INDEPENDENT RESEARCH STUDY

Marine Protected Areas and Island Futures

Ecological effectiveness, fishing livelihoods, tourism and governance in the Paros-Antiparos marine system

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PAROS • ANTIPAROS • THE SURROUNDING MARINE SYSTEM

Contents

Why this study was undertaken

Paros and Antiparos depend upon the sea in ways that are ecological, economic and cultural. Their surrounding waters support fish populations, Posidonia oceanica meadows, rocky reefs, seabirds and other marine life. They also provide fishing grounds, navigation routes, anchorages, recreational space and a foundation for much of the islands' visitor economy. Protecting these waters is therefore not solely an environmental question. It concerns the continuing capacity of the islands to support livelihoods, local identity and a viable coastal economy.

The marine system is exposed to several interacting pressures: professional and recreational fishing, spearfishing, anchoring and boating, coastal development, wastewater and land-sea pollution, warming, marine heatwaves and invasive species. The available local evidence does not yet allow these pressures to be ranked reliably on common spatial and temporal measures, and this study does not assume that any single pressure has been proved dominant. The practical public question is whether the present combination of rules, monitoring and enforcement is sufficient to protect the ecological foundations on which marine life, fishing livelihoods and coastal tourism depend.

The problem in one sentence
How can Paros and Antiparos protect the long-term ecological and productive capacity of their surrounding waters while retaining fair and workable access for the people who depend upon them?

What is a marine protected area?

A marine protected area, or MPA, is a geographically defined part of the sea managed under rules intended to conserve habitats, species or ecological processes. It is not necessarily an area closed to all human activity. Some MPAs regulate only particular activities, such as anchoring, fishing gear, extraction or seasonal access. Others contain stricter no-take zones within a wider multiple-use area. This functional understanding is consistent with the IUCN marine protected-area guidance and the MPA Guide framework (Day et al., 2019; Grorud-Colvert et al., 2021).

A boundary is only the beginning. The ecological effect depends on what the rules actually restrict, whether those rules address the relevant pressure, whether they are implemented and enforced, whether users comply, and whether ecological change is measured against a defensible comparison. An MPA can therefore be a powerful management instrument, a limited objective-specific designation or a poorly implemented 'paper park'. The label alone cannot reveal which one it is.

Essential distinction

Designation is a legal act. Effective protection is a continuing management outcome. The study treats area coverage, restriction intensity, implementation, compliance and ecological response as separate questions.

What experience elsewhere tells us

International evidence provides a qualified but important answer. Strongly protected, adequately enforced and long-established MPAs commonly show higher biomass, abundance or average size of exploited fishes within their boundaries. In some settings, movement or spillover can also benefit fishing outside protected zones. Yet outcomes vary with habitat, species, scale, age, isolation, rule design, staffing, finance and compliance (Edgar et al., 2014; Gill et al., 2017; Giakoumi et al., 2017; Hopf et al., 2024).

The social and economic record is more conditional. Ecological recovery does not automatically become higher catch, profit, employment or local income. Restrictions can impose immediate and concentrated costs, particularly on small or less-mobile fishers, while benefits may take years to appear or accrue to other users. Tourism can provide work and conservation finance, but it can also intensify anchoring, boating, disturbance and public-service pressure. Successful cases therefore join ecological design to legitimate rules, recurrent finance, credible enforcement, representative participation and explicit attention to who bears costs and who receives benefits.

Why consider marine protection around Paros-Antiparos?

Paros-Antiparos already has legally meaningful protection, notably the marine Special Protection Area GR4220025, but this designation covers only part of the wider marine-use system and is not a general prohibition on fishing, anchoring, navigation or diving. The islands also lack a current system-wide ecological baseline and a common-denominator account of fishing, boating, anchoring, enforcement and land-sea pressures. These conditions do not prove that a large new MPA is required. They do establish a reasonable case for asking whether better-targeted or stronger marine protection could improve upon the present fragmented arrangement.

The reason to consider an MPA is therefore not that a fashionable conservation label should be added to a map. It is that a spatially explicit management system might help protect vulnerable receptors, organise compatible uses, make enforcement more coherent and preserve the ecological foundations of

fishing and tourism. Whether that potential justifies targeted controls, a small no-take pilot, a multiple-use system or a broader network depends on evidence that is partly available and partly still missing.

Core research question

The question tested by this study
Under what ecological, legal, institutional and social conditions could marine protection produce measurable and durable benefits in the Paros-Antiparos marine system, and what form of protection - if any - is justified by the evidence presently available?

To answer it, the study examines what MPAs are and how their effects should be measured; compares successful, mixed and weak cases worldwide, in the Mediterranean and in Greece; reviews the Greek and European legal framework; separates ecological recovery from fisheries income, employment and tourism claims; considers the bounded transboundary Aegean question; diagnoses the local evidence; and compares five policy pathways under explicit decision gates.

What kind of study is this?

This publication is a structured evidence synthesis and pre-design decision framework. It does not present a new ecological field survey and cannot determine from current evidence whether the Paros-Antiparos marine system is declining, stable or improving. Its contribution is to establish what can presently be concluded, what remains unknown and which evidential and institutional conditions should precede permanent spatial zoning.

Integrated determination in plain language

The answer
Paros-Antiparos should choose neither immediate large-scale designation nor inaction. The most defensible present course is an Adaptive Targeted Protection Pathway: strengthen the common monitoring and enforcement foundation; introduce targeted and reversible measures where pressures and affected habitats are demonstrated; prepare a small no-take pilot behind explicit ecological, social, legal and financial safeguards; and retain broader protection as a future option if later evidence shows that narrower measures are insufficient.

Spatial overview and comparative atlas

The figures use a deliberately conservative cartographic hierarchy. A solid blue footprint denotes an existing catalogued designation; gold identifies a separately catalogued stricter or nested zone; amber or a dashed/proposed treatment denotes a planning-stage boundary; and a star denotes location only. The maps are explanatory and generalised. They do not replace operative Gazette coordinates, navigation notices or site-specific legal instruments.

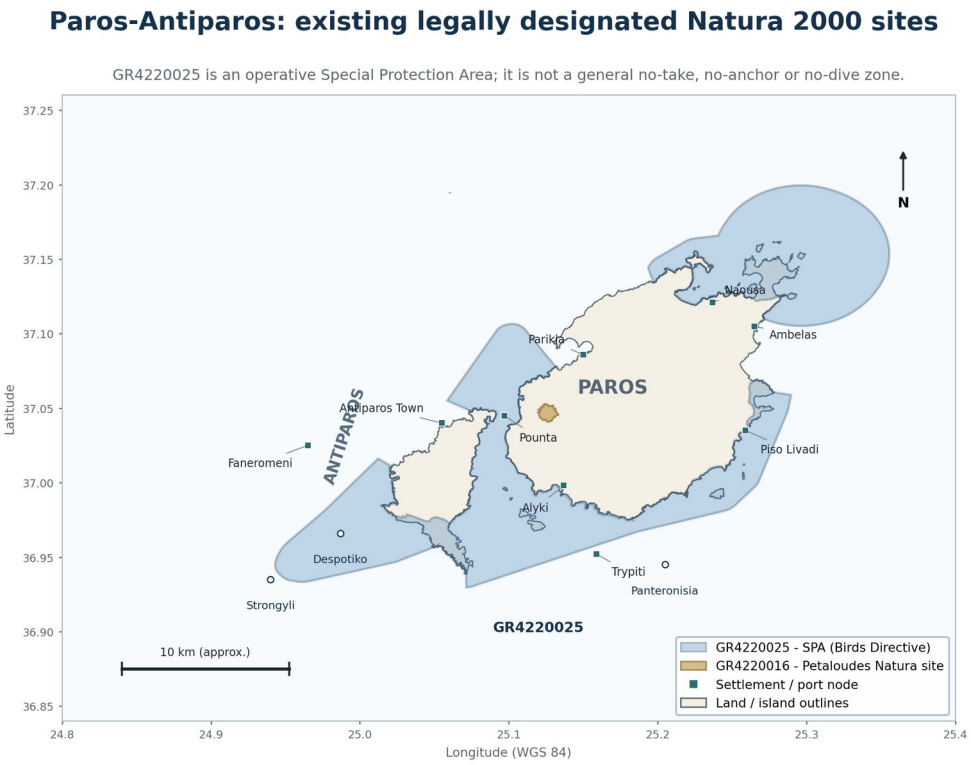
Map treatment	Meaning	Permitted inference
Solid blue	Existing catalogued designation	A legal or administrative footprint exists; the map alone does not identify every prohibited use.
Gold	Separately catalogued stricter or nested zone	A differentiated spatial architecture exists; current restrictions still require source-law verification.
Proposed / amber	Consultation, study or draft material	Planning evidence only; no operative restriction is inferred.
Star	Location without a reproduced boundary	Geographic comparison only; no boundary claim.

Cartographic caution

Protected-area footprints are not interchangeable treatments. Similar shapes may contain very different rules, enforcement capacity, ecological objectives and access arrangements.

Paros-Antiparos: the spatial baseline

The two maps resolve the study's most important spatial distinction. Paros-Antiparos already contains a legally operative marine Natura designation, but it does not cover the whole study system and it is not a general no-take reserve. The published Southern Cyclades consultation footprint is a separate prospective instrument and, in the July 2025 map, does not include Paros or Antiparos.



Boundary source: EEA/European Commission, Natura 2000 vector dataset (end-2024 version, published 1 Dec. 2025). Base outlines: OpenStreetMap contributors (ODbL). Cartography: study authoring team, 2 Aug. 2026.

Figure 1. Existing Natura 2000 designations around Paros-Antiparos. GR4220025 is operative and legally meaningful, but its designation does not by itself prohibit all fishing, anchoring, navigation or diving.

