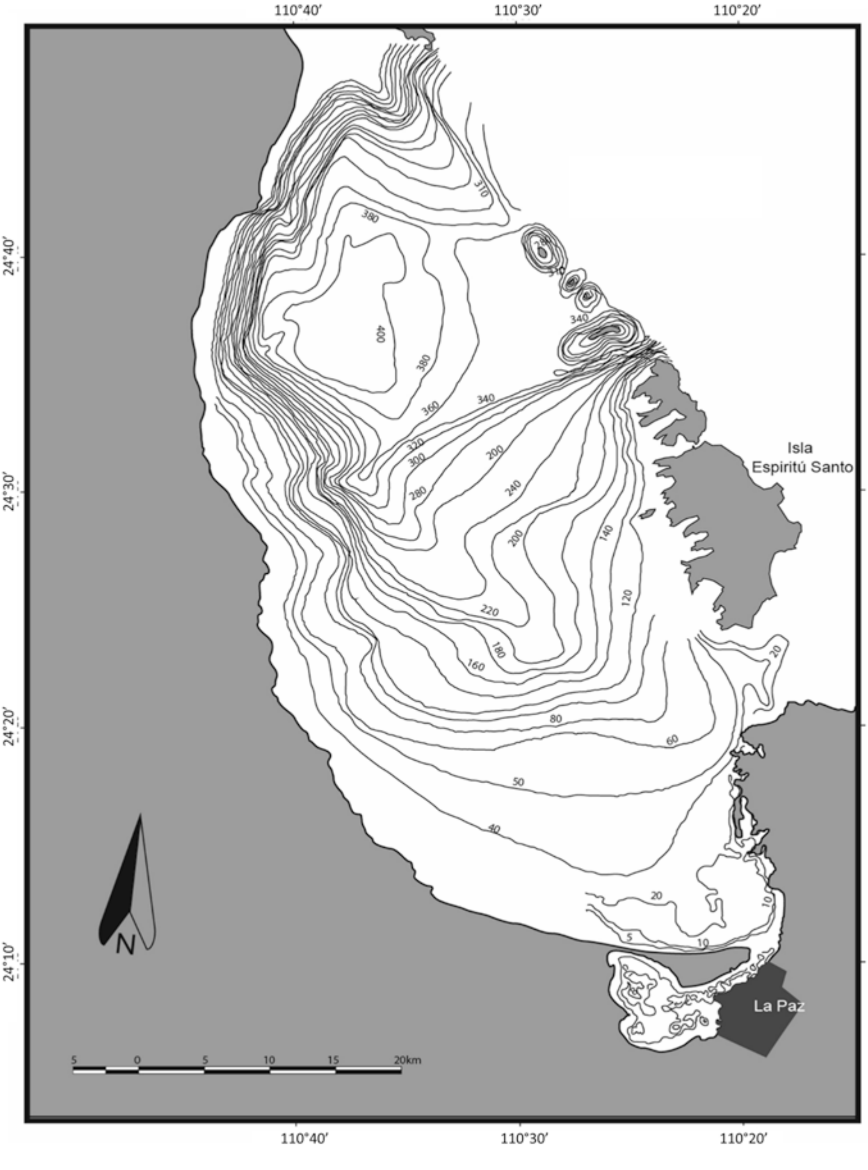

Fig. 27.3 Bathymetry (in meters) of La Paz Bay. (Template from Lechuga-Devéze (2012))

clam (CONAPESCA 2018), and an unknown capture of ornamental marine species, yet the traditional fisherfolk does not work on the activity. It is a different sector, furtive much of it.

Additional features of La Paz Bay worth to know point out a very active ecotourism that exploits the biogeographic regional assets (sea lion colonies, whale-shark, marine birds, snorkeling, camping, sport-fishing, etc.). There is private enterprises (some are micro, and some are larger habitually foreign) in one hand and short tours in touristic boats in the other. Almost any boat owner is allowed to carry out this activity as long as it meets a long series of requirements, like training as a tour guide included first aid and services quality (e.g., food, sanitary, garbage disposal). In addition, boats must comply to mandatory specifications (size/design, engine power, safety, comfort), and the requirements overall are stricter upon SCUBA diving and snorkeling. Therefore, this model may deter the average fisherfolk, or simply they cannot afford the technical requirements.

Another feature in the Bay is the presence of incipient (private) mariculture in operation: one shrimp farm (white-legged *Litopenaeus vannamei*), one of yellowtail *Seriola lalandi* in offshore cages and aquapods, and a pearl oyster farm of *Pteria sterna* (see Sect. 32.3). Importantly, urban sprawl and coastal megaprojects (the classical gated mini-cities of marina-golf-villas) have impacted on ecosystem services provoking inefficient drainage, water loss and insufficient recharge of the aquifer, and overmining and salinization in consequence (McEvoy 2014; Haeffner et al. 2018). We see excessive waste and a growing number of obsolete vehicles. Two smoky fuel-hungry power plants placed near La Paz must be fed by tanker ships to supply the city's electricity and also to both Cabos and villages in the middle, which generates high pollution and constant spills and accidents. Domestic gas and most of the fuel for the vehicles comes through the same way.

