

SHIPWRECK-BASED BLUE ENTREPRENEURSHIP IN

ISLAND TERRITORIES: A

Shipwreck-based blue entrepreneurship in island territories: a case study of *El Peñón* wreck in Tabaiba, Tenerife. A conceptual and practice-based case study of shipwreck-based blue entrepreneurship in an island tourist coastal territory

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ARTICLE INFO

Keywords:

Artificial Reefs

Artificial Wrecks

Blue Entrepreneurship

Coastal Planning

Wreck Diving

ABSTRACT

This article examines the role of artificial wrecks as catalysts for blue entrepreneurship in island territories. The study is grounded in the proposition that deliberately scuttled vessels may generate tourism, training, business and territorial value when they are articulated with appropriate conditions of underwater singularity, accessibility, specialised training provision, entrepreneurial ecosystem development and coastal infrastructure. In contrast to approaches that interpret artificial wrecks solely as reefs, diving attractions or environmentally contested interventions, this paper proposes analysing them as small-scale blue infrastructures capable of activating value chains linked to recreational diving, specialised training, marine conservation, local identity and tourism services. The methodology adopts an explanatory case-study design, supported by light empirical validation based on simple indicators related to market structure, accessibility and territorial infrastructure. The case of El Peñón wreck in Tenerife, Spain, makes it possible to test five propositions: the experiential singularity of the wreck; its shore-based accessibility; its capacity to generate specialised training; the existence of an entrepreneurial ecosystem along the Tabaiba–Radazul axis; and the need for governance mechanisms to ensure its long-term sustainability. The results show that El Peñón operates as a structuring asset within the underwater ecosystem of Tabaiba–Radazul. Its value does not lie solely in the physical presence of the wreck, but rather in the network of products, services, courses, operators, infrastructures and narratives that have been organised around it. The article concludes that artificial wrecks may foster blue entrepreneurship in island and coastal destinations, but only when their recreational use is embedded within a governance model that combines safety, spatial regulation of uses, environmental monitoring, local participation and territorial return.

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1. Introduction

Island territories are defined by a permanent negotiation between land and sea. Their coastline is not merely a line of physical contact, but a productive, cultural, ecological and symbolic interface. On an island, the coastal strip operates simultaneously as an urban frontage, a mobility corridor, a recreational platform, an ecological edge, a tourism resource, a nautical infrastructure and an identity-forming landscape. For this reason, the blue economy in island contexts cannot be reduced to large-scale offshore sectors such as industrial fishing, aquaculture, commercial ports or marine energy. It also

includes situated, small- and medium-scale economies that emerge from the everyday interaction between coastal settlements, marine ecosystems, recreational practices and local entrepreneurship. Scuba diving should therefore be understood as a tourism system composed of interdependent actors, including divers, marine environments, host communities and the diving industry itself (Dimmock & Musa, 2015). This systemic interpretation is particularly relevant in island territories, where diving activity depends on the spatial articulation between coastal access, marine resources, local services, training providers and environmental governance.

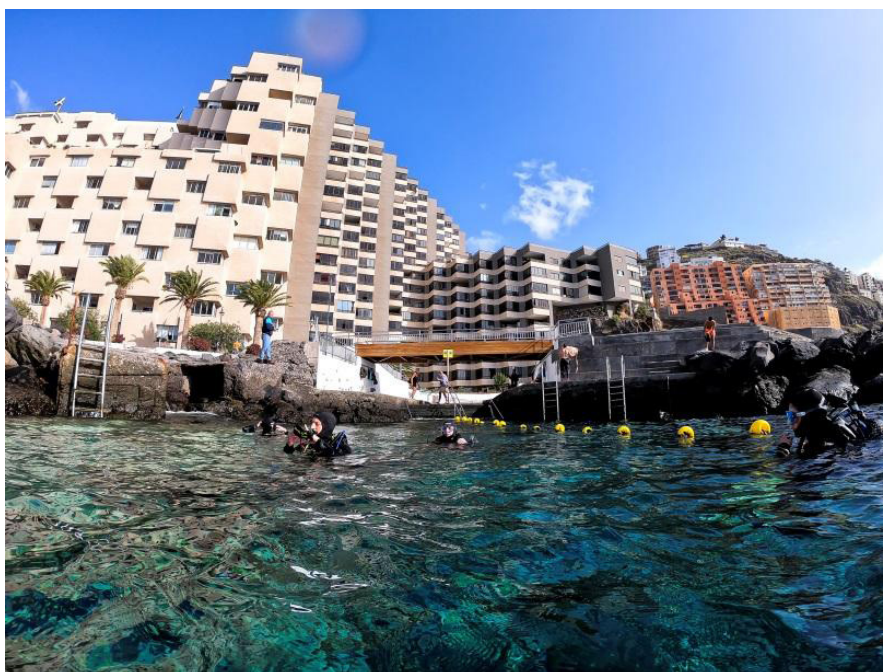


Figure 1: Urban pressure on the infralittoral zone in coastal tourism territories, defined according to the proximity between built development and the sea surface, recreational uses of the infralittoral area, and potential discharges and pollution. Tabaiba urban development, Tenerife.

Source: Juan D. López-Arquillo.

Recreational scuba diving occupies a particularly relevant position within this intermediate blue economy. Although it is not a mass activity in the same sense as conventional beach tourism, it generates a highly specialised service economy based on certification, safety protocols, equipment provision, local ecological knowledge, environmental interpretation, underwater guiding, shore- or boat-based logistics and repeat visitation. Although global estimates vary depending on whether only direct diving expenditure or broader tourism expenditure is considered, recreational scuba diving is consistently described as a significant marine tourism activity with relevant direct and indirect effects on local coastal economies (Dimmock & Musa, 2015; Genç, 2022; Morgan et al., 2009) with worldwide revenues estimated at approximately USD 4.55 billion in 2023 and projected to reach USD 8.83 billion

by 2030. Within this market, scuba diving constitutes the main segment, while broader assessments of recreational scuba diving suggest that its direct and indirect economic effects may reach several billions of dollars annually. These figures are especially relevant for island territories, where diving expenditure is not captured only by the price of an individual dive, but also by associated services such as training, equipment rental, accommodation, food and beverage, local mobility, boat operations, digital booking platforms and specialised retail. Within this system, dive centres operate as the primary engines of the local diving industry. They are not merely intermediaries between tourists and the sea, but technical, educational and entrepreneurial nodes that translate underwater resources into structured economic activity. This role is consistent with the scuba-diving tourism system framework, in which the diving

industry is understood as an intermediary between marine environments, tourists and host communities (Dimmock & Musa, 2015).

Recent official tourism data allow the relevance of scuba diving in Tenerife to be framed more precisely. According to the 2025 tourist profile by activities undertaken at destination published by the Canary Islands Tourism Observatory / Promotur, 168,933 tourists aged 16 or over reported scuba diving as an activity undertaken during their stay in Tenerife. This represents 2.6% of tourists in the island. Although scuba diving is therefore a specialised niche rather than a mass activity, it is a measurable segment within the island's tourism system. Tourists undertaking scuba diving showed an average expenditure per trip of €1,367, an average stay of 8.8 days and an average daily expenditure of €170.59. The same source estimates the total turnover associated with tourists undertaking scuba diving in Tenerife at €231 million, or €174 million when excluding flights (Observatorio Turístico de Canarias, 2026b). These figures do not establish a causal relationship between a specific dive site and tourism demand, but they confirm that scuba diving constitutes a statistically visible and economically relevant segment of Tenerife's tourism economy.

In the case of artificial wrecks, this intermediary role becomes even more important because operators translate a submerged structure into guided routes, safety protocols, certification pathways and marketable experiences (Seaman & Depper, 2019; Stolk et al., 2005). Dive centres organise access, certify skills, manage risk, interpret underwater environments, maintain equipment, create itineraries, produce local knowledge and connect visitors with wider coastal service networks. In territorial terms, they function as small-scale blue enterprises whose viability depends on the presence of attractive, recognisable and operationally reliable dive sites. Without stable

nodes of underwater interest, the local diving economy tends to remain fragmented, generic and weakly differentiated. Conversely, when a destination contains distinctive underwater assets, dive centres can transform them into specialised products, training pathways, repeatable experiences and locally embedded value chains.

Among dive sites, wrecks possess a singular capacity for attraction. A wreck is not simply a sunken object. It is a three-dimensional structure, a navigable spatial sequence, a technical challenge, a visual landmark, a habitat, a device of memory and a tourism product. For divers, a wreck offers an experience that differs substantially from dives over rocky, volcanic or sandy seabeds. It allows descent towards a recognisable object, circumnavigation of a hull, interpretation of superstructures, identification of reference points, planning around a maximum depth, refinement of buoyancy control, underwater photography and, only with specific training, controlled penetration routes. However, not all wrecks have the same operational, educational or safety profile. Natural or accidental wrecks, resulting from shipwrecks, collisions, storms, navigational errors or wartime events, often retain a high degree of material and spatial uncertainty. Their structural stability may be compromised; access points may be irregular; sharp metal edges, fishing gear, cables, enclosed compartments, silt deposits, unstable decks and entanglement hazards may increase risk; and their position, orientation and exposure to currents may not correspond to recreational or training requirements. These wrecks may have exceptional heritage, ecological or narrative value, but they are not necessarily suitable for systematic recreational use, repeated training activities or controlled tourism development. (Alves et al., 2022; Blagojević et al., 2023; Brown & Henderson, 2025; Lousada et al., 2022; Lousada, Cabezas, & Castanho, 2022).