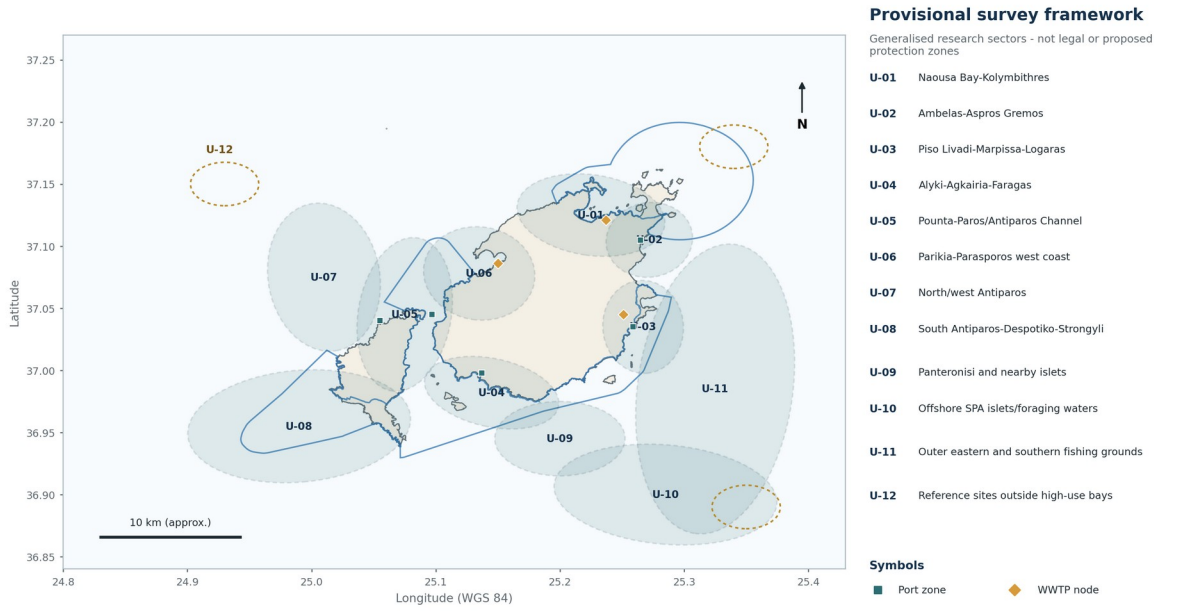


Figure 1B. Local geography and the twelve Phase 7 survey strata. The ellipses are generalised sampling sectors, not legal boundaries or proposed protection zones. U-12 shows the concept of matched lower-use reference sites; final controls require reconnaissance and habitat matching.

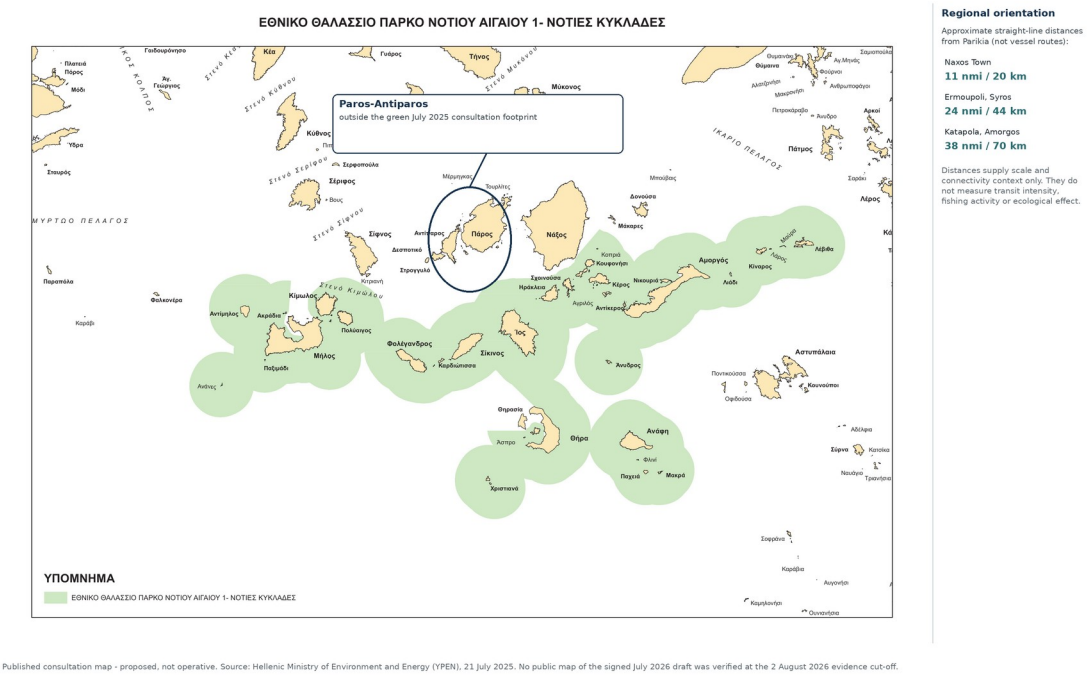
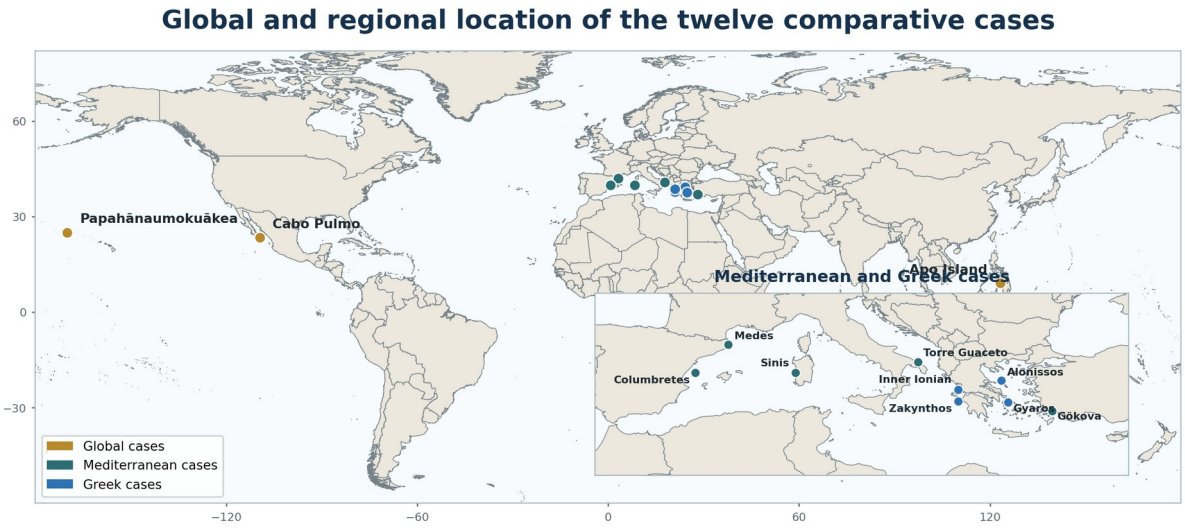


Figure 2. YPEN's July 2025 Southern Cyclades consultation footprint. Paros-Antiparos lies outside the green area. The accompanying straight-line distance cues provide regional scale only; they are not vessel routes or pressure measures. No public map of the signed July 2026 draft was verified at the evidence cut-off.



Locations are explanatory centroids, not protected-area boundaries. Case boundaries and zoning architectures are shown in the following atlas plates.

Figure 3. Locations of the twelve comparative cases. Points identify study locations, not legal boundaries.

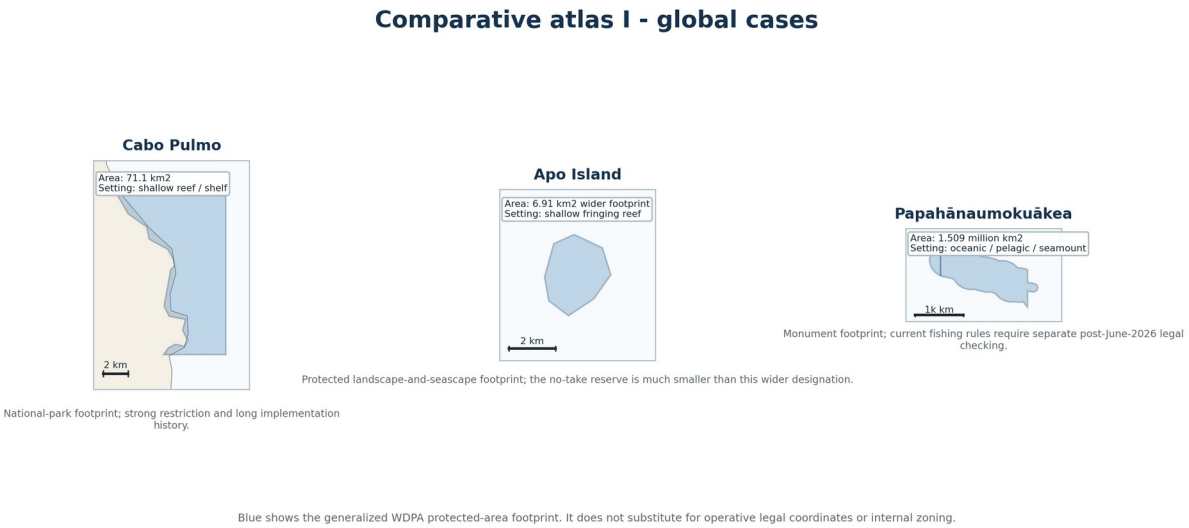


Figure 4. Global comparative footprints: Cabo Pulmo, Apo Island and Papahānaumokuākea. The geometries are generalised WDPA footprints and do not reproduce all internal zones.