27.2.2 Status of Balandra-Merito

After the 1910 Mexican Revolution, slices of the Baja California Peninsula (short coastlines and broad terrain inland) became a sort custom gift to notable persons who had participated in the insurrection, like high-graded military and politicians. With the time, the *ejido* system (communal land), different proprietary families, and real-estate agencies got intermixed in land tenures (Gámez and Angeles 2010; Anderson 2017). Furthermore, several Presidents, top-placed functionaries of the Mexican government, and rich magnates had the customary practice of declaring "from-here-to-there" a personal (governmental?) possession. The aftermaths of these circumstances, combined with the characteristic aridity and isolation of the coastal zone around the Peninsula, the southern part in particular, have drawn striking divergences between large unproductive areas bounded to isolation against regions such as La Paz and "Los Cabos" that have been unable to match the increasing demands of the development model established in the region (Gámez 2008; Gámez and Angeles 2010).

The MPA of our case study did not linger to that trend of appropriation. Among the many hot spots related to real-estate speculation on touristic megaprojects in Mexico (Murray 2007; Monteforte and Cariño 2009; Gámez and Angeles 2010; Anderson 2017), this MPA has attained high relevance even in the international media. Balandra itself, in addition to housing one of the largest mangrove/wetland (relict) colony on the western coast of the Gulf of California (aside Mulegé and Concepción Bay), owns emblematic value of great significance for the locals (paceños). The proximity to La Paz City (10–12 km from downtown and there are public buses and paved road), and its shape of natural swimming pool with nice sandy beach, converts this area the favorite destination of families with children and anyone who wishes to spend a pleasant day in the beach. Balandra, the "jewel of BCS," is among the beautiful and worldwide famous beaches labeled by the Travelers Choice Awards 2019 of the TripAdvisor as second best beach in Mexico, only topped by Playa Norte, Mujeres Island in the Caribbean.

Truly said, the coastal zone at Merito lagoon and also other portions of the MPA do not display such as popular beaches; nevertheless, the exceptional oceanfront landscape, the proximity to La Paz, and consequently the high real-estate value are coveted objects. Long-time environmentalist movements have escalated to protect the area from the descendants of a former President who claim the ownership of 1500 Ha with adjacent coastline and pretend to develop another one of those classic megaprojects (Cariño et al. 2008). As expected, other persons and families dispute older land titles that still present overlapping perimeters anyway. Crisscrossed wire fences and grilles with brightly colored signs of "private property" (English and Spanish) coined to different companies or persons are the normal sightseeing on the way to Balandra, and in many coastal areas of BCS, as a matter of fact (Cariño et al. 2008; Monteforte and Cariño 2009). Despite the circumstances, local civil movements to protect Balandra, and Merito in extension, have achieved several successes, for example, Balandra enjoyed the label of Municipal Park between 1998 and 2002, not entirely official but rather as the result of those such movements that culminated in 2004 with a decree of MPA (Ecological Conservation Zone and of Interest to the Community) on nearly 2000 Ha and adjacent water (Cariño et al. 2008), and finally the present status of Area of Protection of Flora and Fauna since 2012 (DOF 2012) (Fig. 27.1). Hashtags #BalandraEsNuestra (Balandra is ours) are constant in social networks; eventually it triggers public manifestations as often as the promoters re-insist in recommence their project, which is standby for the moment. Today, the Colectivo Balandra constitutes one of the primary sprockets of the local environmentalism movement centered in the area. To a certain extent, the decree of Espiritu Santo archipelago as National Park and its inscription in UNESCO's list of the World Natural Patrimony at Risk, and also the Ramsar designation for wetlands and the distinctive biodiversity of La Paz Bay, have been supportive arguments to incorporate Balandra-Merito in the same terms.

27.3 Influence of the MPA Balandra-Merito in the Mexican Mariculture

The marine coastal area in this MPA harbors one of the three best suitable areas in La Paz Bay[5] to install mariculture farms of bivalves and fish (Fig. 27.4) (Lechuga-Devéze 2012; Monteforte 2013). Table 27.2 compiles a chronologic resume (1939–2019) related to mariculture development in La Paz Bay, with emphasis in the MPA Balandra-Merito-Falsa Bay and based on landmark projects and pioneers in their respective institutions. We did not append the start interval of 1902–1914 in which the Compañia Criadora de Concha y Perla could have installed spat collection experiments for the mother-of-pearl *Pinctada mazatlanica* in the extant MPA (Cariño 1998). After the destruction of this enterprise in 1914, the fishery for pearl oyster shell (*P. mazatlanica*, primarily)[6] became so intensive that the wild stock reached high level of exhaustion leading the economic bonanza of La Paz to end by the middle 1930s and to a permanent ban on pearl oyster fisheries in 1940. In the meantime, there is no evidence of developments in mariculture science and technology[7] or active farms in Mexico whereas freshwater fish aquaculture received more attention (Morales-Díaz 2015; Cuéllar-Lugo et al. 2018). It was until 1939 when a private project focused in *P. mazatlanica* occurred in La Paz Bay, yet it did not work by cultivation techniques like Gaston Vives in his CCCP. Instead, they employed diving gear to extract wild specimens and gather them in culture artifacts to practice pearl induction surgery (Table 27.2). This project was the first of the three major fiascos (1979 and 1980) on the matter of pearl oysters, so far in the Gulf of California, because they aimed to an already depleted wild stock to produce cultured pearls. In addition, the three projects took place in the MPA and were assisted by (Japanese) specialists who were meeting *P. mazatlanica* for the first time. There is no evidence

[5] The single Balandra lagoon is unsuitable for mariculture installations. Falsa Bay is placed on the mouth of Pichilingue Port that lodges cargo ships, fishing boats, and large ferryboats. Although the Port capacity is small (amount/size of units and transit flow), this is a minus point to water quality for mariculture of edible species, filter-feeding mollusks in particular. The area between Diablo Point and the southern tip of San Juan Nepomuceno Barr is the second favorite in La Paz Bay. Number one is placed on the southeast of Espiritu Santo archipelago (Ballena islet to San Gabriel Bay), and the third is on the northwest of the Bay (Figs. 27.2 and 27.3). Other hierarchical criteria include technical and logistic variables, oceanography, depth, experimental data, etc. (Monteforte 2005, 2013; Lechuga-Devéze 2012).