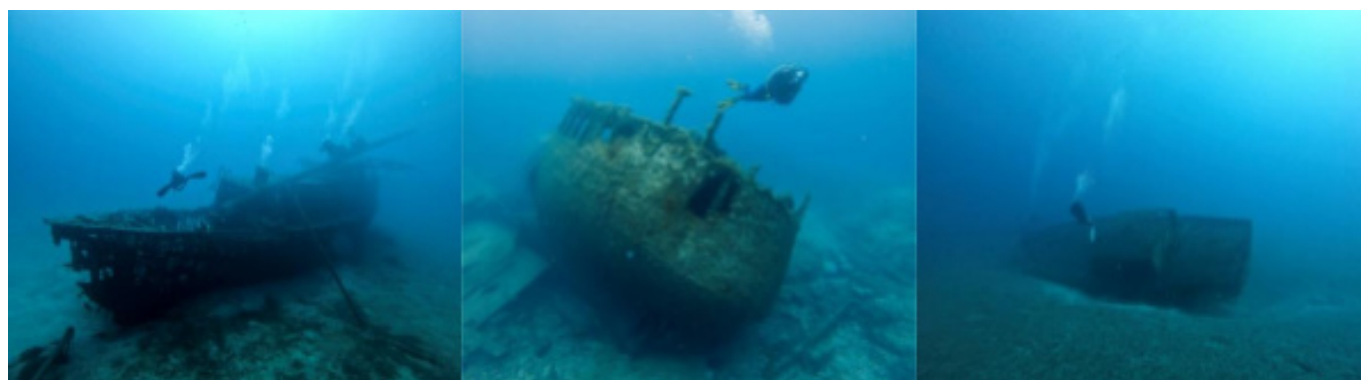


Figure 2: Wrecks in Tenerife. All the wrecks are located within the infralittoral zone and are accessible using recreational scuba-diving techniques. The examples shown include the *Meridian*, a former Second World War Kriegsmarine vessel that was used for whale-watching activities between 1971 and 2005; the *Condesito*, wrecked in 1973; and *El Gemelo*, deliberately sunk off Puerto Colón for the international diving market.

Source: Juan D. López-Arquillo.

By contrast, purpose-prepared or artificial wrecks may mitigate a significant part of these risk components when they are properly selected, cleaned, adapted, sunk and monitored. Vessels intentionally scuttled for diving can be stripped of hazardous materials, stabilised, opened through controlled access points, cleared of dangerous obstructions and positioned at depths and locations compatible with specific certification levels. Their value therefore lies not only in their capacity to function as artificial reefs, but also in their ability to provide a safer, more legible and more pedagogically useful underwater environment. Properly prepared wrecks can support progressive training, advanced buoyancy practice, orientation skills, supervised wreck-diving exercises and controlled forms of underwater interpretation, while simultaneously reducing pressure on more fragile natural habitats. From the perspective of coastal planning, an artificial wreck can therefore be understood as a small-scale blue infrastructure. This interpretation connects wreck-based entrepreneurship with marine spatial planning, understood as a process for organising human uses of marine space in order to reduce conflicts, improve ecosystem-based management and coordinate economic activities with environmental protection (Douvere, 2008; Ehler & Douvere, 2009). It is not a major harbour, an offshore platform or

a conventional tourism facility; rather, it is a submerged asset capable of organising economic relations, user flows, training practices, local services and governance requirements. Its value does not lie solely in its metallic mass, but in the network of access points, operators, services, regulations and narratives that it enables. In this sense, the wreck can operate as an underwater centrality within a broader coastal system.

The selected case is the wreck of *El Peñón*, located off Tabaiba, in Tenerife. This wreck is a former tugboat deliberately scuttled in 2006 to function as an artificial reef and dive site. Its location only a short distance from the coast, its approximate depth of 30 to 32 metres, its recognisable hull and its proximity to the Tabaiba–Radazul axis make it a particularly suitable case for analysing wreck-based blue entrepreneurship. The worldwide Professional Association of Diving Instructors – PADI– describes the site as one of the best-preserved wrecks in Tenerife, located only a few metres off the coast of Tabaiba and sunk at a depth of around 30 metres, with training relevance for Advanced Open Water Diver and Wreck Diver certification pathways. Tourism information from the Canary Islands also identifies the vessel as having been sunk in 2006 as an artificial reef intended to enrich marine life and promote scuba diving, with a maximum depth of approximately 32 metres.

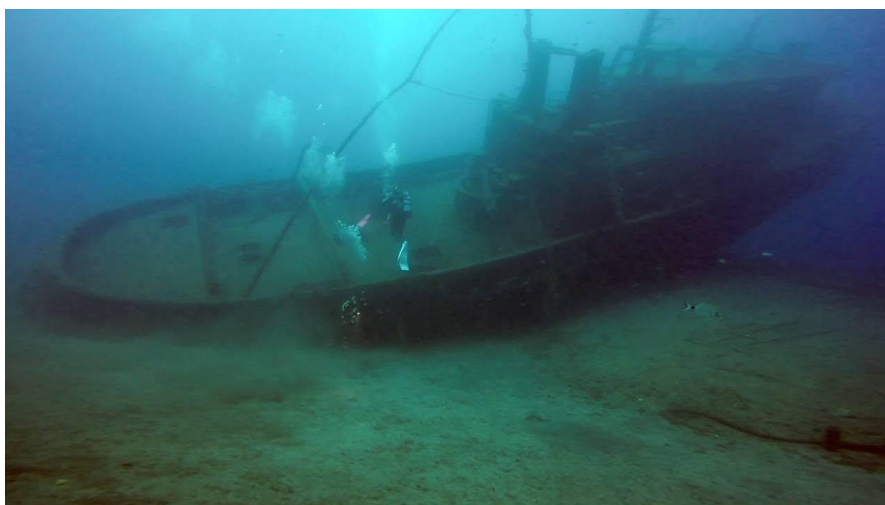


Figure 3: Current condition of the *El Peñón* wreck. Its upright position evidences the intentional nature of the scuttling—showing only a starboard list caused by the morphology of the seabed—as well as the absence of hazardous elements for divers, such as nets and cables, which are commonly associated with natural or accidental wrecks.

Source: José M. Peinado Martín.

This article addresses the following research question: how can an artificial wreck act as a catalyst for blue entrepreneurship in an island territory? This question is applied to the case of *El Peñón* through five explanatory propositions. The first argues that the wreck generates a differentiated and marketable underwater experience. The second proposes that its shore-based accessibility increases its operational and business value. The third considers that its depth and configuration

enable advanced training products. The fourth suggests that its effect is reinforced by the existence of a local diving ecosystem along the Tabaiba–Radazul axis. The fifth argues that its sustainability depends on governance, maritime safety, environmental monitoring and the spatial regulation of uses. The article does not claim that the sinking of *El Peñón* mechanically caused the creation of all nearby diving businesses. Such a claim would be methodologically weak. Rather, it proposes

interpreting the wreck as a structuring asset within a broader coastal system. *El Peñón* reinforces the identity of the area as a diving destination, adds a specialised product to the local and island-wide tourism offer, supports advanced training, attracts operators from other parts of Tenerife and intensifies the need for urban-maritime planning. The causal logic is therefore not linear, but infrastructural and relational: the wreck generates value when it is connected to accessibility, operators, training, services and governance.

2. Literature Review

2.1. Blue economy, Island Territories and the Coastal Interface

The blue economy has become a consolidated framework for analysing the sustainable use of marine and coastal resources, particularly in Europe's outermost regions. Although it is often associated with large-scale maritime sectors such as ports, fisheries, aquaculture or offshore energy production, it also encompasses small-scale activities linked to coastal communities, leisure, education, conservation and tourism. In island territories, this dimension is particularly relevant because the sea is not external to urban and territorial life. Rather, it forms part of the everyday geography of mobility, labour, identity, recreation and environmental responsibility, while also constituting the material basis of freight transport and supply-chain continuity. In the case of the Canary Islands, this interpretation is reinforced by regional blue economy strategies that explicitly link maritime identity, training, innovation, environmental protection, competitiveness and coastal development (Gobierno de Canarias, 2021; Fernández Fernández et al., 2022). At the European level, the renewed strategy for outermost regions also frames the blue economy and biodiversity as strategic assets for sustainable development and opportunity creation (European Commission, 2022).

From an urban-planning perspective, island coastlines should be interpreted as hybrid spaces. They are neither purely natural nor strictly urban. They include residential developments, tourism facilities, coastal roads, beaches, marinas, fishing infrastructures, promenades, stairways and ramps providing access to the sea, informal recreational spaces and underwater landscapes. The coast is therefore a socio-spatial interface. The value of a marine resource does not depend solely on its ecological or scenic qualities, but also on its accessibility, connectivity, edge services, regulatory framework and capacity to become integrated into the wider territorial system.

This interpretation is especially important for underwater tourism. Dive centres constitute the operational node that makes diving activity possible. This is because scuba diving depends on specialised equipment with a markedly technical and industrial character, particularly cylinder-filling systems, which involve compressed air at pressures exceeding 200 at-

mospheres and are therefore subject to specific inspection, authorisation and control by industrial-safety departments within local and national administrations. Dive centres enable the experience by organising access to dive sites either through dive boats or through shore-based entry points. A dive site becomes economically relevant when it can be connected to urban and logistical systems: road access, public transport, parking provision, safe entry and exit points, emergency-response capacity, equipment transport, proximity to compressors, classrooms, accommodation and food-and-beverage services.

Consequently, the entrepreneurial capacity of a dive site is inseparable from the spatial structure of the coastline. The underwater resource and the urban-coastal fabric operate as a combined system. In this sense, underwater tourism should not be understood merely as the consumption of a natural or scenic asset, but as the result of a territorial assemblage in which marine resources, coastal accessibility, technical infrastructure, business operators, safety regulations and local services jointly produce economic value.