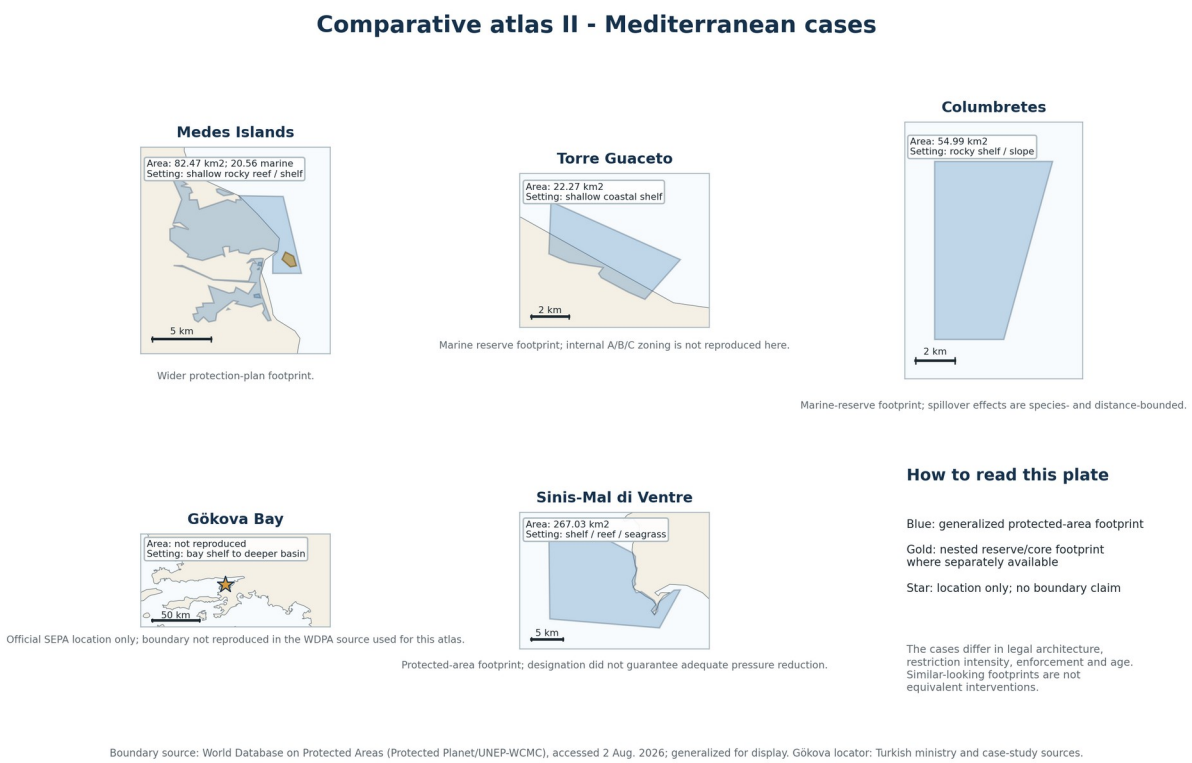


Figure 5. Mediterranean comparative footprints: Medes, Torre Guaceto, Columbretes, Gökova and Sinis-Mal di Ventre. Gökova is a location-only panel because the official boundary was not reproduced in the WDPA source used for the atlas.

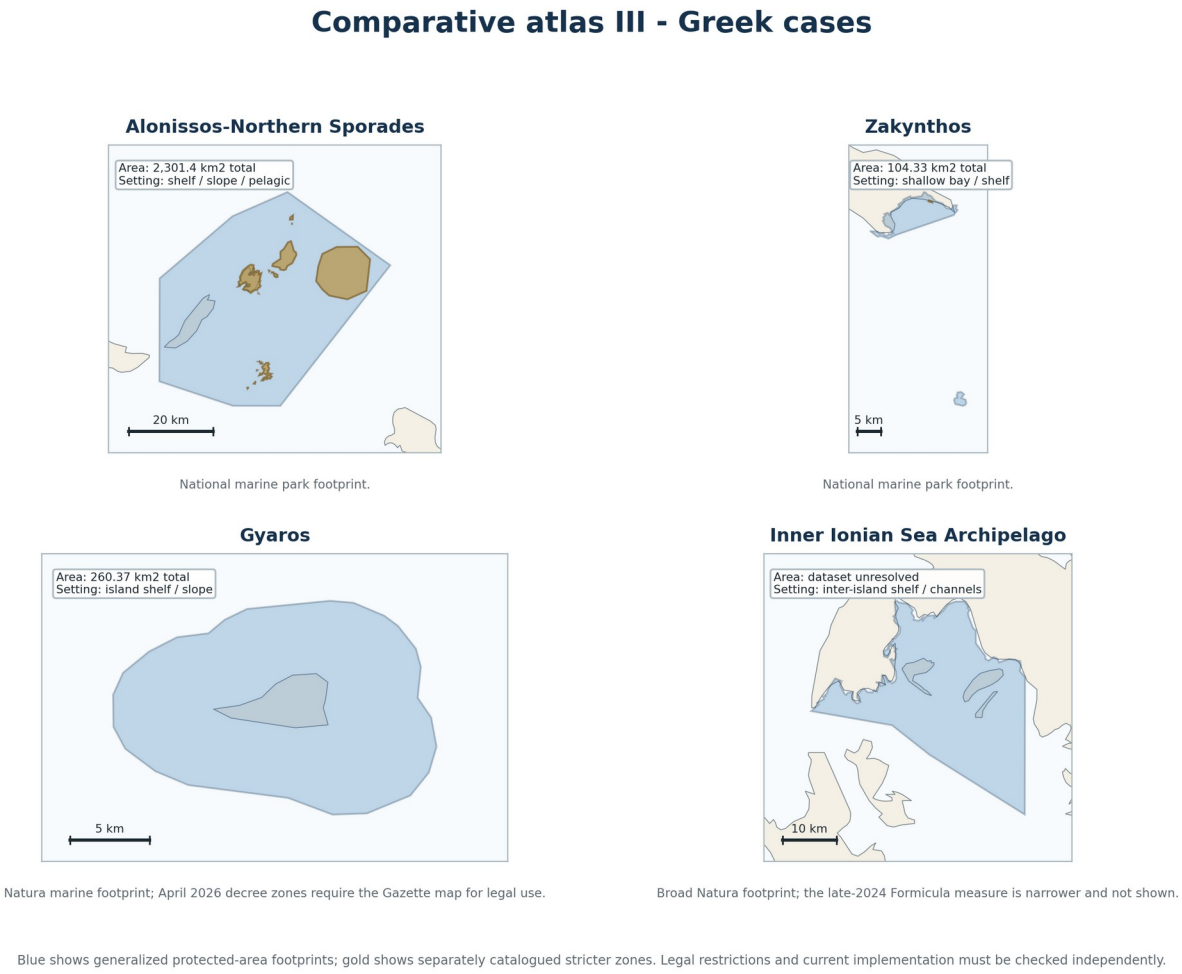


Figure 6. Greek comparative footprints: Alonissos-Northern Sporades, Zakynthos, Gyaros and the Inner Ionian Sea Archipelago. Separately catalogued stricter zones are shown in gold where available.

Spatial conditions of transferability

Comparative transfer depends on more than whether a protected area has produced a favourable outcome. Scale, depth, shoreline geometry, ecological receptors, access, port proximity and the distribution of human uses determine whether the same rule can be implemented and whether its mechanism is relevant to Paros-Antiparos. The matrix therefore distinguishes a transferable governance lesson from a transferable spatial design.

Interpretive rule
Area values describe the footprint reproduced in the atlas source, not a standardised measure of effective or no-take protection. A nested reserve, fisheries closure, Natura designation and multi-use park remain legally different treatments even when their mapped areas can be measured.

Matrix A: footprint, geometry and ecological setting

Case	Atlas footprint	Strict / nested component	Configuration	Depth and receptors
Cabo Pulmo National Park	71.1 km2 WDPA footprint	No separate harmonised core value in atlas source	Coastal fringe	Shallow reef and coastal shelf; Rocky/coral reef and exploited reef fishes
Apo Island marine reserve	6.91 km2 wider 2018 landscape/seascape footprint	Historic no-take reserve is much smaller; definition not harmonised in atlas source	Small island coastal reserve beside fished waters	Shallow fringing reef; Coral reef and reef fishes
Papahanaumokuakea	1,508,846.8 km2 WDPA footprint	Regime-specific; commercial access changed in June 2026	Remote oceanic archipelago	Oceanic, pelagic and seamount system; Seabirds, pelagic species, reefs and cultural seascape
Medes Islands Marine Reserve	82.47 km2 plan footprint; 20.56 km2 marine in WDPA	1.24 km2 nested reserve record; 1.01 km2 marine	Nearshore islets with nested protection	Shallow rocky reef and shelf; Rocky reef fishes, coralligenous habitats and benthos
Torre Guaceto MPA	22.27 km2 WDPA marine footprint	Strict Zone A exists; area not harmonised in atlas source	Mainland coastal fringe with internal zones	Shallow coastal shelf; Seagrass, rocky/sandy habitats and coastal fishes

Case	Atlas footprint	Strict / nested component	Configuration	Depth and receptors
Columbretes Islands Marine Reserve	54.99 km2 WDPA marine footprint	Reserve-wide fisheries restrictions; no separate harmonised core value	Isolated offshore volcanic islets	Rocky shelf and slope; Rocky reef fishes and spiny lobster
Gokova Bay SEPA	Official SEPA boundary not reproduced in atlas dataset	Six no-fishing zones; combined area not harmonised here	Large semi-enclosed bay with nested fisheries closures	Shallow shelf grading to deeper bay waters; Seagrass, rocky habitats, coastal fishes and invasives
Sinis-Mal di Ventre MPA	267.03 km2 WDPA marine footprint	Zone A exists; area not harmonised in atlas source	Coastal shelf and offshore-island system	Shelf, rocky reef, seagrass and sandy habitats; Reef fishes, Posidonia and sea urchins
Alonissos-Northern Sporades National Marine Park	2,301.40 km2 total; 2,172.52 km2 marine in WDPA	221.44 km2 nested nature-reserve records; not synonymous with one no-take core	Large inhabited and uninhabited archipelago	Shelf, slope and pelagic waters; Monk seal, seabirds, reefs and fish communities
National Marine Park of Zakynthos	104.33 km2 total; 88.26 km2 marine in WDPA	No harmonised marine no-take area in atlas source	Tourism-intensive bay and nesting coast	Shallow bay and coastal shelf; Loggerhead turtles, nesting beaches and nearshore habitats
Gyaros protected area	260.37 km2 total; 242.66 km2 marine in WDPA	April 2026 decree has three zones; areas require Gazette-map reconciliation	Uninhabited offshore islet and surrounding waters	Island shelf and slope; Monk seal, seabirds, reefs and benthic habitats
Inner Ionian Sea Archipelago Natura 2000 site	Not reportable from the extracted WDPA record used for the atlas	Narrow 200 m Formicula access restriction is separate from broad Natura site	Inhabited inter-island channels and islets	Shelf and channel system; Common dolphins, prey fishes, monk seal and seagrass