[6] For centuries, and in every pearling region in the world, fisheries for pearl oysters aimed to nacre shells as the main objective. Species of the genus *Pinctada* (mother-of-pearl oyster) were preferred because of their flat-shaped shell that suited the enormous button-making and nacre inlay industry until the 1870s decade when the nacre was substituted by plastic.

[7] The first traces of mariculture research in Mexico appear by 1940, curiously most of them concentrated in the Gulf of California. For instance, the universities of Sonora and Sinaloa opened the line of marine sciences in that period (Morales-Díaz 2015; Cuéllar-Lugo et al. 2018). Also, the UNAM creates the BSc. in Hydrobiology in the Biology Faculty that established the basis for the Institute of Marine Sciences and Limnology in the 1960s and its campus at Mazatlán, Sinaloa, in the 1970s.

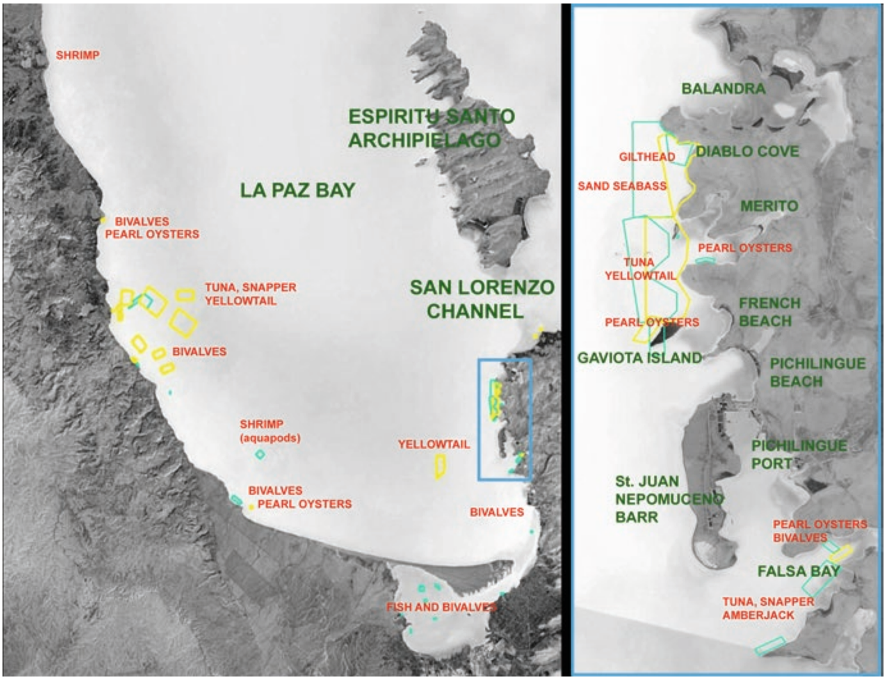

Fig. 27.4 Location of aquaculture licenses (Permit for Aquaculture Fomentation -PAF and Aquaculture Concession -CA) in La Paz Bay with zoom on Balandra-Merito-Falsa Bay area. Yellow polygons correspond to licenses in force; green ones are in process of renewal or have ceased their activity. (Modified from Google Earth with the KML/KMZ layers for PAFs and CAs available in Acuasesor SAGARPA/CONAPESCA. Updated to 2018)

known about round pearls resulting from their learning, and it said that they also tried the surgery on the winged pearl oyster *Pteria sterna*, the sister pearl oyster species of the region.

27.3.1 Timeline Overview

The MPA remained in standby from 1940 until the early 1960s when it started to acquire a significant role in research studies and commercial mariculture in Mexico. The pearling vision has persisted throughout new developments on other commercial native species of gourmet bivalves and fish that began by the 1970s and were diversified and perfected over time (Table 27.2). Much of the importance of La Paz as scientific and technologic center of mariculture in Mexico is linked to a variety experimental studies installed in the said MPA that constitute today a valuable body of systematic information and postgraduate thesis about the area and La Paz Bay. However, its suitable qualities for mariculture brought private entrepreneurs to

Table 27.2 Chronologic briefing (1939–2019) of landmark projects and pioneers related to mariculture in La Paz Bay, with emphasis in the MPA Balandra-Merito