2.2. Artificial Reefs and Deliberately Scuttled Vessels

Artificial reefs are human-made submerged structures that can modify substrate availability, increase spatial complexity, promote biological colonisation, protect resources, enhance fisheries productivity or create recreational opportunities. Deliberately scuttled vessels constitute a specific typology within this broader category: artificial wrecks. These are obsolete, seized, military, commercial or decommissioned vessels that have been previously prepared and sunk under controlled conditions in order to generate a submarine structure. The deliberate sinking of vessels is technically, legally and environmentally complex. It should not be understood as a simple waste-disposal operation. It requires vessel assessment, removal of contaminants, cleaning of fuels and oils, treatment of hazardous materials, analysis of structural stability, site selection, compatibility with navigation, evaluation of potential ecological effects, administrative authorisation and post-deployment monitoring. In the Spanish and international context, such operations are connected to regulations concerning dumping at sea, marine protection, coastal management, ship recycling, maritime safety and environmental assessment (Jaume Munar, 2020). From the perspective of their intended purposes, artificial reefs may be linked to production, protection, restoration, research, education, tourism or recreation. The recreational objective becomes particularly relevant when the structure is a vessel. A sunken ship has immediate experiential value for divers because it offers recognisable geometry, vertical relief, orientation references and a sense of exploration. For this reason, a scuttled vessel can be understood as an underwater infrastructure intentionally arranged to produce specific forms of use.

International experience shows that deliberately scuttled

vessels are increasingly being used as instruments of underwater destination-making. Malta is one of the clearest European examples. Its diving offer is strongly associated with wrecks such as the *Um El Faroud*, *P29*, *Rozi*, *Imperial Eagle*, *Karwela* or *Cominoland*. Some of these vessels were deliberately sunk to create artificial reefs and diving attractions, while others have been incorporated into the recreational diving circuit as structured underwater assets. The *Um El Faroud*, for example, was scuttled off Wied iż-Żurriq in 1998 after a decontamination process and has become one of Malta's most emblematic recreational wreck dives. Malta provides a useful comparative reference because wreck diving forms part of its tourism positioning, with artificial and historical wrecks contributing to destination image, diver motivation and repeat visitation (Cardona, 2025).

Madeira provides a second relevant case. The deliberate sinking of the Portuguese Navy corvette *Afonso Cerqueira* off Cabo Girão in 2018 created one of the island's most recognisable wreck-diving attractions. The vessel, approximately 85 m long, was prepared and sunk to operate as an artificial reef and recreational dive site. Its position, depth range and structural legibility allow it to function simultaneously as an ecological substrate, an underwater photographic object, an advanced diving destination and a business resource for local operators. Madeira's experience is particularly relevant for island territories because the wreck does not operate in isolation: it is connected to boat logistics, coastal resorts, dive centres, underwater visibility, marine biodiversity and the broader tourism economy of the island.



Figure 4: Images of *Dori* wreck, in São Miguel, Azores (PT). Propeller, partially buried in the substrate; beams of the main deck; and remains of the keel.

Source: Juan D. López-Arquillo.

The Azores offer a complementary perspective. The archipelago contains well-known historic and accidental wrecks, such as the *Dori* off São Miguel, a Second World War Liberty ship that sank near Ponta Delgada in 1964 and has become one of the island's most iconic dive sites. Unlike deliberately scuttled artificial wrecks, the *Dori* was not designed as a recreational infrastructure. Nevertheless, its subsequent incorporation into the diving economy shows how wrecks can become powerful territorial attractors when they combine maritime narrative, accessibility, moderate depth, ecological colonisation and proximity to urban and port services. The Azorean case is therefore useful because it reveals both the attraction of wreck diving and the difference between accidental heritage wrecks and purpose-prepared artificial wrecks. The former may possess exceptional historical and symbolic value, but they also require careful protection, interpretation and regulation; the latter can be designed from the outset to support safer and more controlled recreational use.

These examples suggest that artificial wrecks and deliberately submerged structures should not be interpreted only as ecological devices. They also operate as territorial and entrepreneurial infrastructures. Their impact depends on the com-

bination of several factors: underwater singularity, preparation and environmental safety, depth compatibility with different certification levels, access by boat or from shore, proximity to dive centres, availability of emergency response, integration into destination branding, and governance mechanisms capable of regulating use intensity. In this sense, the value of a deliberately scuttled vessel is not contained exclusively in the object itself, but in the operational system that surrounds it. This distinction is fundamental. Natural or accidental wrecks often emerge from maritime disasters, wartime events, navigational failure or storm-related losses. They may be structurally unstable, partially collapsed, archaeologically sensitive, legally protected or environmentally hazardous. Their interiors can include silt, cables, nets, sharp metal, enclosed compartments and unpredictable collapse risks. By contrast, purpose-prepared artificial wrecks can mitigate many of these risks through prior cleaning, removal of hazardous materials, controlled openings, structural assessment, planned orientation, selected depth and post-sinking monitoring. They do not eliminate risk, since wreck diving always requires training, planning and conservative procedures, but they can transform an uncontrolled hazard into a managed underwater infrastructure.

2.3. Wreck Diving as a Specialised Tourism Product

Wreck diving is one of the most recognisable specialisations within recreational scuba diving. Its appeal lies in the combination of adventure, technical progression, maritime narrative, underwater spatiality and ecological observation. From the diver's perspective, a wreck is not perceived as a homogeneous seabed, but as a constructed object: bow, stern, deck, bridge, engine room, superstructure, openings, shadows, internal volumes and colonised surfaces. These elements generate a sequence of perception and movement that approximates an architectural experience, although one developed under conditions of neutral buoyancy. This spatial quality has clear tourism value. The dive can be narrated before and after it takes place. The operator can describe the route, show photographs, indicate the maximum depth, specify whether penetration is allowed or excluded, explain the vessel's history, identify expected marine fauna, define the required certification level and offer a clearly legible product. The wreck is therefore easily translated into commercial language: it is not merely a dive, but a wreck dive.

The literature on artificial wrecks has shown that deliberately scuttled vessels can generate local benefits through dive operations, associated tourism expenditure and destination differentiation (Genç, 2022; Morgan et al., 2009; Schaffer & Lawley, 2008). Other studies have examined diver preferences, showing that size, challenge, marine life, novelty and perceived uniqueness influence the attractiveness of wrecks (Seaman

& Depper, 2019; Stolk et al., 2005). Artificial reefs have also been analysed as recreational scuba-diving resources in their own right, with attention to how divers perceive, value and use them as alternatives or complements to natural dive sites (Stolk, 2007; Stolk et al., 2005). These findings support the idea that artificial wrecks can operate as tourism assets, provided that they are articulated with accessibility, safety, operators and governance.

2.4. Training & Entrepreneurship Value: The Wreck as a Submerged Classroom

An essential dimension of artificial wrecks is their training value. Wrecks enable technical progression because they combine depth, structure, orientation, buoyancy control and risk management within a single underwater environment. They are particularly suitable for developing competencies related to advanced diving, deep diving, underwater navigation, nitrox use, underwater photography, risk assessment, gas planning, emergency procedures and, where appropriate, controlled penetration under specific training conditions. This pedagogical role is also relevant from an environmental-management perspective, since diver training and briefing are among the main tools for reducing underwater impacts associated with contact, buoyancy problems, sediment disturbance and inappropriate behaviour (Edney & Spennemann, 2015; Sumanapala et al., 2022).



Figure 5: Become a PADI Wreck Diver, promotional flipchart for PADI's "Wreck Diver" specialty course.

Source: Professional Association of Diving Instructors (PADI) ©

From the perspective of scuba-diving education, a wreck provides a structured learning environment. Unlike an open rocky seabed, a vessel has recognisable limits, identifiable reference points and a spatial sequence that can be planned, briefed

and supervised. It allows the instructor to design a route briefing, establish a descent reference, define a maximum operating depth, set turn-pressure criteria, identify prohibited or restricted areas, plan a circumnavigation, avoid unauthorised

overhead environments, control group positioning and execute an ascent with an appropriate safety stop. The wreck is therefore not merely a recreational attraction, but a pedagogical and professionalisation device. This training dimension is directly linked to entrepreneurship. Certified courses generate higher added value than isolated recreational dives. They require instructors, classrooms, teaching materials, repeated sessions, specific equipment and structured customer follow-up. They also foster client retention: a diver who completes an advanced course may return for deep diving, nitrox, wreck diving, photography or technical-diving pathways. In this sense, the wreck forms part of a progressive training ladder rather than a one-off leisure product. It enables dive centres to convert a submerged asset into a sequence of educational services, specialised certifications and recurrent business opportunities.

But the success of a recreational wreck should not be measured solely by the number of divers or businesses it attracts, but by its capacity to become integrated into a sustainable model of coastal management. This includes prior decontamination, impact control, environmental monitoring, safety provisions, signage, mooring regulation, coordination among dive centres, local participation and the equitable distribution of benefits. The legal dimension adds a further layer of complexity. Moreu Ballonga (2025) demonstrates the density of the legal regime governing wrecks, particularly in relation to

historic shipwrecks, State vessels, treasure, ownership and underwater cultural heritage. In the case of *El Peñón*, this reference is especially useful for conceptually delimiting the object of study: it is not a historic archaeological wreck, but a contemporary artificial wreck, deliberately scuttled and managed as a recreational resource and artificial reef.

3. Conceptual Framework: Wreck-Based Blue Entrepreneurship

Wreck-based blue entrepreneurship is the process through which a wreck, particularly when deliberately scuttled as an artificial reef or recreational resource, acts as a catalyst for economic, educational, spatial and environmental value in a coastal or island territory. The conceptual key lies in understanding that an underwater object can operate as infrastructure when it enables repeated practices, services, training processes, mobility patterns, interpretation and governance. The proposed conceptual framework is structured around five interrelated dimensions: experiential singularity, operational accessibility, training value, entrepreneurial ecosystem and sustainable governance. These dimensions make it possible to analyse when a wreck is merely a submerged object, when it becomes a diving attraction, and when it reaches the condition of blue infrastructure.

Table 1
Conceptual dimensions of wreck-based blue entrepreneurship, from description to specific considerations on the case study.
Source: Authors.