Matrix B: access and transfer to Paros-Antiparos

Case	Access and pressure context	Transferable feature	Principal limitation
Cabo Pulmo National Park	Adjacent village; road and small-vessel access; intensive diving tourism	Coastal tourism, local legitimacy and enforcement	Tropical reef ecology and a much smaller settlement/use system
Apo Island marine reserve	Resident island community; small boats and visitor access	Small-island co-management and spatially bounded spillover	Far smaller geography, tropical reef system and different national institutions

Case	Access and pressure context	Transferable feature	Principal limitation
Papahanaumokuakea	Extremely remote; no comparable resident port or mass-tourism system	Legal durability and political reversibility	Scale, remoteness and oceanic ecology are not local design analogues
Medes Islands Marine Reserve	Immediately accessible from a major dive-tourism coast	Tourism capacity, recovery lags and nested zoning	Much more spatially concentrated than the Paros-Antiparos system
Torre Guaceto MPA	Adjacent ports, towns, tourism and authorised artisanal fleet	Core-plus-local-access design and multi-use compliance	Mainland coastline and more concentrated governance geography
Columbretes Islands Marine Reserve	Offshore vessel access; fishing and regulated tourism	Bounded spillover and surveillance dependence	Uninhabited offshore geometry with fewer resident-use conflicts
Gokova Bay SEPA	Fishing cooperatives, settlements, marinas and tourism	Eastern Mediterranean ecology, small-scale fisheries and co-management	Bay geometry and Turkish institutional framework differ
Sinis-Mal di Ventre MPA	Adjacent coastal settlements, tourism and fisheries	Multiple-use zoning and risk of nominal protection	Different fleet, coastline and compliance history
Alonissos-Northern Sporades National Marine Park	Island settlements, fisheries, ferries and wildlife tourism	Greek authority chain and archipelagic multiple use	Larger, less urbanised system with different focal objectives
National Marine Park of Zakynthos	Urban/tourism nodes, ports, excursion and recreational vessels	Activity-specific tourism controls and compliance burden	Target-species and nesting-beach objectives dominate
Gyaros protected area	No resident settlement; fishing and authorised vessel access dominate	Greek legal executability and allocation design	No resident population, mass tourism or comparable port network
Inner Ionian Sea Archipelago Natura 2000 site	Ferries, tourism, aquaculture and local fisheries	Cumulative pressure and paper-park risk in an inhabited archipelago	Different hydrodynamics, fleet pattern and protected features

The matrix makes three distinctions especially important for Paros-Antiparos. Gyaros and Columbretes are useful evidence about isolated-site protection and surveillance but weak direct analogues for a resident, tourism-intensive inter-island system. Medes, Torre Guaceto, Zakynthos and Gokova offer stronger lessons about intensive access, local fleets, visitor pressure and compliance, although their ecological and institutional settings still differ. Alonissos and the Inner Ionian illustrate the Greek problem of joining broad spatial designation to activity-specific rules, monitoring and enforcement.

Executive synthesis

Integrated determination
Marine protection is a credible instrument for Paros-Antiparos, but current evidence does not justify an immediate final protected-area geometry or an automatic promise of higher catches, employment or tourism income. The defensible present course is an Adaptive Targeted Protection Pathway: strengthen the common evidence and enforcement foundation; introduce targeted, reversible controls where receptor-pressure chains are demonstrated; prepare a small no-take pilot behind explicit entry gates; and retain multiple-use or broader protection as conditional future options.

This conclusion rejects two symmetrical errors. The first treats an MPA label or a percentage of sea area as an ecological outcome. The second treats uneven or failed implementation as evidence that marine protection is inherently ineffective. Global and Mediterranean studies instead reveal a conditional causal chain: law must create restrictions that address the relevant pressure; institutions must implement them; users must comply; pressure must fall; ecological response must be measured against a defensible counterfactual; and any social benefit must be tested separately for distribution, timing and retention.

The Paros-Antiparos system is legally protected in part and ecologically important, but locally measured evidence is sparse and asymmetric. No contemporary, peer-reviewed, depth-stratified ecological baseline for the marine system was identified by the evidence cut-off. A July 2011 survey at 14 sites is a valuable historic snapshot of shallow-water alien megabiota, not a baseline of current ecosystem condition, fish biomass, demersal stocks or benthic integrity. Current professional and recreational fishing effort, spearfishing removals, anchor-event exposure, habitat condition, receiving-water response, enforcement rates, recurrent management cost and distributional dependence have not been measured on common spatial and temporal denominators. A final boundary drawn before those relationships are resolved would be a political geometry rather than a demonstrated ecological design.

No.	Integrated finding	Decision meaning
1	Protection is conditional	Strong, implemented and enforced protection commonly improves exploited-fish biomass, density or size inside boundaries; designation alone does not.
2	Area is not effectiveness	Coverage statistics must be separated from restriction intensity, implementation, compliance and ecological outcomes.

No.	Integrated finding	Decision meaning
3	Livelihood effects are distributive	Spillover can occur, but catch, profit, employment and welfare depend on displacement, access, costs, prices, ownership and time.
4	Tourism is a dual pathway	It can support livelihoods and finance while also increasing anchoring, boating, disturbance, crowding and infrastructure pressure.
5	Greek law can act	The legal instruments exist, but protection requires interoperable environmental, fisheries, navigation, licensing and enforcement chains.
6	Existing Paros protection is partial	GR4220025 is operative but covers only part of the system and is not an automatic no-take, no-anchor or no-dive rule.
7	The local diagnosis remains open	Current evidence cannot rank professional fishing, recreational fishing, spearfishing, anchoring, tourism, land-sea loads, warming and invasives on common denominators.
8	The Turkish issue is regional, not locally attributed	Transboundary governance matters, but current evidence does not establish Turkish fishing as a measurable cause of decline around Paros-Antiparos.
9	Targeted measures are the best provisional package	They are pressure-specific, reversible and less exposed to unresolved distributional and fiscal risks.
10	Stronger spatial protection remains a live option	A small no-take pilot, multiple-use system or broader network should advance only when ecological, social, legal, enforcement and finance gates pass.

What may begin now

- Reconcile existing legal boundaries and rules in one versioned public GIS, while preserving the distinction between Natura designation and activity-specific restrictions.
- Establish a multi-year ecological and use baseline across the twelve Phase 7 survey strata, with matched lower-use reference sites and repeatable methods.
- Create denominator-based enforcement reporting: patrol hours, inspections, detected events, verified infringements, sanctions, appeals and final dispositions.
- Develop targeted anchoring, visitor-use, fisheries, wastewater or coastal-project measures only after the relevant receptor, exposure, legal, safety, maintenance and enforcement chain is complete.
- Prepare - but do not yet enact - one or more small no-take-core pilots with matched controls, confidential fishing-ground dependence analysis, transition safeguards and pre-specified expansion or exit rules.

- Publish annual ecological, socioeconomic, enforcement and finance results, including dissent and any deviation from the prospective protocol.

What the study does not claim

- It does not claim that a large MPA is unnecessary; it concludes that its present geometry and incremental value are not yet demonstrated.
- It does not claim that targeted measures will be sufficient under every diagnosis; they may fail if later evidence shows system-scale fishing mortality, connectivity or cumulative pressure.
- It does not infer local fishery welfare from biomass recovery or spillover alone.
- It does not infer illegality or ecological impact from Turkish vessel presence, public AIS traces or national fleet totals.
- It does not treat warming, marine heatwaves or invasive species as pressures that a local boundary can remove.

Research design and claim discipline

The study was governed prospectively by Marine Protected Areas and Island Futures: Research Prospectus and Evidence Protocol v0.1, dated 1 August 2026. It used a hybrid design combining structured literature synthesis, uniform comparative-case coding, legal-institutional analysis, socioeconomic causal-pathway analysis, a bounded transboundary assessment, a local diagnostic and explicit scenario comparison. The ontology is critical realist: an MPA is not a single treatment but a configuration of legal rules, spatial design, enforcement, finance, ecological receptors and social relationships.

Evidence class and evidential strength were judged separately. Official law is authoritative for legal status but cannot prove ecological effectiveness. A peer-reviewed inside-outside comparison can identify an association while remaining vulnerable to site selection or habitat confounding. Local testimony can identify a place, period and hypothesis but cannot become a calibrated trend without repeatable methods and competing explanations. Unknown pressure was never coded as zero pressure.

Claim level	Minimum evidence	Permitted wording
Legal status	Primary law, Gazette, official register or authoritative administrative source	Operative, prospective, superseded or unverified, with date
Activity	Coordinates, time, vessel/use class and behaviour	Presence or observed activity, not inferred illegality
Pressure	Effort or exposure linked to a receptor	Plausible or measured pressure
Ecological response	Condition metric, comparator and timing	Associated response; causal only where design supports it
Economic effect	Catch, cost, price, income or employment counterfactual	Segment- and period-specific effect
Distribution	Identity of cost bearers and beneficiaries, ownership and timing	Net local welfare only after gains and losses are reconciled

Protocol limitation

Formal exhaustive-search closure remains open because direct Scopus and Web of Science exports and import-level deduplication were unavailable. No exhaustive-review claim is made.