Date/actors	MPA and/or influence	Actions	Outcomes
The pearl oysters sector			
1939. Y. Matsuii, Mexico-Japan agreement	La Paz and Loreto Bays. Operative station in Falsa Bay	Prospection for natural beds; pearl culture assays on wild individuals	Very scarce natural populations. Large mortality postsurgery. Project abandoned
1961–1962. Secretaría de Pesca	Falsa Bay and Merito Point Diablo	Assays of spat collection and extensive culture	Results not satisfactory. Project cancelled, change government actors
1962 A. Martínez CRIP, Secretaría de Pesca	La Paz and Loreto Bays, islands nearby	Prospection for natural beds and transplants	Populations in alarming state of exhaustion. Barely acceptable results on transplanting. Project abandoned
1969–1972 Denis George (Australia), agreement with the Secretaría de Pesca	Merito-Pt. Diablo	Spat collection and culture (Mabé and round pearls in wild individuals)	Great mortality and rejection postsurgery. Promising results on extensive culture
1970–1971 M. Díaz-Garcés and A. Gallo (Mexico); trained by D. George in 1969	Merito-Pt. Diablo	Extensive culture and Mabé implants	Good results, but the commercial initiative did not progress because of political rivalries. Project abandoned with a large economic loss
1979 Shoei Shirai and K. Sano (Japan), agreement with the Secretaría de Pesca	La Paz Bay (Falsa Bay)	Prospection for natural beds attempt to install a pearl farm (Falsa Bay); pearl culture in wild individuals	Deceiving results concerning abundance of pearl oysters. Great mortality and rejection postsurgery. Project abandoned
1976–1978 government project	La Paz Bay. Install in Falsa Bay and Merito-Pt. Diablo	Assay of extensive culture	Acceptable results. Project abandoned because of budget shortfall and administrative shifts
1979–1980. K. Sano and Yamamoto, agreement with private group in La Paz	Extraction of wild stock from La Paz Bay and islands. Installations at Merito-Pt. Diablo	Pearl culture in wild individuals	Scandalous failure. Ransack of natural beds. Expensive installations were abandoned and later pillaged
1981–1982 Jaime Singh (CRIP-BCS, Secretaría de Pesca, Mexico)	La Paz Bay. Installs. In Falsa Bay	Assays of extensive culture; pearl culture in wild individuals	Good results overall. High mortality postsurgery. No pearls

(continued)

Table 27.2 (continued)

Date/actors	MPA and/or influence	Actions	Outcomes
1987 Manuel Mazón (CRIP-BCS, Mexico)	Laboratory research	Hatchery studies in *P. mazatlanica*	Gonad conditioning and larval growth and survival were acceptable. No fixation. Project abandoned
1988–1998 Pearl Oysters Research Group (GOP) of CIBNOR	La Paz Bay and islands nearby. Station network, installations in La Paz Bay included Espiritu Santo Island. Surveys on the north coast up to Bay of Los Ángeles	Research on extensive culture and pearl production in *P. mazatlanica* and *Pt. sterna*. Restocking in La Paz Bay by repopulation cells of these species and other commercial bivalves studied there	Harvest high-quality Mabé pearls in April 1992. Certified technology of extensive culture in 1998. Punctual experiments continued until 2004 (certification of Icon Pearls). Influence in the NOM-058 for pearl oyster farms and pearl culture in Mexico (2013)
2002–2004 Ingeniería y Síntesis (private group assisted by GOP/CIBNOR)	Merito-Pt. Diablo	Pilot commercial, extensive culture of *P. mazatlanica* and Mabé	Harvest of 1500 high-quality Mabé. The project did not continue
From 2001 UABCS (Perlas del Cortéz)	Gaviota Island	Extensive culture of *Pt. sterna*	Smaller than the farm at Guaymas. Harvest is only Mabé so far, jewelry and nacre-based cosmetic products
Gourmet and marine aquarium sectors			
Late 1970s. Araceli Avilés and group (CRIP La Paz)	Falsa Bay	Research on fish and bivalve culture	Technologic basis
From 1986. Carlos Cáceres. UABCS	La Paz Bay and Espiritu Santo Island. Station network. Campus in Pichilingue	Research on extensive and semi-extensive culture of bivalves and pearl oysters. Restocking of corals	Detailed timeline of environmental parameters and mariculture indicators on the species. Owner of Perlas del Cortéz farm (*Pteria sterna* extensive culture
From 1990 Arturo Tripp CETMAR	Ensenada de La Paz, Falsa Bay	Research on extensive and semi-extensive culture of scallop *Argopecten ventricosus* and pen-shell *Pinna rugosa* and *Atrina maura*	Detailed timeline of environmental parameters and mariculture indicators on the species

(continued)

Table 27.2 (continued)

Date/actors	MPA and/or influence	Actions	Outcomes
From 2007. Miguel Robles. Acuacultura Robles	Commercial bivalve seed production in laboratory. San Juan Nepomuceno Barr	Major regional supplier of seed of the common commercial native species (Catarina scallop, both pen shells, oysters included the introduced Japanese *Crassostrea gigas* and *Ostrea sikamea*, and mule-paw cockles *Anadara* spp.)	Most of the product is received by producers in the west coast of BCS although a small farmer has recently installed in Ensenada de La Paz. Isolated experiments in Merito-Point Diablo (CIBNOR's installation)
From 2002 CIBNOR. Different users of the Aquaculture Program	Merito-Point Diablo, Gaviota Island, and intermittent sites in Espiritu Santo Island, Ensenada de La Paz, and the Bay	Research on extensive and semi-extensive culture of commercial fish (Lutjanids, *Seriola*, *Totoaba*), edible bivalves and pearl oysters, and ornamental marine species. Monitoring	Certified technologies have ensured the commercial production of fish in La Paz Bay and mainly bivalves in other sites of the west BCS coast
From the 1990s. CRIP, CICIMAR, CETMAR, UABCS. Different users (e.g., student thesis, sponsored projects, etc.)	Merito-Point Diablo, Gaviota Island, and intermittent sites in Espiritu Santo Island, Ensenada de La Paz, and the Bay	Diverse experiments of short duration, principally on bivalves and fish (snappers, Lutjanidae, and seabasses, Serranidae)	Important assets of data and information
2010–2014 fisherfolk cooperatives (SCPP) assisted by Mario Monteforte	Merito-Point Diablo	Polyspecific extensive culture of gourmet bivalves; special devices tested for ornamental marine species	A capacity-building action; promising results; abandon due to issues of group dynamics and finances (see Monteforte and Cariño 2018)
From 2012 to 2013. CIBNOR creates the aquaculture park Biohelix (*)	La Paz Bay, Ensenada de La Paz.	Commercial culture of Lutjanids, *Seriola* spp., *Totoaba*, and shrimp *L. vannamei* and *Penaeus californiensis* (brown shrimp)	Promote private investment in aquaculture. Fisherfolk groups often do not fit in this kind of models
Hot spot cases			
2002–2004 private Mexican enterprise foreign partners.	North Gaviota Island	Yellowfin tuna ranching	Issues of logistic, provision, and financial nature led the project to fail. Moving to semi-extensive culture of *Seriola lalandi* with CIBNOR support