Dimension	Description	Translation to the case of <i>El Peñón</i>
Experiential singularity	The wreck creates a differentiated, recognisable and narratable underwater experience.	<i>El Peñón</i> operates as an underwater landmark and as a specific wreck-diving product.
Operational accessibility	The resource becomes viable when safe access exists from shore or by boat, together with connectivity and urban support.	Shore entry from Tabaiba and proximity to Radazul reduce logistical costs and facilitate recurrent use.
Training value	Depth and structure enable advanced courses, deep diving, wreck diving, nitrox, orientation and safety training.	The 20–32 m profile allows routes to be segmented for Open Water, Advanced and Deep divers, with an emphasis on non-penetration except under specific training conditions.
Entrepreneurial ecosystem	The wreck generates greater value when embedded within a network of dive centres, clubs, instructors, services and operators.	The Radazul–Tabaiba axis concentrates dive centres, clubs and operators that use or market the surrounding underwater environment.

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Table 1 (continued)

Dimension	Description	Translation to the case of <i>El Peñón</i>
Sustainable governance	Growth requires planning, safety, environmental monitoring and territorial return.	The coexistence of divers, bathers, boats and fishers requires buoyage, protocols and coordination.

The conceptual contribution of this article lies in shifting the analytical focus from the wreck as an object to the wreck as a node. This nodal interpretation is consistent with spatial approaches to coastal tourist territories in which the coastline is understood not as a fixed boundary, but as a relational interface between emerged territory, submerged support, social use and symbolic recognition (López Arquillo, 2023). It also resonates with marine spatial planning approaches that seek to organise uses, reduce conflicts and integrate environmental and economic functions in marine space (Douvere, 2008; Ehler & Douvere, 2009). A node is relevant because it concentrates relationships, not merely because it exists physically. In this sense, *El Peñón* can operate as an underwater centrality: a place beneath the sea that organises routes, products, memories, training activities and economic flows along the urban-marine edge.

- On the basis of these dimensions, five propositions are formulated:
- The wreck fosters blue entrepreneurship because it creates a differentiated underwater experience that can be marketed as a wreck dive.
 - Its shore-based accessibility and its connection with urban-coastal infrastructures increase its entrepreneurial value.
 - Its depth and configuration enable advanced and specialised training products.
 - Its effect is reinforced by the presence of operators, clubs, instructors and complementary services along the Tabaiba–Radazul axis and across the island of Tenerife.
 - The sustainability of entrepreneurship based on *El Peñón* depends on safety, spatial regulation, environmental monitoring and coordination among stakeholders.

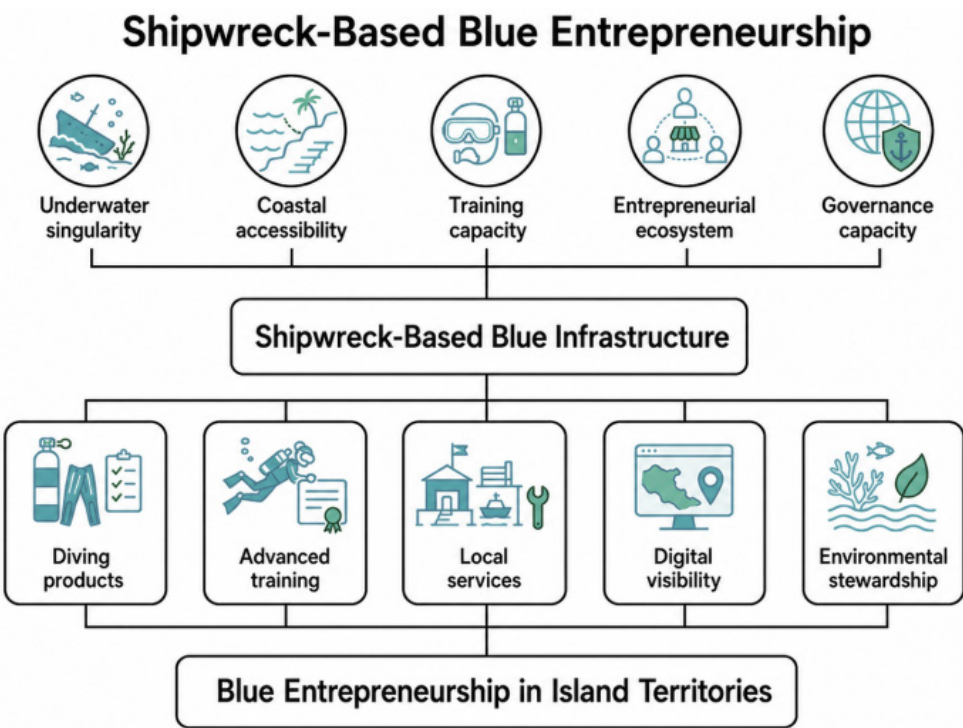


Figure 6: Wreck-Led Blue Entrepreneurship model. How a wreck ceases to be merely a sunken object and comes to function as wreck-based blue infrastructure, capable of activating blue entrepreneurship in island territories.

4. Case Study: *El Peñón* Wreck, Tabaiba, Tenerife

El Peñón is located off Tabaiba, in the municipality of El Rosario, on the eastern coast of Tenerife. It is a former tugboat deliberately scuttled in 2006 for the purposes of creating an artificial reef and a recreational dive site. Public descriptions place the wreck approximately between 20 and 32 m depth, with variations depending on the source and the specific dive route. Excel Scuba identifies it as a tugboat built at the Seville shipyards in 1958, with a length of 26.96 m, a beam of 7.70 m and a final sinking date of 11 July 2006. *El Peñón* should not

be interpreted as a historic archaeological wreck. Its value does not derive from antiquity or from heritage significance in the classical sense, but from its condition as a contemporary blue infrastructure. This clarification is important in order to avoid legal and conceptual confusion. The framework developed by Moreu Ballonga (2025) is useful for distinguishing the legal regime of historic wrecks from the case of a recent artificial wreck. *El Peñón* is a managed, contemporary wreck, functionally oriented towards recreational, training and environmental use.

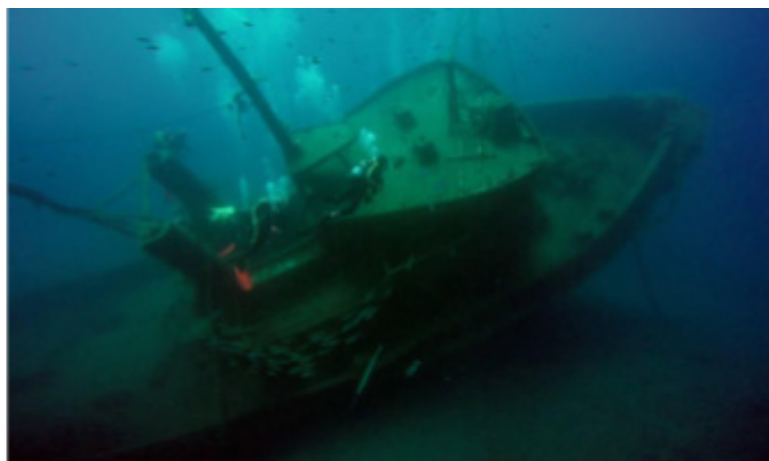
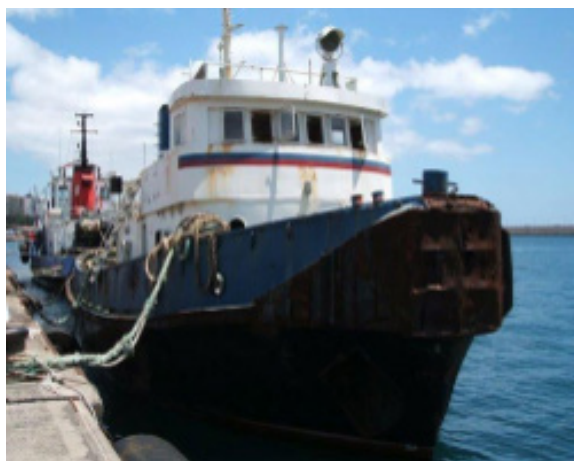


Figure 7: Images of *El Peñón* in 2004, prior to its controlled scuttling, and in 2018, similar to nowadays.

Source: José M. Peinado Martín.

The most relevant spatial characteristic of *El Peñón* is its shore-based accessibility. Many wrecks require a boat, harbour schedules, moorings, a skipper, fuel and favourable weather conditions. *El Peñón*, by contrast, can be integrated into a land-based diving operation. This reduces costs, allows greater flexibility, facilitates repeated training use and makes it possible for clubs and diving schools to use the site frequently. From the perspective of urban planning, the dive site does not begin underwater, but in the complete sequence of arrival, parking, equipment loading, briefing, sea entry, surface navigation, descent, underwater route, ascent, exit, rinsing of equipment and subsequent consumption in local services.

The Tabaiba–Radazul setting amplifies this value. Tabaiba provides the physical access point and the direct identity of the wreck. Radazul contributes marina facilities, nautical services, dive centres, food-and-beverage spaces and the condition of a metropolitan coastal node. Puerto Deportivo Radazul declares 202 berths, with a maximum vessel length of 20 m and a minimum draught of 4 m, in addition to associated harbour services (Puerto Deportivo Radazul, 2026). TITSA connects Santa Cruz with Tabaiba Baja and Radazul Bajo through line 138, and complements the area's accessibility with line 139 towards Playa La Nea and Tabaiba Baja (TITSA, 2026a, 2026b).

From a diving perspective, *El Peñón* allows several dive profiles. A complete profile around the hull, reaching depths close to 30–32 m, requires advanced planning, gas-consumption control, buoyancy mastery, monitoring of no-decompression limits and a safety stop. Scubanana Diving Center & tech diving School presents an Advanced/Deep route involving external circumnavigation of the hull at 28–31 m, with no penetration except for Wreck-trained divers, recommending nitrox and a torch, a referenced descent and small groups (Scubanana, 2026). PADI identifies the site as useful for Advanced Open Water Diver and Wreck Diver training pathways (PADI, 2026).