Methodological roadmap: research phases and implementation stages

References to Phase 0 through Phase 9 describe the completed internal analytical workflow used to build this publication. They are not dates, legal stages or commitments to future public action.

Internal research phase	Function in this study
Phase 0	Prospective research question, evidence protocol, neutrality rules and claim boundaries.
Phase 1	Global ecological, governance, livelihood and wellbeing evidence.
Phase 2	Purposive comparative cases: mechanisms, failures, durability and transfer limits.
Phase 3	Mediterranean and Greek effectiveness assessment.
Phase 4	Greek and European legal, institutional and enforcement analysis.
Phase 5	Fisheries, employment, tourism, finance and distributional pathways.
Phase 6	Bounded Turkish and transboundary Aegean assessment; no presumed local attribution.
Phase 7	Paros-Antiparos diagnostic, provisional survey strata, data gaps and baseline design.
Phase 8	Qualitative scenario comparison, decision gates and adaptive pathway.
Phase 9	Integrated synthesis, public publication and conditional determination.

External implementation stages

The proposed real-world programme is separate. It is expressed later as conditional periods from 0-6 months through Years 3-5. Those stages would begin only after competent authorities authorise them, and each remains subject to the study's ecological, legal, financial, enforcement and distributional decision gates.

Comparative evidential roles

Cases were assigned limited roles: ecological effect; governance and compliance; livelihood transition; legal durability or failure; or spatially transferable Mediterranean analogue. Tropical and uninhabited cases do not forecast local effect sizes or determine Paros geometry. Mediterranean multi-use and inhabited archipelagic systems carry the greatest transfer weight; non-equivalent global cases test mechanisms and failure modes only.

Global evidence: what MPAs can and cannot do

The classification problem

The term ‘MPA’ describes a legal or policy class containing radically different interventions. Some areas prohibit extraction; others permit commercial fishing, recreational fishing, aquaculture, anchoring or seabed use. A single label therefore cannot carry an ecological effect estimate.

Operational consequence for the project

Every comparative case must be coded at four levels: the legal label; permitted and prohibited activities; implementation stage and operational capacity; and measured outcomes against a stated comparator. Greek Natura 2000 status, fisheries closures and prospective Paros zoning therefore cannot be placed in one undifferentiated ‘protected’ category.

Ecological outcomes inside MPAs

Across the strongest global syntheses, the direction of evidence for exploited fish is consistent: biomass, abundance or density, body size and sometimes species richness are commonly higher inside no-take reserves than in comparable open areas. The magnitude varies by taxon, habitat, reserve history and comparator. This is an average pattern, not a promise for every site or outcome.

Protection gradient

Lester and Halpern (2008), Lester et al. (2009), Stewart et al. (2008), Sciberras et al. (2015) and Hopf et al. (2024) identify a positive average response to strong protection, while also documenting substantial heterogeneity and recurring habitat or placement confounding. The MPA Guide meta-analysis strengthens the implementation interpretation: actively managed, fully or highly protected MPAs had the clearest fish-density and biomass advantages, whereas designated or merely implemented areas did not reliably produce the same result (Horta e Costa et al., 2025).

What the ecological evidence actually measures

Taxonomic and habitat bias

Fish dominate because they are policy-relevant and comparatively measurable. Woodcock et al. (2017) found review evidence strongest for fish abundance and size or age, with weaker coverage of broader taxa. Rodríguez-Rodríguez and Martínez-Vega (2022) located only 23 BACI studies covering 66 MPAs in 18 countries, showing how sharply the evidence contracts under stronger temporal counterfactuals. The 2026 reef synthesis reports strong carnivore-fish responses but context-dependent coral and functional

effects. Posidonia, rocky reefs, soft sediments, nursery habitat and invertebrates around Paros therefore require direct evidence.

Design features: real mechanisms, no universal recipe

Edgar et al. (2014) associated strong outcomes with five accumulated features-no take, enforcement, age greater than ten years, size greater than 100 km² and isolation. This 'NEOLI' result remains an important diagnostic, but it is not a universal siting formula. The features covary, the study was cross-sectional and concentrated on shallow reef systems. Large or isolated reserves may be ecologically powerful while institutionally or geographically unrealistic in crowded Mediterranean seascapes.

Age and time lag

Age is a plausible mechanism because mortality reductions need time to change body size, reproductive capacity and food-web structure. Yet age can also proxy political durability, accumulated monitoring or the survival of unusually successful sites. The correct inference is not 'old MPAs work'; it is that durable protection creates time for response, provided rules and compliance are real.

Size, shape and isolation

Absolute size interacts with species movement, habitat coverage, edge-to-area ratio and network connectivity. A small reserve may produce high local density while exporting benefits rapidly across its boundary; a larger area may retain mobile species and represent more habitats. Giakoumi et al. (2017) found Mediterranean relationships that do not reproduce a simple global 'larger is always better' rule. Paros scenarios must therefore test size together with shape, habitat representation, mobility, enforcement cost and displacement-not as a standalone threshold.

Partial protection

The apparent contradiction in the literature is informative. Sciberras et al. (2015) and Zupan et al. (2018) found that some partially protected areas outperform open access, especially where fewer damaging activities are allowed and enforcement is credible. Turnbull et al. (2021) found no measurable difference between partial and open sites in southern Australia, while fully protected sites performed much better. A matched global comparison reported substantially larger fish-biomass differences for no-take than multiple-use MPAs, but also found that multiple-use outcomes improved with adequate staffing and well-fitted rules (Gill et al., 2024). The 2026 Mediterranean review likewise reports stronger effects under full protection and high enforcement than under partial or minimal enforcement (Castro-Cadenas et al., 2026). These findings are compatible once 'partial' is treated as a family of rules rather than one intervention.

Causality and the counterfactual problem

The literature's central weakness is not a lack of positive observations; it is the scarcity of designs that can determine how much change was caused by protection. Many studies compare sites inside and outside an MPA after designation. Such comparisons can be valid descriptions, but reserve placement is rarely random. Habitat quality, accessibility, historical fishing pressure and enforcement may differ before protection begins.

Review redundancy

Woodcock et al. (2017) showed that multiple reviews can reuse overlapping primary studies while applying different quality standards. Counting review conclusions as independent votes would therefore exaggerate certainty. The v0.2 register reconciles nine review families, identifies the preferred synthesis for each proposition and treats corroborating reviews as overlapping rather than independent votes. Primary studies are revisited when a result is pivotal, unusually transferable or contradictory.

Phase 1 attribution rule

Spillover, catches and fishing livelihoods

Protection can increase the density and size of mobile adults, creating a plausible mechanism for movement across reserve boundaries. Di Lorenzo et al. (2020) found adult spillover to be detectable but generally local and distance-dependent. Species mobility, habitat continuity, reserve geometry and fishing effort outside the boundary all influence the observed gradient.

Why spillover is not a livelihood conclusion

A declining abundance gradient across a boundary may indicate movement, but it does not identify net fishery gain. Fishers may concentrate effort at reserve edges, shift to other grounds, travel farther or change gear. Benefits can be captured by vessels that did not bear the initial access cost. Catch can rise while catch per unit effort or profit does not, and aggregate gains can coexist with losses among small local operators.

Illustrative-not general-fishery evidence

Lenihan et al. (2021) reported a large post-designation rise in California spiny-lobster catch despite reduced fishing area. The case is important because it joins ecological, spatial and fishery information within an integrated, enforced network. It remains low-confidence for general causal transfer: there was no pre-designation ecological baseline, catch per unit effort did not rise and the result is species- and institution-specific. It should inform case selection, not forecast Paros catches.

Governance, capacity and legitimacy

The most consistent non-biological predictor is not a boundary characteristic but the capacity to turn rules into practice. Gill et al. (2017) documented widespread staffing and budget shortfalls across 433 MPAs; adequate staffing was associated with an estimated 2.9-fold larger ecological effect in the ecological subset. A later matched global analysis of more than 14,000 reef surveys across 216 MPAs found that no-take areas had much larger fish-biomass differences than multiple-use areas, while multiple-use performance remained conditional on context, staffing and rule design (Gill et al., 2024). These studies remain observational or quasi-experimental rather than randomised, but their convergent mechanism is consistent with the MPA Guide's distinction between designation and active management.

Enforcement must be decomposed

Shared governance

Mast et al. (2025) found a high probability that shared-governance MPAs had greater fish biomass than state-governed areas in a global reanalysis. This supports a plausible mechanism: participation may improve knowledge, legitimacy, rule fit and compliance. Confidence remains low because governance categories are broad, baseline differences are unresolved and shared arrangements can empower local elites as well as marginalised users. Co-management must therefore be evaluated by who holds authority, whose knowledge counts and how conflicts are resolved-not by the label alone.

Human wellbeing, equity and tourism

Social outcomes are not ecological outcomes translated into money. Restrictions alter access immediately, while biological benefits may arrive later, elsewhere or not at all. The correct unit of analysis is therefore a group over time-not an undifferentiated ‘community’.

Livelihoods and distribution

Mascia et al. (2010) found mixed and indicator-specific welfare effects, with insufficient evidence for broad claims about employment and income. Ban et al. (2019), reviewing 118 peer-reviewed articles, found that positive and negative wellbeing outcomes frequently co-occur and vary among dimensions and groups. Reimer et al. (2021) similarly mapped heterogeneous contributions to Sustainable Development Goal 14 across 177 studies. Mizrahi et al. (2019) identified 32 socioeconomic factors conditioning ecosystem and livelihood impacts, and Hampton-Smith et al. (2024) found a small and uneven evidence base connecting perceptions of equity to conservation outcomes. Singh et al. (2026), mapping 2,508 papers, confirmed both positive and negative contributions across sustainable-development goals and a striking dependence on secondary data, with little local-knowledge evidence.