(continued)

Table 27.2 (continued)

Date/actors	MPA and/or influence	Actions	Outcomes
2005 private foreign enterprise BIOTECMAR	Merito-Point Diablo	Cage culture of introduced hybrids of striped bass *Morone saxatilis x M. chrysops*	Project failed. High mortality from invasion of local hydrozoans (*Apolemia, Obelia, Lytocarpus*) (Monteforte et al. Monteforte-Sánchez et al. 2014)
2006–2007. Same enterprise	Same site	Cage culture of introduced (normal) *Sparus aurata*	Project failed. Legal problems, strong opposition in the locality. Escapees were confirmed in amounts estimated between 20,000 and 60,000 fertile individuals (Monteforte et al. Monteforte-Sánchez et al. 2014)

(*) The idea of industrial technologic parks was originally based on business centers for electronics, multimedia, software, engines, biomedics, etc. The Monterrey Technologic Institute of Superior Studies (ITESM) was the entryway of this trend to Mexico. Agriculture and livestock parks spread out since the 1990s in nations attached to mono-specific production (Soares-Silva et al. 2016). Several aquaculture-based parks were created at that time, like the TALIARTE in the Grand Canaria Island, the Cawthron Park in New Zealand, the Büsum Park in Germany (focused mainly in aquaculture equipment), and Mikimoto Pearl Island in Japan, just to mention some.

install a tuna ranch in 2003 (Monteforte 2008) and cage culture of exotic hybrid striped bass *Morone saxatilis* × *M. chrysops* and Mediterranean gilthead seabream *Sparus aurata* in 2006–2007 (Monteforte-Sánchez et al. 2014), despite their well-known invasive potential, particularly the second one.

These projects are considered hot spots in the Mexican mariculture and had corollaries at larger scale (Table 27.2). Tuna ranching in La Paz Bay (the MPA) was first experienced beyond Ensenada area (Baja California, north State of the Peninsula) where the largest farm is placed since the early 1990s (Lechuga-Devéze 2012). Unfortunately several problems led the project to fail, principally due to the level of depletion of tuna wild stock and low captures the boat had to go farther off and then trawl the capture back, suffering high mortality as a result. Additional difficulties to obtain fresh sardine to feed the tuna delivered food shortage. Sardine is essential for the sport-fishery sector as bait; therefore it raised harsh disputes (Monteforte 2008; Lechuga-Devéze 2012).

In reference to offshore cultivation of non-modified and genetically modified marine fish, turning them into exotic species had not been tried commercially at that time aside the salmon industry in course of expansion. The introduction of foreign species in mariculture was, and continues, being restricted or precautionary principally in developed countries (Europe, United States, Canada, Australia). Cage culture of hybrid striped bass had not been tried but in the United States by leisure fishery in dams or controlled reservoirs and some experiments of cage culture in New York Bay, Atlantic coast, neither *S. aurata* away the Mediterranean, yet it had been already introduced in Aqaba, Israel, and Canarias Islands (Monteforte-Sánchez et al. 2014). In La Paz Bay the project with hybrid striped bass failed because the cages and the culture area got infested by aggressive hydrozoans (*Lytocarpus nuttingi*, *Apolemia uvaria*, *Obelia* spp.), locally known as "grullas," a pest for swimmers and snorkelers, that led to high mortality to the juvenile fish in the cages. This natural defense seems quite an uncommon event in fish mariculture (Monteforte-Sánchez et al. 2014).

The venture with *S. aurata* yielded satisfactory results, probably they used repellent paint on the cages, or the fish was immune. Nonetheless, some groups of the local society had been opposing to both projects, in particular the invasive potential of *S. aurata* motivated greater awareness. There were queries concerning the legal import of the fish fry through the La Paz international airport, and the name of "golden snapper" (*pargo dorado*) that the entrepreneur invented to disguise the species like a member of the regional snappers (Lutjanidae—*pargo, huachinango*) raised further suspicions. By July 2007 one escapee was caught way inside Ensenada de La Paz (Balart et al. 2009), and during the next weeks more specimens caught in the Bay were donated by fishermen. The situation generated a massive movement against BIOTECMAR, the enterprise proprietary of both projects that culminated in the closure, extract, and sacrifice of the fish and the enactment of an official survey to estimate the impact. Persons of academic institutions in La Paz (CIBNOR, UABCS and CICIMAR) and of environmental departments of the municipal government (PROFEPA, CONANP, SEMARNAT) carried out explorations (25 November to 5 December) on snorkeler, SCUBA, and fishing nets that resulted in 35 individuals observed free in the MPA area and 3 more captured with the nets in different parts of the Bay. In addition, contradictions on the amount of fish fry entered by the airport, the notification to the corresponding departments (SAGARPA/CONAPESCA) as to how many fish were placed alive in the cages, and the report of individuals extracted at the time of closure remind us that an amount between 20,000 and 60,000 healthy young adults, many of them aged enough to be fertile, escaped from the MPA 12 years ago (Monteforte-Sánchez et al. 2014). There has been some physical captures and reports in decreasing frequency to none in the last 4–5 years although once in a while news arrive from distant sites (e.g., Loreto, Cabo San Lucas, even Magdalena Bay and Guaymas). This is not trustable enough to surmise any forecast.