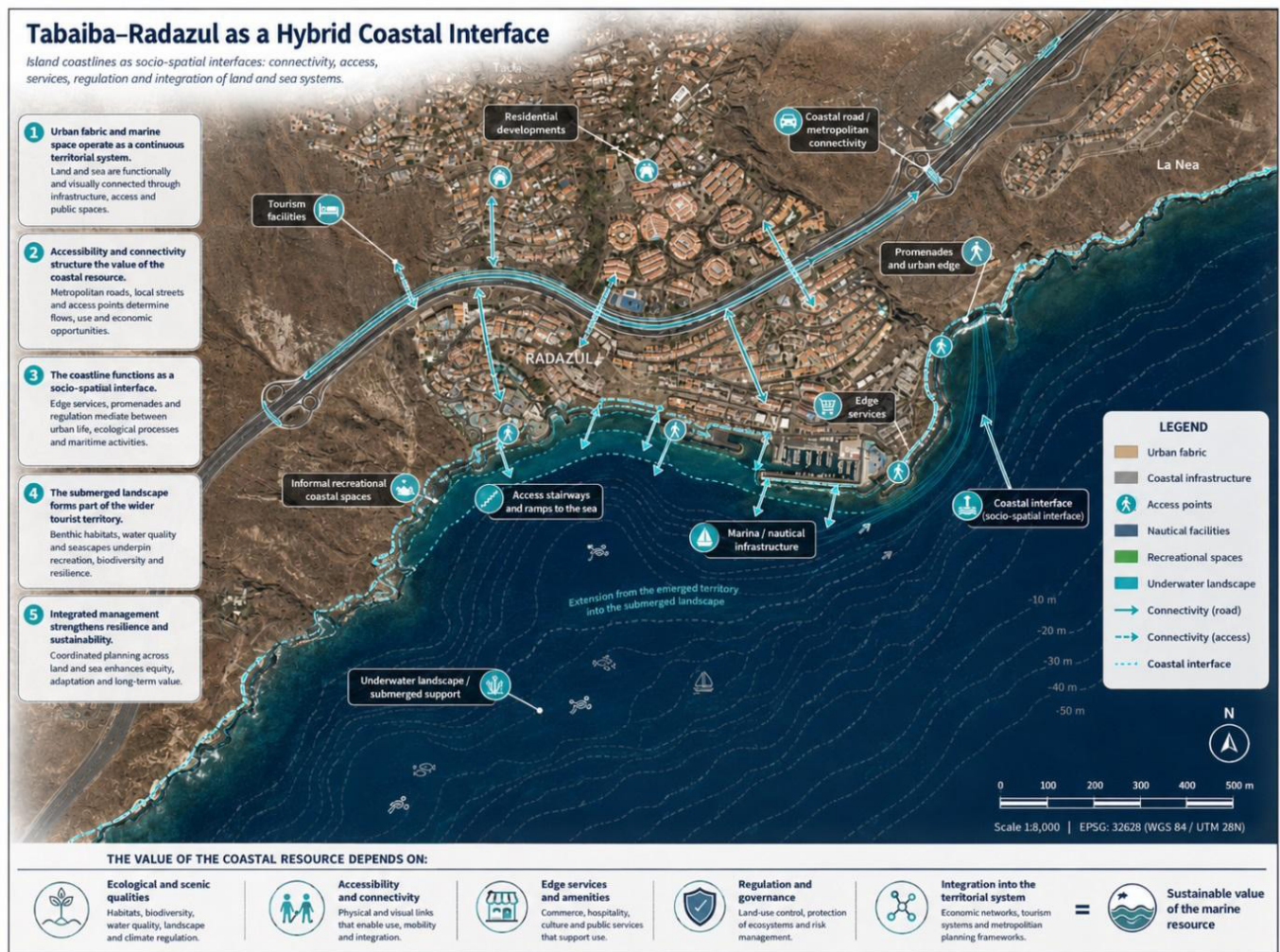


Figure 8: Tabaiba-Radazul as a Hybrid Coastal Interface. Conceptual coastal-planning map showing the Tabaiba-Radazul area as a hybrid socio-spatial interface between urban fabric, coastal infrastructure and submerged landscape. The figure illustrates how the value of a marine resource is not determined only by its ecological or scenic qualities, but also by accessibility, metropolitan connectivity, edge services, nautical infrastructure, regulatory capacity and integration into the wider territorial system.

5. Methodology

The study adopts an explanatory case-study design with light empirical validation based on indicators related to market structure, accessibility and territorial infrastructure. The selection of *El Peñón* as a case study is justified by its deliberate scuttling as an artificial reef, its shore-based accessibility, its integration into Tenerife's recreational diving offer and its proximity to the Tabaiba-Radazul axis, where a relevant concentration of underwater activities can be observed. This design is consistent with case-study research approaches in which a bounded empirical case is used to examine a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are analytically relevant (Flyvbjerg, 2006). It seeks to explain why an artificial wreck may foster processes of blue entrepreneurship and to verify whether the theoretical conditions identified in

the conceptual framework are observably present in the case of *El Peñón*. Empirical validation is therefore intentionally simple, transparent and replicable.

In order to strengthen the empirical grounding of the case study, the qualitative source triangulation was complemented with a contextual quantitative layer. This layer did not seek to measure the direct economic impact of *El Peñón* itself, nor to attribute tourism demand to the wreck. Instead, it was used to situate the case within the wider scuba-diving tourism system of Tenerife. Two types of quantitative sources were incorporated. First, official tourism-demand data from the Canary Islands Tourism Observatory / Promotur were used to identify the number of tourists undertaking scuba diving in Tenerife, their share within total tourism demand, average expenditure, average stay and estimated turnover. Second, the Register of Active Tourism Activities was processed to identify the number of formal scuba-diving activity registrations in Tenerife

and in the Canary Islands. These data were used as contextual indicators of demand and supply, complementing the qualitative evidence derived from dive-site descriptions, certification platforms, operator websites, cartography and territorial infrastructure sources.

The methodology is organised around the five propositions. For each proposition, a set of indicators is identified. Experiential singularity is validated through the presence of the wreck in dive-site catalogues, the use of terms such as *pecio*, wreck or artificial reef, photographs, route descriptions and references to marine fauna. Operational accessibility is analysed through shore-based access, proximity to the urban fabric, roads, bus lines, parking facilities, marina infrastructure and entry and exit points. Training value is examined through depth profile, certification requirements, Advanced, Deep, Wreck or Nitrox products, guided routes and non-penetration protocols. The entrepreneurial ecosystem is validated through the number of operators, years of activity, certifications, visible employment, services offered and digital presence. Governance is addressed through user conflicts, interaction between boats and divers, the need for buoyage, protocols, environmental monitoring and coordination among stakeholders. The main unit of analysis is the wreck as a submerged infrastructure. However, two secondary units are also considered. The first is the set of underwater operators active in the Tabaiba–Radazul area or marketing *El Peñón* as part of their diving offer. The second is the territorial support system that makes the resource usable: public transport, parking, marina facilities, coastal access, food-and-beverage services, equipment logistics and emergency-response capacity.

The spatial scope is divided into three scales. The first is Tabaiba, understood as the immediate coastal settlement and physical access point to the wreck. The second is Tabaiba–Radazul, interpreted as a functional micro-ecosystem of nautical and underwater activity. The third is Tenerife, incorporating operators from other parts of the island that include *El Peñón* in their dive portfolios. This multiscale reading is essential be-

cause the entrepreneurial effect of a dive site may exceed its immediate neighbourhood: a wreck may be local in its location but island-wide in its market.

The data sources are public and verifiable. The first group includes tourism websites, dive-site platforms, operator websites and certification platforms describing *El Peñón* and its diving profile. The second group includes corporate websites, legal notices, business directories and publicly available company information used to identify operators, years of activity, legal form and available labour data. The third group includes sources on accessibility and territorial infrastructure, such as public transport information, marina descriptions and references to parking provision. The fourth group includes journalistic and institutional sources on safety, regulation, accidents, user conflicts and coastal management. Validity is supported through source triangulation. A data point is considered more robust when it can be cross-checked across more than one type of source. For example, a description of a dive site is stronger when it appears both on a certification platform and in the offer of a diving operator. An accessibility indicator is more robust when it can be verified through transport timetables, cartography and local sources. Employment data are treated with caution because business directories may not be fully up to date and because part of the diving sector operates through self-employed professionals, clubs or seasonal collaborations.

The study has several limitations. First, publicly available data do not capture the full economic volume of underwater activity. Second, digital presence does not necessarily equate to actual turnover. Third, some operators may offer *El Peñón* without publishing detailed information. Fourth, the causal relationship between the 2006 scuttling and subsequent business activity cannot be demonstrated without a complete longitudinal series. Fifth, carrying capacity, ecological impact and diver behaviour would require specific underwater monitoring. These limitations do not invalidate the approach; rather, they define it as an explanatory and exploratory study based on observable indicators.

Table 2

Propositions, dimensions and indicators for empirical validation. It operationalises the conceptual framework by translating each analytical dimension into a set of observable indicators identified through public sources, operator information, dive-site descriptions, territorial infrastructure data and governance-related observations.

Propositions	Analytical dimension	Qualitative indicators	Contextual quantitative indicators
P1	Experiential singularity	Presence of wreck in catalogues; route descriptions; photos; artificial reef references.	Number and share of tourists undertaking scuba diving in Tenerife.