The social evidence is therefore broader than the initial anchor corpus suggested, but not more uniform. A matched study in the Mesoamerican Reef found co-benefits for fish and households under specified conditions (Nowakowski et al., 2023); it is valuable precisely because it estimates both sides of the claim with a counterfactual method. It does not establish that co-benefits are automatic or transferable to Aegean fleets, rights and tourism markets.

Tourism is a dual pathway

A healthy marine environment can support diving, snorkelling, sailing and destination quality. The same attraction can increase anchoring, wildlife disturbance, boat traffic, artificial feeding, coastal development and crowding. Marcos et al. (2021) maps credible pathways from ecological change to ecosystem services and societal benefits, but does not supply an integrated estimate of net tourism effects across conservation finance, local retention of revenue, employment quality and ecological pressure. The gap has therefore narrowed from ‘unmapped’ to ‘pathways identified, net distribution unquantified’. It still requires a dedicated search and carefully selected high-tourism cases.

Climate resilience: specify the mechanism

Claims that MPAs create ‘climate resilience’ are too broad to evaluate. Protection may reduce local fishing or habitat pressure, preserve age structure and functional diversity, or improve recovery capacity. It cannot prevent heat exposure, acidification, sea-level change or species redistribution.

Implication for Paros

The Aegean analysis must specify the biological object and response: Posidonia persistence, reef-fish abundance, invasive-species interactions, coral or sponge mortality, recovery after heatwaves, or fisheries adaptation. A scenario may be credited for reducing local cumulative pressure; it must not be credited with excluding climatic exposure.

Contradictions resolved by better questions

The contradictions do not weaken the research question. They sharpen it. The most informative comparison is not ‘MPA versus no MPA’, but which intervention, implemented by whom, under which pressures, for which outcome, over what period, compared with what counterfactual.

Evidence-gap map

What a gap means

A gap is a search and design priority, not proof of no effect. Conversely, a crowded literature is not proof of causality when studies reuse the same sites, outcomes or weak comparator. Phase 2 case selection

should maximise information about mechanisms and failures rather than reproduce the best-known success stories.

Stabilised Phase 1 propositions

Current answer to the central question

Marine protected areas produce measurable and durable ecological benefits when the intervention meaningfully reduces the relevant pressures, is actively managed and enforced, persists long enough for response, covers appropriate habitats and species, and retains sufficient legitimacy and capacity to sustain compliance. Durable social benefit additionally requires that access costs, gains, risks and authority be distributed fairly. Phase 1 cannot yet determine whether those conditions can be created around Paros and Antiparos; it has defined the evidential tests that decision must pass.

Comparative cases: success, failure and durability

Cabo Pulmo National Park

A strong ecological recovery case whose transfer depends on community legitimacy, long implementation and fair tourism retention.

Analytical interpretation

The case remains the portfolio's strongest example of large ecological recovery associated with a no-take regime, community legitimacy and a long implementation period. Its evidential value is not the celebrated percentage alone. It is the interaction of clear restriction, local surveillance, political resistance to incompatible development and an alternative visitor economy. The principal unresolved question is distribution: aggregate tourism value cannot establish which households, workers or outside investors retained the gains.

Apo Island marine reserve

A positive small-island reserve whose spillover and governance benefits are real but bounded and period-dependent.

Analytical interpretation

Apo is most useful because its literature narrows the spillover claim. Target fish recovery and a near-boundary catch gradient can coexist with a modest contribution to total fishery yield. The case also warns against treating 'community based' as a permanent institutional property: later centralisation under national protected-area administration changed decision rights and generated local misgivings. Ecological and governance periods must therefore be coded separately.

Papahānaumokuākea

A high-conservation-value reserve whose 2026 legal rollback makes political durability-not direct Paros ecology-its principal comparative function.

Analytical interpretation

This is primarily a durability case. Its conservation value and long remote-protection history do not settle its current legal status. The June 2026 proclamation removed monument-based commercial-fishing prohibitions in specified zones, while sanctuary rules and older NOAA pages still describe other restrictions or earlier conditions. The correct conclusion is not that ecological gains vanished, but that a high-value reserve can remain legally and politically reversible.

Medes Islands Marine Reserve

A mature Mediterranean recovery case that shows long time lags and the need to manage the tourism pressure created by ecological attractiveness.

Analytical interpretation

Medes rejects two common shortcuts. Recovery was neither immediate nor uniform across species, and a successful dive destination is not automatically a conservation-finance success. Visitor quotas exist, but research indicates that limiting numbers alone has not removed all ecological pressure. For Paros, the case implies that fishery expectations need long horizons and that activity-specific tourism limits must be linked to monitored ecological thresholds.

Torre Guaceto MPA

The strongest selected Mediterranean comparator for strict protection combined with controlled, co-managed artisanal access.

Analytical interpretation

Torre Guaceto is the closest selected model for combining a strongly protected core with controlled local fishing. The mechanism is administrative as much as ecological: eligible fishers, permitted gear, effort limits, monitoring and sanctions define the arrangement. Higher CPUE among authorised participants is relevant, but does not show that displaced or excluded fishers benefited. The model is transferable only if allocation can be executed transparently and monitored continuously.

Columbretes Islands Marine Reserve

A historically effective fisheries reserve with unusually direct lobster spillover evidence and a new surveillance-durability risk.

Analytical interpretation

The Columbretes evidence is unusually useful because it traces a species-specific export mechanism rather than assuming that biomass inside a reserve becomes catch outside it. The benefit decays with distance and depends on lobster movement and fleet location. Historic performance also rested on surveillance. Reported 2025-26 staffing gaps should be treated as a current operational risk, not yet as evidence of ecological decline; they nevertheless show why past enforcement quality cannot be projected indefinitely.

Gökova Bay SEPA

A promising eastern Mediterranean co-management case whose recent outcome narrative requires independent triangulation.

Analytical interpretation

Gökova provides the eastern Mediterranean and Turkish institutional comparator the project needs. No-fishing zones, cooperatives, ranger activity, illegal-fishing control and invasive species can be studied in a climate-exposed setting. Recent recovery and livelihood narratives are promising, but several derive from programme-linked monitoring. They require triangulation with independent studies and official records. The case is not evidence that Turkish fleets affect Paros; that remains a separate transboundary workstream.

Sinis-Mal di Ventre MPA

A deliberate underperformance case showing that designation and age do not ensure fish recovery when pressure reduction and compliance are weak.

Analytical interpretation

Sinis is indispensable because it documents underperformance rather than treating every mature designation as a success. Repeated surveys found little appreciable fish response, and separate work on the sea-urchin fishery identifies non-compliance and unsustainable extraction. The inference is conditional: age and legal designation could not compensate for weak pressure reduction, shifting zones or design problems. Later rules require new outcome evaluation rather than retroactive reclassification of the earlier result.

Alonissos-Northern Sporades National Marine Park

The mature Greek park comparator: legally developed and ecologically valuable, but with incomplete causal and livelihood evidence.

Analytical interpretation

Alonissos is the mature Greek institutional comparator, but its ecological code remains mixed. Recent spatial fish observations are useful; they are not a long before-after-control-impact series. The park also protects monk seals and broader habitats, so fish biomass alone cannot define success. The main Paros lesson concerns the translation of zonation into coordinated delivery across NECCA, fisheries authorities and the coastguard, supported by budgets, patrols and outcome monitoring.

National Marine Park of Zakynthos

A target-species park in which tourism is both an economic pathway and a directly demonstrated ecological pressure.

Analytical interpretation

Zakynthos provides the portfolio's clearest Greek evidence that tourism is an ecological pressure pathway inside a protected area. The COVID interruption showed that reduced boat activity changed turtle use of nearshore habitat. Clear rules on speed, access, fishing and anchoring therefore need observed compliance, not merely publication. Nesting totals are encouraging but cannot be assigned to the park alone, especially while summer infractions and habitat pressures continue.

Gyaros protected area

A newly permanent Greek protected area whose strongest current lesson is administrative executability, not mature ecological effect.

Analytical interpretation

Gyaros must not be called an ecological success on the strength of its April 2026 decree. The new permanent framework is a major legal advance, yet outcome time is insufficient. Its strongest present evidence concerns administrative failure: a co-designed small-scale access model lacked an operational permit system; a brief unrestricted opening produced race-for-fish dynamics and renewed closure. For Paros, permits, eligibility, monitoring and sanctions must exist before any access change takes effect.

Inner Ionian Sea Archipelago Natura 2000 site

A nominal broad designation with a recent narrow intervention; strong evidence of cumulative pressure but no defensible designation-effect estimate.

Analytical interpretation

The Inner Ionian case needs a two-part code. The broad Natura 2000 designation did not create a comprehensive, enforceable fisheries-and-pressure regime; the late-2024 Formicula restriction is a narrow operational measure too recent for outcome evaluation. The historic collapse of common dolphins and prey supplies strong evidence of cumulative pressure, not an effect estimate for the designation. It is therefore a paper-park warning with a recent targeted intervention, not a single static failure label.

Cross-case synthesis

The cases do not sort into a binary success/failure list. They form recurrent configurations in which legal intensity, implementation, legitimacy and external pressure interact.

What appears necessary

- Ecologically appropriate boundaries and restrictions that target the actual pressure pathway.
- A delivery chain covering permits, patrols, monitoring, sanctions and responsibility for each activity.
- Legitimate allocation rules that identify whose access changes, who pays and who captures later benefits.
- A monitoring design that measures both inside ecological outcomes and outside effort, catch, employment and distribution.
- Tourism rules based on activity-specific ecological thresholds, not gross visitor or revenue targets.
- Legal and fiscal safeguards strong enough to survive changes of government, budget and coalition.

Implications for Paros-Antiparos

The comparison supports conditions for a local diagnostic; it does not yet justify a particular Paros boundary or no-take percentage.

Mediterranean and Greek effectiveness

The measurement problem: area is not protection

Coverage is politically convenient because it can be counted. Effectiveness is more demanding because it requires rules, implementation and outcomes to be examined together. This distinction explains why Mediterranean and Greek statistics can appear impressive while the ecological conclusion remains uncertain.