In synthesis, the contribution of La Paz Bay to the Mexican mariculture has been minimal in terms of commercial role but significant in terms of accumulated knowledge and influence at a larger scale. For example, La Paz has always been source of multidisciplinary information related to the world history of fisheries, commerce, and culture of nacre and pearls, and the MPA is reputed to be the cradle of the modern science and technology available for *P. sterna* and *P. mazatlanica* (Table 27.2).

In fact, much of the standards for extensive culture and pearl production in Mexico,[8] and used in recent ventures in Latin America, are assigned to results of research studies carried out in the MPA (see Monteforte 2005, 2013). However, diverse factors, mainly of oceanographic nature (e.g., lower temperature average, higher primary productivity, larger coastal lagoon systems), have directed the commercial mariculture of BCS to the Pacific coast aiming in Japanese oysters *Crassostrea gigas* and *C. sikamea* and a few white-legged shrimp *L. vannamei* farms. There are recent development in La Paz Bay (Fig. 27.4) with cage culture and aquapods with this shrimp at its sister species, the brown shrimp *Penaeus californiensis* and diverse fish (yellowtail *S. lalandi* and *S. rivoliana*, snappers *Lutjanus argentiventris* and *L. peru*, sand seabass *Paralabrax maculatofasciatus*, and *Totoaba macdonaldi*). Most of these projects belong to private transnational enterprises attached to Biohelix, the CIBNOR's aquaculture park (Table 27.2). Nevertheless, apart from the private pearl oyster farm at Gaviota Island rooted to the UABCS, commercial mariculture in the Bay accounts for just three or four pilot scale records of pearl oysters and gourmet bivalve farms of short duration, all of them placed in the MPA under study in this chapter.

27.3.2 Mariculture into the MPA Precint: What Works?

The mariculture chronology in La Paz Bay and the MPA reveals the lack of extension programs to promote integration of fisherfolk cooperatives (SCPPs) through mariculture SMEs, and in the other side there are private projects that monopolize propitious sites in a disarranged pattern (Fig. 27.4) commonly seen around the Gulf of California (Sonora, Sinaloa, and Nayarit) and other coastal sites in Mexico. Moreover, the information of each lease[9] could suggest that certified technology is available for all of the commercial species of fish and bivalves—pearl oysters too, inhabiting the Gulf of California (CONAPESCA 2018). Undoubtedly the modern technology should be able to ensure this to happen; even so, the reality does not reflect productive benefits from direct applications. Figure 27.5 serves to illustrate the statement on three cases that are ordinary in many areas with attributes for mari-

[8] NOM-058-SAG/PESC/SEMARNAT-2013 regulates the pearl oyster cultivation in Mexico: mother-of-pearl (*Pinctada mazatlanica*), nacre shell (*Pteria sterna*), Atlantic mother-of-pearl (*Pinctada imbricata*), and Atlantic winged pearl oyster (*Pteria colymbus*).

[9] SAGARPA and CONAPESCA regulate two leasing forms of productive aquaculture for private groups, cooperatives, or other kinds of entrepreneurial associations: a Permit for Aquaculture Fomentation (PAF) renewable by merits every 4 years (e.g., proofs of good work) that eventually can be leveled up to an Aquaculture Concession (CA) of 10 or 20 years, or it is directly conceded if the entrepreneurs fulfill technical and financial requirements. The average surface for the licenses is 10 Ha, up to 20 Ha in some cases of fish farms, amberjack and tuna, in particular. Detailed information of PAFs and CAs is of public access online through a tool called Acuasesor (https://acuasesor.conapesca.gob.mx/) which contains all about fisheries and aquaculture production in Mexico.

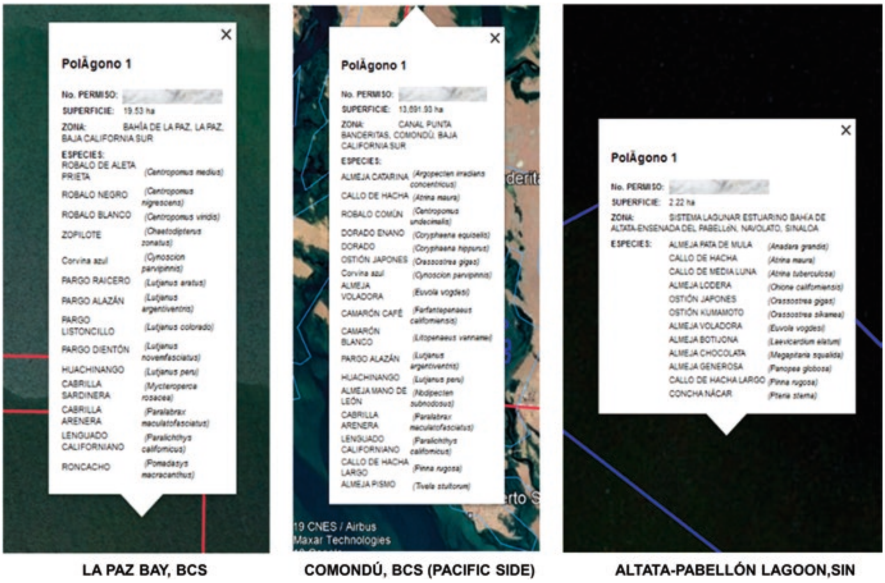

Fig. 27.5 The Acuasesor KML/KMZ layers deploy summary information on each license in aquatic areas in Mexico. The database contains nearly 2000 records in coastal marine areas. This figure presents three examples. (Modified from Google Earth with the KML/KMZ layers for PAFs and CAs available in Acuasesor SAGARPA/CONAPESCA. Updated to 2018)