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Table 2 (continued)

Propositions	Analytical dimension	Qualitative indicators	Contextual quantitative indicators
P2	Operational accessibility	Shore access; public transport; parking; marina; entry/exit points.	Not directly quantified; supported by territorial and infrastructure data.
P3	Training value	Depth; Advanced/Deep/Wreck/Nitrox; protocols; guided routes.	Expenditure, stay and daily spending of scuba-diving tourists as proxy for specialised tourism segment.
P4	Entrepreneurial ecosystem	Operators; clubs; services; digital presence; certifications.	Number of registered scuba-diving active-tourism activities in Tenerife and Canary Islands; estimated turnover of scuba-diving tourist segment.
P5	Governance	User conflicts; safety protocols; monitoring; coordination.	Not directly quantified; future work should combine carrying capacity, diver pressure and ecological monitoring.

6. Data Analysis and Results

6.1. *El Peñón* as an Experiential Underwater Landmark

The first proposition is supported by the way in which *El Peñón* is described and marketed. The wreck appears as a differentiated product rather than as a generic underwater location. Its identity as a wreck is central to its attractiveness. The term *pecio* or *wreck* is not incidental; it defines the experience. PADI presents it as a wreck located only a few metres off the coast of Tabaiba and sunk at a depth of 30 m, with training relevance for advanced and wreck diving (PADI, 2026). Promotur Turismo de Canarias describes it as a vessel sunk in 2006 to enrich marine life and promote scuba diving (Promotur Turismo de Canarias, 2026).

From a spatial perspective, *El Peñón* operates as an underwater landmark. In urban planning, landmarks help structure perception and orientation; they are recognisable points that organise mental maps. Underwater, where visibility, buoyancy and orientation are governed by conditions different from those on land, a wreck performs a comparable function. It becomes a destination, a descent reference, a route generator and a memorable object. The diver does not merely dive in Tabaiba; the diver dives *El Peñón*. This landmark condition is reinforced by the morphology of the vessel. Hull, deck, superstructure, list, openings and tugboat elements generate a legible spatial sequence. The exterior route can be planned as a circumnavigation. The maximum depth can be clearly defined. The ascent can be organised through references and group

control. The wreck therefore provides spatial legibility, a factor that is essential both for safety and for tourism narration. The commercial value of this singularity is evident. Operators can present the dive as one of Tenerife's reference wreck-diving sites. They can use photographs, route descriptions, certification requirements and expected marine life. The dive becomes a named product, rather than an undifferentiated location.

6.2. Shore-Based Accessibility and Urban-Coastal Integration

The second proposition is also supported. Shore-based accessibility is one of the strongest entrepreneurial attributes of *El Peñón*. A wreck accessible from land differs substantially from one that requires a boat. Shore entry reduces costs, increases timetable flexibility, enables repeated use, facilitates training and lowers barriers for local divers, clubs and diving schools. This condition turns the wreck into a recurrent operational resource.

From an urban-planning perspective, the dive site is not located only underwater. It begins on land. The user arrives by car, bus or dive-centre vehicle; prepares the equipment; transports cylinders and weights; receives the briefing; enters the sea; navigates on the surface or descends using a reference; completes the dive; performs a safety stop; exits the water; rinses the equipment and, frequently, consumes nearby local services. This sequence constitutes an amphibious itinerary. The quality of the diving product depends on the land-sea continuity of that itinerary. In Tabaiba-Radazul, several ter-

territorial factors reinforce this itinerary: road connectivity, proximity to the Santa Cruz metropolitan area, public transport lines, marina facilities, coastal access points and the presence of operators. TITSA identifies line 138 as connecting Santa Cruz, Tabaiba Baja and Radazul Bajo, and line 139 as serving Playa La Nea and Tabaiba Baja (TITSA, [2026a](#), [2026b](#)). This connectivity makes it possible to interpret the wreck within a framework of metropolitan accessibility, rather than merely as a recreational enclave dependent on private cars.

Parking is another relevant territorial variable, although it should be measured more precisely in future phases. The availability of parking supports the operation of dive centres and visiting divers, but it may also become a carrying-capacity constraint. Diving equipment is heavy and bulky; the distance between parking and the entry point directly affects the usability of the site. Parking is therefore not a secondary convenience, but part of the operational capacity of the blue infrastructure. The marina at Radazul adds an additional layer. Although *El Peñón* is mainly used from shore, the marina contributes to the nautical identity of the area and provides complementary services. Its 202 berths, maximum vessel length of 20 m and associated services reinforce Radazul's condition as a coastal node rather than a simple residential edge (Puerto Deportivo Radazul, [2026](#)). P2 is thus supported: accessibility and infrastructural integration increase the entrepreneurial capacity of the wreck.

6.3. Training Value, Technical Profile and Product Segmentation

The third proposition is supported by the depth and configuration of the wreck. *El Peñón* is located within a range that allows recreational levels to be segmented. The upper parts can be observed through limited profiles under supervision, while a complete route around the hull, at approximately 28–31 m, requires advanced planning. This condition makes it a valuable teaching resource.

From the perspective of a wreck-diving instructor, *El Peñón* allows several pedagogical profiles to be designed. In Advanced Open Water, it can be used for a deep adventure dive, orientation tasks, buoyancy control and planning. In Deep Diver training, it allows work on gas management, depth awareness, discussion of narcosis, ascent control and safety-stop discipline. In Wreck Diver training, it enables external recognition, risk identification, route planning, discussion of reel or line use, non-penetration briefing and, only with appropriate training, overhead-environment practice. In Nitrox training, it allows discussion of maximum operating depth, oxygen exposure and the extension of no-decompression limits within recreational parameters. Scubanana Diving School describes an Advanced/Deep route involving exterior circumnavigation of the hull at 28–31 m, with no penetration except for Wreck-trained divers, recommending nitrox and a torch, a referenced

descent and a safety stop (Scubanana, [2026](#)). This type of description shows the conversion of the wreck into a technical and training product. It is not an unstructured recreational dive, but a practice organised by level, depth, procedure and risk control.

This dimension generates entrepreneurial value because training products are more complex and higher-value than an isolated recreational dive. They require an instructor, teaching materials, a classroom, repeated sessions, equipment, insurance and follow-up. They also foster customer retention. A diver may first encounter the upper part of the wreck, return for an advanced course, complete a deep dive, undertake nitrox training and subsequently progress into wreck diving. *El Peñón* thus acts as a training ladder and as a support for professionalisation. P3 is therefore supported.

6.4. Entrepreneurial Ecosystem and the Functionality of the Urban Zone.

The fourth proposition concerns the existence of an entrepreneurial ecosystem. Publicly available evidence shows that *El Peñón* is embedded within a broader environment of diving and nautical activity. In Tabaiba, Radazul and at the island scale, there are clubs, PADI centres, SSI centres, operators with retail facilities, training provision, rental services, cylinder filling and guided-dive offers. Some actors are physically located along the axis; others operate from different parts of Tenerife but include *El Peñón* in their dive portfolios. Club de Buceo El Pejín presents a direct connection with Tabaiba and with the history of the wreck's sinking, highlighting the role of Manolo Beltrán, an instructor from the club, as a promoter of the initiative that allowed the vessel to be visited by scuba divers (Club de Buceo El Pejín, 2026). Scubanana appears on PADI with an address on Avenida Colón, Puerto Deportivo Radazul, and offers PADI courses and guided dives (PADI, [2026c](#)). Macaron Divers, Diving Canarias specifically markets the *El Peñón* wreck in Open and Advanced versions, with shore-based routes. Other non-profit clubs and collectives also operate in the area, likewise using the wreck as a target for their advanced dives.

The following table summarises the preliminary validation matrix. It should not be understood as a complete census, but as evidence that the wreck does not operate in isolation, but within an ecosystem of actors, services and scales.

Table 3

Matrix of actors linked to the Tabaiba–Radazul underwater ecosystem, related to evidences.

Actor / entity	Spatial relationship	Type of actor	Observable evidence	Relevance for <i>El Peñón</i>
Club de Buceo El Pejín	Tabaiba	Diving club / diving school	Public presence and connection with the sinking (this club promoted the sinking)	Reinforces local identity, diving culture and community appropriation of the resource.
Scubanana diving School & Tech Diving	Puerto Deportivo Radazul	PADI centre / company	PADI lists its address on Avenida Colón, Puerto Deportivo Radazul, and its provision of courses and dives.	Connects the wreck with the marina economy, PADI courses and island-wide guiding services.
Diving Canary Islands	Radazul	Island-based centres or operators	Public offer of dives in Radazul and other dive sites in Tenerife.	Expands the island-wide reach of the underwater ecosystem.
CBU Tenerife	Radazul	PADI club	Public presence centered in University ecosystem	Research-based operations in the wreck
Macaron Diver	Radazul	Island-based centres or operators	Publishes specific Open and Advanced routes for the <i>El Peñón</i> wreck.	Directly markets the wreck as a guided and training-oriented product.
Non-profit and collectives	Puerto Deportivo Radazul	Clubs	Non-profit courses and low-level facilities	Local divers underwater ecosystem.
External operators from	Island scale	Commercial operators	Include <i>El Peñón</i> in dive portfolios or wreck-diving routes.	Transform the local resource into an island-destination product.

The value of this table is not to demonstrate direct business causality, but to evidence structure. *El Peñón* is not an isolated attraction; it forms part of a network of operators with diverse profiles. Some are proximity-based actors, while others operate at the island scale. This dual condition reinforces the propositions that the wreck produces value both for Tabaiba and for Tenerife's wider underwater tourism offer. The existence of instructors, guides, retail services, equipment rental, cylinder filling, courses and active operators demonstrates a professional service economy. P4 is therefore reasonably supported.

The interpretation of the Tabaiba–Radazul diving envi-

ronment as an entrepreneurial ecosystem is consistent with approaches that understand entrepreneurship as embedded in territorial configurations of actors, infrastructures, institutions, markets and support services rather than as the isolated action of individual firms (Isenberg, 2010; Stam, 2015; Spigel, 2017).