The 2020 Mediterranean analysis concluded that most designated area lacked regulations capable of materially reducing human impacts, while the provisional 2025 assessment reports that only 23% of 1,154 MPAs had fully or partly implemented management plans. These are different measurements, yet they converge on the same proposition: regional conservation performance cannot be inferred from hectares alone (Claudet et al., 2020; MedPAN & SPA/RAC, 2025).

The European Union evidence reinforces this point. Aminian-Biquet et al. (2024) classified 86% of EU MPA area as lightly, minimally or not effectively protected under the MPA Guide, while a companion assessment found that publicly available regulation data were complete for 40% or less of MPA area for most activities; fishing rules were better represented, but still often lacked operational detail (Aminian-Biquet et al., 2025).

Mediterranean ecological effectiveness

The strongest regional result concerns targeted fish assemblages. In a meta-analysis of 24 Mediterranean MPAs, full protection produced stronger effects than partial protection, and the biomass effect of full protection was associated with enforcement. Fish density responses also tended to be larger in older, better-enforced and, within the analysed sample, smaller MPAs (Giakoumi et al., 2017).

What the meta-analysis supports

- Removing or sharply reducing extraction can increase the biomass and density of targeted fishes inside protected areas.
- Partial protection is not necessarily ineffective, but its results are more heterogeneous because permitted gears, effort and compliance vary.
- Enforcement is part of the causal treatment. A legally strict but unenforced reserve is not functionally equivalent to an enforced one.
- Small reserves can produce local responses in crowded seascapes; this does not establish that they are sufficient for mobile species, larval connectivity or representative habitat networks.

What it does not support

The regional evidence does not demonstrate that every fully protected area will recover, that larger reserves are undesirable, or that older designations necessarily outperform younger ones. Medes and Sinis are instructive counterweights. Medes showed slow and species-specific recovery over long periods, whereas Sinis showed little appreciable fish response in repeated surveys despite its age. The explanatory contrast lies in pressure reduction, design, compliance and context-not chronology alone (García-Rubies et al., 2013; Marra et al., 2016).

Enforcement, governance and administrative execution

The Mediterranean record repeatedly reduces to a practical chain: a rule must be legible; regulated users must know what it means; permits and eligibility must exist; surveillance must make violation detectably risky; sanctions must be credible; and monitoring must reveal whether ecological conditions improve. Failure at any link can turn a defensible design into a paper park.

Community participation is therefore neither cosmetic nor magical. It can increase legitimacy, local knowledge and surveillance, but only when decision rights and access rules are explicit. Torre Guaceto's controlled artisanal access is relevant because it specifies beneficiaries and allowable practice. Gyaros is relevant for the converse reason: a designed small-scale access regime could not be executed when permits were absent, and the resulting opening generated competitive entry rather than controlled co-management (Damalas et al., 2024).

This is a central lesson for Paros-Antiparos. Stakeholder support cannot substitute for an operational authority map; nor can administrative precision substitute for legitimacy. Effective governance requires both.

Fisheries, livelihoods and spillover

The fisheries case for MPAs is often stated too broadly. Protection may rebuild spawning biomass, export larvae or generate adult spillover. Yet a biological export is not automatically a net economic benefit. The result depends on the species, the width and placement of the closure, fisher mobility, displaced effort, distance from boundaries, market conditions and the identity of those permitted to fish nearby.

Three levels of claim

Columbretes supplies unusually direct, species-specific evidence for spiny-lobster export, but the effect is spatially bounded. Torre Guaceto reports higher catch-per-unit-effort among authorised artisanal fishers, but participant selection and outcomes for excluded or displaced users remain less well measured. These studies support possibility, not universality (Goñi et al., 2006; Guidetti et al., 2010).

The correct distributional question is therefore not simply whether fishing improves. It is which fishers face immediate loss of grounds, which can adapt, which later gain access to boundary effects, and whether benefits remain local or are captured by larger, more mobile vessels. A Paros assessment will require a fleet and fishing-ground baseline before any spatial scenario can be considered fair or testable.

Tourism: an economic pathway and ecological pressure

Tourism complicates the MPA argument because it can finance management, support diving and excursion businesses, and strengthen the island's environmental reputation. The same attractiveness can increase vessel traffic, anchoring, diver contact, wildlife disturbance and shoreline development. The net effect cannot be determined from visitor expenditure alone.

Evidence from the comparative cases

- At Medes, long-running diving controls show the need for activity quotas and ecological thresholds; reducing visitor numbers alone does not guarantee that damage disappears.
- At Zakynthos, the interruption of boat tourism during the pandemic created a natural experiment: reduced activity altered loggerhead-turtle use of nearshore habitat, demonstrating a direct pressure pathway (Schofield et al., 2021).
- At Cabo Pulmo, tourism supported a community transition after fishing withdrawal, but household distribution, ownership and the ecological cost of later visitation remain incomplete.

For Paros, the relevant accounting identity is broader than tourism revenue. A defensible assessment must include local ownership, employment quality, seasonal crowding, conservation fees, enforcement cost, anchoring damage, wastewater and the opportunity cost of foregone access. This links the MPA project directly to the wider carrying-capacity and Fiscal Carrying Capacity work: an MPA that attracts visitors but cannot finance monitoring and pressure control may weaken the ecosystem it markets.

Climate change, invasive species and resilience

MPAs cannot stop marine heatwaves, acidification, warming-driven range shifts or Lessepsian migration. Their plausible climate function is indirect: by reducing extraction and other local pressures, they may preserve abundance, functional richness and response diversity, thereby improving stability under disturbance.

Benedetti-Cecchi et al. (2024) analysed more than 71,000 reef-fish population time series across protected and open sites and concluded that well-enforced MPAs can promote community and metacommunity stability and moderate some effects associated with marine heatwaves. This is important but easily overstated. Stability is not climatic insulation; a protected Aegean reef remains exposed to the same heatwave and invasive-species pool as surrounding waters.

Implication for the eastern Mediterranean

The eastern Mediterranean is already undergoing ecological reorganisation. Gökova is therefore useful not because it offers a shield against warming or invasive species, but because it tests whether pressure reduction and co-management can preserve ecological function while those external drivers continue. A Paros intervention should similarly be evaluated for resilience: whether it maintains reproductive capacity, habitat condition and functional diversity under change-not whether it can restore a historical climate regime.

Greece: a system in transition

The Greek system combines high nominal coverage with incomplete operationalisation. NECCA reports that more than 19% of Greece's marine territory lies within the Natura 2000 network, while the 2024 WWF Greece rapid assessment reported 18.3% of territorial waters within MPAs. These figures use different sources and denominators, but both describe legal extent rather than effectiveness.

The same 2024 assessment found that only 12 of 174 marine Natura 2000 sites had an identified protective regime, corresponding to less than 3.4% of national waters. That baseline is already being altered by newer instruments, notably Amorgos in 2025 and Gyaros in 2026. It should not, however, be 'updated' by simply adding sites or areas: legal overlaps, denominators and the precise content of each regime require a fresh national reconciliation (WWF Greece, 2024).

Institutional strengths

- NECCA provides a national structure and management units with formal responsibilities for planning, monitoring, reporting, consultation and local priority actions.
- Greece has mature protected-area experience at Alonissos and Zakynthos, and new examples of more explicit fisheries restrictions at Amorgos and Gyaros.
- LIFE MareNatura is building offshore species and habitat knowledge that may improve representativeness and future designation.

Persistent weaknesses

- Environmental designation, fisheries regulation, coastguard enforcement and local implementation remain divided among institutions.
- Comparable national series on patrols, infringements, sanctions, staffing, budgets and ecological outcomes are incomplete.
- Socioeconomic monitoring rarely aligns catch, effort, income, employment, access and benefit distribution with ecological time series.

Greek effectiveness by case and objective

Alonissos and Zakynthos demonstrate why effectiveness must remain objective-specific. Alonissos protects monk seals, habitats and seascape values in addition to fish communities; Zakynthos is organised around loggerhead-turtle nesting and use of Laganas Bay. A fish-biomass metric cannot exhaust either park's purpose. Conversely, favourable species trends cannot substitute for fisheries, employment or tourism-distribution evidence.

Gyaros and Amorgos are more relevant to future institutional design than to current outcome estimation. Their importance lies in the move from general designation toward explicit access rules. Gyaros exposes the risks of opening before permits exist; Amorgos creates a prospective Cycladic test of no-take cores, a seasonal 1.5-nautical-mile closure and fisher-led legitimacy. Both require monitoring before they become precedents for ecological or economic claims.

Recent Greek reforms: what is established and what is not

The Greek policy environment has moved materially since the 2024 national assessment. Three developments must be kept separate.

Amorgos

Presidential Decree 73/2025 established three year-round no-take areas and an island-wide seasonal closure during April and May within 1.5 nautical miles. The measure is unusually important because it emerged from local professional fishers and applies to professional and recreational fishing. Its legal adoption is established; its ecological, compliance and distributional performance is not yet known (YPEN, 2025).

Gyaros

Government Gazette D 280/20 April 2026 created a permanent protected-area regime following a history of temporary closure, attempted controlled access and renewed closure. The decree is a legal advance, but only months old at the evidence cut-off. The appropriate classification is 'operational framework, outcome pending'.

Southern Cyclades

The proposed National Marine Park of the South Aegean 1-Southern Cyclades passed consultation and the necessary special environmental studies were approved in April 2026, clearing the path toward a presidential decree. No final decree was verified by 2 August 2026. The park therefore remains prospective in this assessment (YPEN, 2025; YPEN, 2026).

Bottom trawling commitment

The Environment Ministry stated in June 2026 that bottom trawling was prohibited in all national marine parks. Phase 3 records this as an official implementation claim, not a completed doctrinal finding. The next phase must verify the exact instrument, spatial scope, exceptions, relationship to fisheries law and enforcement arrangements.