culture in Mexico: La Paz Bay (the figure corresponds to the MPA in scrutiny here), and the coastal lagoons of Magdalena on the Pacific coast of BCS, and Pabellón-Altata, this one in Sinaloa, southeast of the Gulf of California. It is conceivable that the bioecology of bivalves would allow rustic less costly schemes than fish culture, particularly if laboratory generations are part of the equation; nevertheless, inferences on Fig. 27.5 may yield unlikely indicators. Perhaps some of the farms could have achieved small and sporadic harvests of some species for which the cultivation technology is sufficiently advanced or in process of certification (e.g., pilot harvests), so announcing a long list of species seems justifiable, or at least technically feasible. In reality, just a handful of PAF (Permit for Aquaculture Fomentation) or CA (Aquaculture Concession) sited in La Paz Bay have commercialized occasional pilot harvests during the last 38 years.[10] The current ventures installed in the study area (Fig. 27.4) announce around 25 species of fish and bivalves overall; this is likely true in terms technologic feasibility (some species still are in experimental

[10] The first Statistical Yearbook of Aquaculture and Fisheries was published in 1980 (SAGARPA/CONAPESCA) and has been continued more or less constantly every 2 years. Since then, the Mexican commercial mariculture is concentrated on the east coast of the Gulf of California and the Pacific coast of the Baja California Peninsula. White-legged shrimp and Japanese oysters are the flag production. Notably, the only two pearl oyster farms in Mexico are placed in Guaymas and La Paz. A third one in Cozumel Island is just starting, and there are more in prospect in the Gulf of California (La Paz, Loreto, and near Cabo San Lucas).

stage), but not in terms of commercial production. Furthermore, most of the licenses (10 Ha in average, up to 20 Ha in some cases of fish farm) belong to private groups well established in the market. Of course, there are professional specialists in aquaculture (e.g., ex-alumni and scientists of academic institutions) that create entrepreneurial entities. The increasing interest to develop mariculture in La Paz Bay is certainly novel though a rapid progress is expected; however, academic institutions display low participation except as a logistic need within the technologic park (e.g., Biohelix in La Paz or similar schemes like the CREMES and PIDEMAR in Kino Bay, Sonora), or source of information and solutions, such as diseases, locally made food, or support to obtain the licenses (PAF, CA) such as elaboration of technical documents and guidance in administrative procedures, even financial funds from the government. Fisherfolks are aware that turning into mariculture farmers would bring them better income; hence they often seek assistance in government departments like CONAPESCA or in the academic institutions. This is a global model that has produced both good and deficient results.

In Mexico, various obstacles prevail for the SCPPs, for example, they are insolvent to afford counterpart funds, a mandatory requirement in most government programs, while knowledge-holder scientists generally confer social extension activity less priority because it is underrated in academic evaluation criteria. This convergent factors marginalize small entrepreneurs and cooperatives considering that the installation and operation of a minimally profitable aquaculture venture often exceeds their financial, logistical, and technological capacity, to which we must add that for fisherfolk that live from their daily work, the waiting for dividends from the harvest may be untenable, not to mention the influence of complex group dynamics and conflicts into or among different groups. Table 27.2 includes one of these projects occurred in the MPA between 2010 and 2014. To present it in minimalistic form, the project attempted to join two SCPPs in developing polyspecific farming[11]of gourmet bivalves, pearl oysters, and ornamental marine species at pilot scale (Monteforte and Cariño 2018). Previous socioeconomic surveys in La Paz led us to contextualize this bipartite SME as a means to optimize scarce funds slowly gained and share the logistic management of the farm. We needed almost 2 years to acquire the elementary equipment and material to manufacture the cultivation systems and artifacts and install them in Point Diablo area, including a small temporal work camp on the Cove. Once everything settled and in function on the site, the next 7 months yielded promising results. The fisherfolk attained good training level, and nearly 40,000 specimens of gourmet bivalves distributed in nine species (Fig. 27.6) were growing to young adult stage, including 15,000 *P. sterna* specimens (Monteforte and Cariño 2018). A prototype device (inspired on the functional principle of a "portable" artificial reef) to cultivate ornamental marine species in extensive culture modality was in test process. Nevertheless, the SCCPPs showed disproportionate commitment to the project, likely because one partner owned better elements to

[11] Plans included extensive culture (wild spat collection and grow-out phase in the sea) and semi-extensive culture (based on the reception of laboratory-reared spat).