6.5. Contextual quantitative evidence: scuba-diving demand and registered active-tourism supply in Tenerife

The qualitative interpretation of *El Peñón* as a potential catalyst for blue entrepreneurship can be reinforced through contextual quantitative evidence. Official data from the Canary Islands Tourism Observatory / Promotur show that 168,933 tourists aged 16 or over undertook scuba diving during their stay in Tenerife in 2025, representing 2.6% of the island’s tourist population in that age group. This confirms that scuba diving is not a marginal or anecdotal activity, but a measurable specialised segment within the island’s tourism system. (Instituto Canario de Estadística, 2026). The same source reports that tourists undertaking scuba diving had an average expenditure per trip of €1,367, an average stay of 8.8 days and an average daily expenditure of €170.59. When flights are excluded, average daily expenditure remains €126.98, which is especially relevant for interpreting the territorial capture of value through accommodation, food and beverage, mobility, training, equipment rental, guiding and other local services.

At the economic scale, the estimated total turnover associated with tourists undertaking scuba diving in Tenerife reached €231 million in 2025, or €174 million when excluding flights. These values should not be interpreted as direct expenditure on diving centres, nor as the economic impact of *El Peñón*.

Rather, they indicate that diving tourists participate in a wider expenditure system that connects marine activities with the broader destination economy. At the regional scale, 405,575 tourists undertook scuba diving in the Canary Islands in 2025. Tenerife therefore accounted for approximately 41.7% of the regional scuba-diving tourist segment. This reinforces the relevance of Tenerife as one of the main islands in the Canary Islands for this specialised tourism activity (Instituto Canario de Estadística, 2026). The supply-side context also supports this interpretation. Processing the Register of Active Tourism Activities shows 269 scuba-diving activity registrations in the Canary Islands, of which 102 correspond to Tenerife. This represents approximately 37.9% of registered scuba-diving activity entries in the archipelago. Within Tenerife, scuba diving accounts for around 9.0% of all active-tourism activity registrations. Although these figures refer to activity registrations and not necessarily to unique firms or effective annual activity, they confirm the existence of a formalised supply base capable of supporting recreational diving, training, guiding and related services. In this context, *El Peñón* should be interpreted not as an isolated attraction, but as a specialised underwater asset inserted into a measurable demand segment and a registered active-tourism supply system.

Table 4
Contextual quantitative indicators for scuba-diving tourism and active-tourism supply in Tenerife. Tourism-demand and expenditure indicators are taken from the 2025 tourist profile by activities undertaken at destination for Tenerife (Observatorio Turístico de Canarias, 2026b). The Canary Islands comparison is based on the regional activity profile (Observatorio Turístico de Canarias, 2026a). Active-tourism supply indicators are based on the Register of Active Tourism Activities (Gobierno de Canarias, 2026). Tenerife’s 41.7% share of the regional scuba-diving tourist segment is an author calculation.

Dimension	Indicator	Value	Interpretation for the case study
Tourism demand	Tourists aged 16+ in Tenerife	6,443,553	Reference universe of island tourism demand.
Tourism demand	Tourists undertaking scuba diving	168,933	Scuba diving is a measurable specialised tourism segment.
Tourism demand	Share of scuba-diving tourists	2.6%	It is a niche activity, but statistically visible.
Tourist expenditure	Average expenditure per trip	€1,367	Indicates relevant economic profile.
Tourist expenditure	Average stay	8.8 days	Supports interpretation as part of a complete stay.

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Table 4 (continued)

Dimension	Indicator	Value	Interpretation for the case study
Tourist expenditure	Average daily expenditure	€170.59	Shows spending capacity of the segment.
Territorial expenditure	Average daily expenditure excluding flights	€126.98	Approximates expenditure more capturable in destination.
Economic relevance	Estimated total turnover	€231 million	Indicates economic significance of the scuba-diving tourist segment.
Economic relevance	Estimated turnover excluding flights	€174 million	Approximates territorial economic relevance.
Regional position	Scuba-diving tourists in Canary Islands	405,575	Regional comparison.
Regional position	Tenerife share of Canary Islands scuba-diving tourists	41.7%	Tenerife concentrates a major part of the regional segment.
Formal supply	Registered scuba-diving active-tourism activities in Canary Islands	269	Formal supply base at regional level.
Formal supply	Registered scuba-diving active-tourism activities in Tenerife	102	Formal supply base at island level.
Formal supply	Tenerife share of registered scuba-diving activities	37.9%	Tenerife has a significant share of registered supply.

6.6. Governance, Safety and Spatial Conflict

The fifth proposition is the most important for evaluating the sustainability of the model. The same factors that make *El Peñón* a valuable resource—accessibility, popularity, proximity to the shoreline and concentration of uses—also generate governance challenges. The Tabaiba–Radazul coastline is a shared space used by divers, bathers, boats, fishers, paddle-board users, residents, visitors and marina users. Underwater entrepreneurship does not take place in an empty sea; it depends on a common public space in which uses overlap both vertically and horizontally. From a spatial-planning perspective, this is a classic problem of carrying capacity and compatibility of uses. A dive site may be environmentally and commercially successful, yet spatially fragile. The more accessible it is, the more governance it requires. Buoyage, vessel-speed control, surface-marker-buoy protocols, designated entry and exit

points, compulsory briefings, coordination among operators and emergency access are planning instruments, not merely operational details.

From the perspective of diving safety, *El Peñón* requires disciplined procedures: verification of certification level, briefing of the dive profile, definition of maximum operating depth, turn-pressure criteria, no-decompression control, safety stop, group control, a no-touch policy, prohibition of penetration except under specific training conditions, use of a surface marker buoy where appropriate and attention to surface traffic. These protocols are not only diving techniques; they are instruments for governing a public marine space.

Environmental governance is also necessary. The fact that the wreck attracts marine life does not automatically mean that it produces net conservation benefits. Castro et al. (2025) warn against oversimplified conservation narratives regarding artificial wrecks. Operators should integrate environmental

briefings, contact control, respect for fauna, no-feeding rules, no-extraction rules and photographic or citizen-based monitoring. The resource must be monitored, not merely exploited. P5 is therefore confirmed as a necessary condition. The entrepreneurial value of *El Peñón* is sustainable only if it is

supported by governance. The wreck should not be managed as a free-access attraction without rules, but as a shared blue infrastructure requiring stewardship, safety and territorial return.

Table 4

Empirical validation of the propositions through observable indicators and verifiable evidence links. The table translates the five proposition into public, verifiable indicators and summarises the evidence identified in the case of *El Peñón*. The validation does not measure total economic impact, but assesses whether the conditions for shipwreck-based blue entrepreneurship are present in the Tabaiba–Radazul case.

Prop.	Analytical dimension	Observable indicators	Evidence identified in the case of <i>El Peñón</i>	Verifiable evidence links	Interpretation
P1	Experiential singularity	Presence of the wreck in dive-site catalogues; use of terms such as wreck, pecio or artificial reef; photographs; route descriptions; references to marine fauna; recognition as a named dive site.	<i>El Peñón</i> is repeatedly described as a recognised wreck dive located only a few metres off the coast of Tabaiba and sunk at approximately 30 m. Scubanana presents the Tabaiba wreck as Tenerife's true wreck-diving experience and as a deliberately sunk tugboat from 2006, intact and recognisable as a ship.	PADI: El Peñón dive site Hello Canary Islands: Tabaiba dive point Excel Scuba: Dive site Tabaiba Scubanana: Tabaiba wreck discussion	The wreck operates as an underwater landmark. Its value lies in its recognisable morphology, narrative identity, artificial-reef condition and capacity to be translated into a marketable wreck-diving product.
P2	Operational accessibility	Shore-based access; proximity to the urban fabric; metropolitan road connection; public transport; parking provision; marina infrastructure; entry and exit points; relationship with edge services.	<i>El Peñón</i> is accessible from the Tabaiba shoreline, reducing dependence on boat logistics and allowing recurrent use by clubs, instructors and dive centres. The Tabaiba–Radazul axis is connected to Santa Cruz by TITSA lines 138 and 139. Radazul provides complementary nautical infrastructure, including a marina with approximately 202 berths, vessel services and a consolidated urban-coastal edge.	PADI: El Peñón dive site TITSA line 138 TITSA line 139 Puerto Deportivo Radazul SITCAN / GRAFCAN territorial viewer	Shore access, metropolitan connectivity and Radazul's nautical infrastructure increase the operational value of the wreck. Parking, entry-point congestion and equipment-carrying distances remain local capacity variables that should be assessed through fieldwork.

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Table 5 (continued)

Prop.	Analytical dimension	Observable indicators	Evidence identified in the case of <i>El Peñón</i>	Verifiable evidence links	Interpretation
P3	Training value	Depth profile; certification requirements; Advanced, Deep, Wreck or Nitrox products; guided routes; no-penetration protocols; referenced descent; safety stop; segmentation by diver level.	The wreck is located within a depth range generally described between 20 and 32 m. PADI identifies the site as requiring at least Advanced Open Water Diver level and as relevant for Wreck Diver training. Scubanana's wreck-diving training offer explicitly covers navigation and orientation around wrecks, structural assessment, safety procedures, reel and guideline techniques and controlled penetration.	PADI: El Peñón dive site Scubanana: wreck diving course Scubanana: PADI dive center profile CBUT: safety and training approach Excel Scuba: Wreck and Deep specialties	<i>El Peñón</i> functions as a submerged classroom. Its depth, morphology and route legibility allow segmentation into advanced, deep and wreck-related training products, generating higher added value than an isolated recreational dive.
P4	Entrepreneurial ecosystem	Number and type of operators; certifications; visible team or club information; services offered; digital presence; relation to Radazul-Tabaiba; evidence of training, guiding and community-based diving activity.	The entrepreneurial and community ecosystem is evidenced by different diving centres. These actors show that the wreck is embedded not only in commercial diving, but also in educational, community and university-linked diving practices.	Scubanana: Tabaiba wreck discussion El Pejín Diving Club Apnea canarias Diving Canarias Macaronesian Divers Quimera Sub (only the located in Radazul and Tabaiba coastal zone are shown)	The wreck is embedded in a functional diving ecosystem centred on Scubanana and CBUT in Radazul. The evidence supports a structural reading of local blue entrepreneurship and community-based underwater activity, without claiming that the 2006 scuttling directly caused the creation of each actor.
P5	Governance and sustainability	Interaction between divers, boats, bathers and other coastal users; need for safety protocols; certification checks; surface-	The Tabaiba-Radazul coast is a multi-use public coastal space where diving activity coexists with bathing, recreational boating,	PADI: El Peñón qualification requirement Scubanana: wreck-diving safety and course content	The entrepreneurial value of the wreck is sustainable only if accompanied by governance. The available

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Table 5 (continued)

Prop.	Analytical dimension	Observable indicators	Evidence identified in the case of <i>El Peñón</i>	Verifiable evidence links	Interpretation
		marker procedures; no-penetration rules; environmental briefings; coordination among operators, clubs and authorities; environmental monitoring.	marina activity, fishing, paddle use and residential/tourist visitation. Governance evidence is therefore addressed through operational and educational sources. These sources support governance as a necessary condition, while detailed buoyage, carrying capacity and institutional coordination require fieldwork and official verification.	CBUT: safety, laws and marine-environment commitment Puerto Deportivo Radazul SITCAN / GRAFCAN territorial viewer	public evidence supports the need for safety, training, environmental responsibility and coordination, but detailed claims about conflict, buoyage or enforcement should be supported by official or field-based sources.

7. Discussion

The analysis presented of *El Peñón* supports the central argument of this article: artificial wrecks can foster blue entrepreneurship in island territories when they operate as small-scale blue infrastructures embedded within a coastal system. Their value does not reside solely in the submerged vessel, but in the interaction between underwater singularity, shore-based accessibility, training pathways, entrepreneurial ecosystem and governance.

The first issue for discussion is spatial centrality. *El Peñón* creates a form of underwater centrality. In urban planning, centrality emerges when a place concentrates flows, functions, meanings and services. The wreck performs an analogous role beneath the surface. It concentrates dives, courses, digital attention, operator products and territorial identity. It becomes a node within Tenerife's underwater geography. The second issue is land–sea continuity. Traditional urban planning often stops at the coastline, while marine spatial planning frequently begins offshore. Dive sites demonstrate that this separation is inadequate. The diving experience is amphibious: it begins in the urban realm, continues through roads and parking areas, crosses the coastal edge, enters the water column, reaches the seabed and returns to land. For this reason, wreck-based entrepreneurship must be analysed through the continuity of the urban-coastal interface. The third issue is the productive role of technical knowledge. Wreck-based entrepreneurship depends on expertise. It requires instructors, guides, safety protocols, certification systems, gap planning, environmental

sensitivity and local knowledge of site conditions. This distinguishes it from more passive forms of coastal tourism. A beach can be consumed with minimal mediation; a wreck requires professional mediation. That mediation creates qualified employment and training opportunities. The fourth issue concerns the relationship between artificial reefs and conservation narratives. The fact that a wreck is colonised by marine life does not automatically mean that it constitutes a conservation strategy. Castro et al. (2025) rightly question simplified narratives that present any artificial wreck as an ecological benefit. In the case of *El Peñón*, this article therefore avoids claiming that the wreck is intrinsically beneficial for the ecosystem. What is argued is that its entrepreneurial legitimacy depends on environmental monitoring and stewardship of the resource. Kirkbride-Smith et al. (2016) analyse artificial reefs in marine protected areas and show that they can provide habitat for biodiversity observation and generate user-derived revenues, but only within a management framework. The fifth issue is the risk of spatial inequality. If the benefits generated by the wreck are captured by a limited number of operators while risks, conflicts and environmental pressures fall upon the public realm, the model becomes weak. Responsible blue entrepreneurship requires local return. This may take the form of environmental education, cooperation among operators, information panels, school activities, citizen science, municipal coordination, contributions to safety, good-practice campaigns and maintenance of access points. The sixth issue is replicability. The case of *El Peñón* cannot be mechanically translated into the idea of scuttling more vessels along any coastline. It works because

several conditions coincide: a tourism-oriented island, a diving culture, an accessible coastline, nearby operators, marina facilities, metropolitan proximity, recognised underwater value and the capacity for territorial integration. Other territories considering artificial wrecks should first assess whether these conditions exist. Scuttling a vessel without accessibility, operators, governance or monitoring may create a problem rather than an asset.

These data reposition the case of *El Peñón* within a wider tourism-demand framework. The wreck is not analysed in an abstract recreational context, but within an island destination where scuba diving is a measurable activity involving 168,933 tourists and an estimated turnover of €231 million. This does not mean that *El Peñón* explains this demand. Rather, it means that the wreck is inserted into a destination where scuba diving already has statistical presence, expenditure capacity and business relevance. Consequently, the contribution of the case lies in showing how a specific artificial wreck can help structure part of this wider segment through accessibility, training, operator networks and territorial integration.

8. Conclusions

This article asked how an artificial wreck can act as a catalyst for blue entrepreneurship in an island territory. The case of *El Peñón* shows that this process is not explained by the physical presence of the wreck alone, but by the interaction between underwater singularity, shore-based accessibility, training capacity, entrepreneurial ecosystem development, contextual tourism demand and governance requirements.

Artificial wrecks should be understood as small-scale blue infrastructures located at the intersection of marine ecology, tourism planning, maritime safety and local entrepreneurship. They create new underwater centralities, support specialised dive products, extend the portfolio of coastal destinations and provide dive centres with stable nodes of interest around which courses, guided dives, photographic itineraries and advanced training programmes can be organised. Their relevance is therefore not only environmental or recreational, but also spatial, economic and territorial. The main contribution of the article is both conceptual and methodological. Conceptually, it reframes artificial wrecks as small-scale blue infrastructures. Methodologically, it shows that the entrepreneurial role of a wreck can be analysed through simple but meaningful indicators: operators, years of activity, certifications, visible employment, public transport, harbour infrastructure, parking provision, commercial products and governance issues. These indicators do not replace detailed economic or ecological studies, but they provide a practical pathway for assessing whether a wreck functions as a territorial resource. When properly integrated, it can operate as a blue infrastructure connecting underwater tourism, advanced training, local services, harbour systems, coastal accessibility and maritime identity. The case

shows why artificial wrecks can foster blue entrepreneurship in island territories, but also why such entrepreneurship must be planned, regulated and monitored. Future research should extend this framework through comparative and longitudinal approaches. In particular, the methodology proposed in this article could be applied through a contrastive case-study method to other artificial wrecks in island and coastal contexts such as Malta, Madeira, the Azores, Cyprus, the Balearic Islands or other sites within the Canary Islands. This interpretation is consistent with research on artificial reefs and diving tourism (Ramos, 2024; Stolk, 2007), with economic assessments of artificial wreck reefs (Genç, 2022), and with marine spatial planning approaches that emphasise coordination, monitoring and ecosystem-based management (Douvere, 2008; Ehler & Douvere, 2009).

This article has analysed the application of the methodology on the wreck of *El Peñón*, in Tabaiba, Tenerife, as a case study for understanding how artificial wrecks can contribute to blue entrepreneurship in island territories. The paper has proposed the concept of wreck-based blue entrepreneurship to describe the process through which a deliberately scuttled vessel becomes a catalyst for tourism, training, business activity, territorial identity and environmental stewardship. The analysis provides reasoned support for the propositions formulated: the wreck generates experiential singularity: it is not a generic dive, but a recognised wreck with spatial, narrative and photographic value, with a shore-based accessibility and its integration into the Tabaiba–Radazul system increase its operational value. Besides, its depth and configuration enable advanced and specialised training products for dive centres, clubs, instructors and services. Finally, its sustainability depends on governance, maritime safety, environmental monitoring and coordination among users.

The revised analysis also incorporates contextual quantitative evidence that strengthens the interpretation of *El Peñón* as a potential catalyst for blue entrepreneurship. Official tourism data show that scuba diving is a measurable specialised segment in Tenerife, involving 168,933 tourists in 2025 and an estimated turnover of €231 million. In addition, the Register of Active Tourism Activities identifies 102 scuba-diving activity registrations in Tenerife, confirming the existence of a formal supply base. These data do not demonstrate direct causality between *El Peñón* and tourism demand, but they show that the wreck is embedded in an island tourism system where diving has demand, expenditure and entrepreneurial structure. This reinforces the article's main contribution: artificial wrecks may operate as small-scale blue infrastructures when they connect a distinctive underwater asset with a real market, formal operators, training pathways, coastal accessibility and governance capacity. The case of *El Peñón* also shows that blue entrepreneurship should not be confused with unlimited growth. The success of a dive site may generate pressure, conflict and risk. Entrepreneurship must therefore be linked to

stewardship. A wreck generates value only if the marine space remains safe, ecologically monitored and socially legitimate. In this sense, the future of *El Peñón* as a blue infrastructure depends not only on diving demand, but also on planning capacity.

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Acknowledgements

Authors would like to express his special gratitude to Scubanana Diving Center for its example in the development of one of the leading diving centres in the Canary Islands, emerging from a young entrepreneurial initiative strongly committed to the local area and to the professionalisation of recreational diving in Tenerife. Authors also wishes to thank Club de Buceo El Pejín, and particularly Manuel Beltrán, for the effort and commitment involved in promoting, at the time, the controlled scuttling of the *El Peñón* wreck as a resource for the diving community. Finally, the author is especially grateful to José Manuel Peinado Martín for providing the photographic material documenting *El Peñón* after its scuttling.

Visiting the Tabaiba Wreck: <https://www.youtube.com/watch?v=bRVhouUTKZ8>

Ethical Statement

Peer Review: Single-blind.

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Funding: Nothing to declare.

Conflict of Interest: Nothing to declare.