Fig. 27.6 Exhibit of some fieldwork activities in the mariculture project with two fisherfolk cooperatives (SCPP) in Diablo Point area (2010–2014). (**a**) Juveniles of commercial bivalves –pen shell, Catarina scallop, lion-paw scallop, winged nacre shell, and mule-hoof clam on the mesh board underneath. (**b**) and (**c**) fisherfolk of the 'good' SCPP in a spat harvest session. (**d**) A maintenance session of Nestier trays containing livestock of bivalve juveniles. (Photos in situ taken by the author (see text and Table 27.2))

accomplish the tasks than the other one (e.g., financial solvency—in their scale, infrastructure in La Paz such as workshop and storage area, two vehicles and two *panga* boats with 95 HP outboard engine, one air compressor diving gear, etc.). In particular, this SCPP (6–8 constant workers) was more convinced toward the project and therefore proved more enthusiastic participation (Fig. 27.6) even though the other SCPP had more than 20 members. However, something else beyond financial constraints and possible jealousies was instigating psychologic stress in the backgrounds (Monteforte and Cariño 2018). We discovered, too late (how did that come out?), that the senior presidents of the SCPPs had old feuds pendent when the level of hostilities was nearly uncontrollable. Within a couple of weeks, the installations were abandoned and vandalized, yet we were able to save about 12,000 specimens that were used for repopulation (throwing them overboard, basically).

At the bottom line, the double-partnership was a mistake. As Perkins et al. (2002) put it: "Psychological factors point to what motivates individuals to participate in particular settings and behaviors, how to maintain that participation, and how those motivations and behaviors interact with various setting and organizational characteristics to promote effective social capital." In addition, administrative issues were an impasse because aquaculture licenses are given to a single beneficiary and cover only its territory (polygon), even if contiguous projects are the same and/or directed by the same expert. This pyramidal policy amplifies the cost of licenses and the making of bulky files differentiated only by the name of the licensee and the polygon shape. Other administrative variables also had parallel impacts; for example, the cultivation site is part of Balandra-Merito MPA, and some of the targeted species are under some level of protection (e.g., *P. mazatlanica*, *Pt. sterna*, the lion paw scallop *Nodipecten subnudosus*, and various fish and invertebrates identified as ornamental). However, aquaculture permits had been issued in the MPA before the formal declaration, in particular the CIBNOR has carried out research studies in that location since 1988 (Table 27.2). Ultimately, these issues should have been a minor hindrance; we always stressed that repopulation would be carried out and that natural populations would not be touched. The farm itself was seen as a bank of larval dispersal. Nonetheless, the denouement of experience showed the laxity of the governmental bureaucracy and a clear manipulation of federal resources.

27.4 Final Reflections

Mariculture comes in many modalities (species, type of technologies, degree of intensification, etc.). Enterprises and rustic community-based small scale, there exists a wide range of practices, types, and scales that could provide opportunities for greater synergies within multiple-use MPAs. Multiple-use designs could also offer alternative livelihoods to develop sustainable financing opportunities for the MPA management (e.g., Brugère et al. 2008; Berkes and Davidson-Hunt 2010; Davidson-Hunt et al. 2012; Le Gouvello et al. 2017). The assessment of multiple-use in the case study seems predetermined by natural assets of the MPA related to ecotourisand to likelihood for mariculture SME models. Gourmet bivalves, pearl oysters, ornamental marine species, and pan-sized fish species (Lutjanidae and Serranidae), either in mono or polyspecific modality, may be advised as best conversion/diversification choice for the fisherfolk in La Paz Bay so that the MPA could acquire a socioeconomic role by re-activating its proven potential as productive site. It stands to reason that fisherfolks will be more likely to invest and stay rooted in places that are worth caring about, places with appealing local identity, an ambiance of belonging, and a sense of place. In corollary, it is clear that fisherfolk fit into distinct frameworks in accordance with species type and culture modalities that should ensure results within reasonable timeframes in order to prevent them from losing cohesion and interest towards a project. Since Balandra-Merito MPA has been submitted to thorough research studies on mariculture, and on environment and socioeconomic lines, a subsequent review of capacity-building actions might vindicate the fact that specific approaches are required in order to integrate target groups in collective projects without disrupting the sense of being local. Fostering a sense of place or nurturing local identity and authenticity begins by investigating what site-specific distinctive potentials determine a case study and how they could be used to raise community capital. This principle should guide to better understanding the profile of local and regional players (e.g., Emery and Flora 2006; UN 2011; Davidson-Hunt et al. 2012). Therefore, the livelihood of fisherfolk communities in the context of socio-ecological systems may be interpreted by behavioral and/or stance expressions of group dynamics toward the management of common-pools, such as altruism, self-interest, and conformism (Cárdenas and Ostrom 2004; Vélez et al. 2009); collaboration (e.g., willingness to engage in commitments, a sense of appropriation, solidarity, and collective participation) (Leopold et al. 2013; Bennett and Dearden 2014a, b; Barratt et al. 2015); and internal and external corruption (Tonoyan et al. 2010; Barratt et al. 2015). Moreover, heterogeneous perceptions of conservation and protection introduce broadened meanings to these expressions. Thus, questions arise when technology-based research is conducted on production processes such as those involved in aquaculture, in particular when matters related to gender and/or small communities, and/or isolation and marginalization in general, hinder collective/proactive actions.

It could be concluded by arguing that creating added-value in Balandra-Merito MPA is feasible if the civil society and knowledge-holders reconsider their capacity for empowerment in the management of this emblematic place. The acquisition of skills to develop a mariculture in SMEs is a first step, but not enough. What follows is to balance the terms with the use, management, and control of the sources and benefits related to the MPA. Advantages and disadvantages will have to be evaluated upon the expectation of ideal sceneries that are difficult to generate. Evidence indicates that every conversion/ diversification process has to face complex relationships between society and nature, with distinct expressions even among specific cases locally. In addition, perceptions of privatization, conservation, and production are deeply interwoven, as are political, socioeconomic, and long-term histories in which cultural and psychological factors and group dynamics engender crucial structures.

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