Overall effectiveness judgement

The central question is not whether MPAs 'work' in the abstract. The evidence identifies a conditional mechanism with five linked requirements.

Where these conditions coincide, Mediterranean evidence supports meaningful ecological benefit. Where they do not, designation can remain biologically weak or politically unstable. The fisheries and tourism evidence is less secure because distribution is rarely measured with the same rigour as fish abundance or species presence.

Implications for Paros-Antiparos

Phase 3 does not yet justify a boundary, a no-take percentage or even the conclusion that a new MPA is the best local instrument. It does establish the questions that must be answered before any such proposal becomes scientifically credible.

Amorgos is the most relevant near-term Cycladic sentinel, but precisely because it is new. Its value lies in the opportunity for prospective evaluation under comparable Aegean conditions. Paros should learn from its monitoring architecture and implementation experience, not borrow an untested claim of recovery.

The Turkish dimension remains outside the Phase 3 causal verdict. Gökova is a valuable eastern Mediterranean governance comparator; it does not demonstrate that Turkish fishing materially affects Paros. That question requires separate jurisdictional analysis, verified vessel activity, shared-stock evidence and explicit treatment of AIS/VMS limitations.

Greek and European legal-institutional framework

EU nature law: obligation without automatic no-take status

The Birds and Habitats Directives create the legal foundation for Natura 2000. GR4220025 is a Special Protection Area under the Birds Directive. Through Article 7 of the Habitats Directive, the prevention, appropriate-assessment and derogation duties in Article 6(2)-(4) apply to SPAs.

What Article 6 supplies

- A duty to avoid deterioration of protected habitats and significant disturbance of the species for which the site was classified.
- Appropriate assessment of plans or projects likely to have a significant effect, alone or in combination, against site conservation objectives.
- A consent rule: the competent authority may approve only after ascertaining that site integrity will not be adversely affected, subject to a tightly controlled overriding-public-interest route.

What it does not supply automatically

- A uniform prohibition on professional or recreational fishing throughout every marine Natura site.
- A general no-anchor rule over every mapped Posidonia meadow.
- A blanket prohibition on navigation, diving, swimming or tourism.

This distinction is not a weakness in EU nature law; it reflects an objective-specific system. The necessary conservation measure must correspond to the protected features and pressures. The legal deficiency arises when designation is not followed by measures sufficiently precise to prevent the relevant pressure.

The Greek protected-area architecture

Greek Law 1650/1986, as amended principally by Laws 3937/2011 and 4685/2020, provides the current protected-area architecture. It recognises biodiversity-protection areas, national parks, wildlife refuges, protected landscapes and graduated management zones. Marine and mixed areas can be included.

From science to law

The four statutory zone types range from absolute nature protection to sustainable natural-resource management. The decree may prohibit or limit activities where they undermine protected objectives. This gives Greece ample design flexibility: small no-take cores, habitat-protection zones, controlled-use areas and broader multiple-use space can coexist, provided that the rules are ecologically justified and legally precise.

Fisheries competence: the environmental-CFP junction

Fishing is the activity for which institutional precision matters most. Conservation of marine biological resources is governed through the Common Fisheries Policy, while Natura obligations arise under environmental law. A valid Paros measure must satisfy both systems rather than assuming that an environmental boundary automatically binds every fleet.

Principal CFP routes

The practical decision is therefore not simply whether Greece can prohibit fishing. It must specify the target pressure, geographic basis, professional and recreational scope, affected fleets, gear, season, transit, authorisation, scientific rationale and enforcement design. Article 11 itself requires supporting evidence and practical implementation and enforcement details when the regionalised route is used.

Fisheries control and evidential standards

The amended EU Control Regulation requires Member States to control fishing activities in waters under their sovereignty or jurisdiction and to operate fisheries-monitoring systems. For restricted fishing areas, the coastal Member State must detect and record vessel entry, transit and exit. Greece's Hellenic Coast Guard Fisheries Control Directorate operates the fisheries-monitoring function and coordinates Port Authority inspections.

Four facts that must not be conflated

This is especially important for small-scale and recreational fleets. AIS or VMS may be absent, intermittent or legally switchable under limited conditions; shore fishing and spearfishing are not observable through vessel tracking. A credible Paros regime therefore requires mixed detection: digital monitoring, patrols, harbour and ramp checks, ranger observation, complaints and catch/gear inspection.

Recreational fishing and spearfishing

Recreational fishing around Paros is governed by the national recreational-fishing decree read together with directly applicable EU Mediterranean rules. The Hellenic Coast Guard's consolidated materials expressly flag that older national permission for recreational nets no longer applies under Article 17 of Regulation 1967/2006.

Current general rules relevant to design

- Sale and general marketing of recreational catch are prohibited.
- Recreational use of specified nets and dredges is prohibited under the Mediterranean Regulation.

- Spearfishing is prohibited during May, between sunset and sunrise, by persons under sixteen, in defined safety zones and with underwater breathing apparatus or lights, subject to the detailed decree.
- Catch, species, gear and seasonal rules continue to apply outside any MPA proposal.

These rules provide a baseline, but they do not quantify local effort or guarantee compliance. A site-specific Paros measure could add a no-take core, gear restriction, seasonal spawning closure or recreational permit/reporting system if legally authorised. The ecological rationale and allocation consequences must be explicit; recreational pressure cannot be assumed to be negligible simply because individual catches are smaller.

Anchoring and Posidonia protection

Posidonia oceanica is protected as a priority habitat under EU nature law, and bottom-contact fishing over protected vegetation is constrained by the Mediterranean fisheries regime. Neither proposition creates a general, directly legible Natura-wide prohibition on dropping an anchor.

An enforceable anchoring package

The local Port Authority is central for navigation, safety and on-water enforcement; NECCA supplies protected-area monitoring and guard planning; YPEN supplies the environmental zoning basis. A municipality or port fund may be a practical mooring partner, but infrastructure ownership is not equivalent to regulatory power.

Boating, tourism and wildlife disturbance

General Port Regulations apply across the jurisdiction of each Port Authority and supply safety and operating rules for craft and water recreation. An MPA can add ecological controls-speed, approach distance, seasonal access, routes, caps and permits-but these must be anchored in a binding site or port instrument and coordinated with navigation law.

Regulatory building blocks

A tourism licence does not establish ecological permission, and gross tourism revenue does not prove a conservation benefit. The authority chain must connect commercial licensing, protected-area rules and Port Authority enforcement. This is where the wider Paros carrying-capacity work becomes legally material: visitor caps require a defensible ecological threshold and a lawful allocation method.

Diving, snorkelling and underwater heritage

Greek recreational-diving law regulates safety, providers and oversight. Diving is generally possible unless environmental, archaeological, port or other site-specific rules restrict it. Underwater

archaeological sites supply a distinct example: cultural-heritage law can prohibit fishing and anchoring while allowing controlled guided observation.

MPA design options

- Open diving with operator registration, codes of conduct and ecological monitoring.
- Site routes, guide requirements and limits on group size or daily visits.
- Seasonal closure where breeding, fragile habitat or safety evidence requires it.
- A prohibition only where less restrictive controls cannot protect the stated objective.

Diving should not be coded as either intrinsically beneficial or inherently incompatible with an MPA. It is an activity with a measurable pressure pathway and a possible conservation-finance pathway. Any fee or quota must be tied to local retention, monitoring cost and ecological thresholds.

Projects, coastal development and pollution

Natura 2000 law is strongest as a consent gate for plans and projects. Greek Law 4014/2011 operationalises environmental licensing and ecological assessment. A marina, coastal structure, dredging, cable, aquaculture development or other project likely to affect the SPA must be assessed against conservation objectives, including cumulative effects.

The limits of project control

- Appropriate assessment can refuse or condition a licensable project; it does not continuously regulate every anchor, swimmer or fishing trip.
- A project permit can require monitoring and restoration; it does not substitute for a zone-wide activity rule.
- Small, individually modest developments can create cumulative pressure if assessment and post-consent monitoring are fragmented.

Pollution similarly requires a source-to-sea chain. Wastewater, stormwater, solid waste and vessel discharges are controlled through environmental, water, waste, utility and port law. An MPA boundary does not stop sewage or runoff. Municipalities and utilities therefore occupy a central ecological role even though they cannot independently create a national marine reserve.

Institutional responsibility map

The most important administrative design choice is to assign case ownership. A ranger observation, AIS alert, fisher complaint or pollution sample must enter a named workflow, reach the competent authority and return a recorded outcome. Without closure data, management cannot distinguish low violation from low detection or low follow-up.

Operational capability is not a legal proxy

Administrative executability must be demonstrated through deployable assets rather than inferred from a Gazette entry or assignment of competence. The minimum record should identify dedicated full-time-equivalent personnel, patrol-vessel availability, fuel and maintenance budgets, night and weekend coverage, appropriate surveillance and evidence equipment, response times, case-handling capacity, sanction follow-through and recurrent annual funding. Legal authority without verified deployment remains a paper-capacity risk.

Paros-Antiparos: current legal baseline

The geographical research unit remains the wider Paros-Antiparos marine system because ecology, fishing and tourism cross the SPA boundary. Legally, however, each proposed restriction must be tied to a mapped jurisdiction and an instrument capable of reaching the regulated conduct.

Southern Cyclades park: status and evidential correction

The Southern Cyclades marine-park process has changed rapidly and therefore requires periodisation. Public consultation began in July 2025. The marine-park special environmental study was approved after consultation in December 2025. The wider South Aegean EPMs 8A and 8B were approved in April 2026. On 15 July 2026, YPEN reported that the minister had signed the draft Presidential Decree and that it would next proceed to the Council of State.

Correct status coding

This correction is substantive. A draft may shape expectations and investment, but enforcement cannot be backdated to the study or announcement. The Phase 4 matrix therefore preserves separate dates for consultation, study approval, ministerial signature, Council of State review and future publication.

Jurisdiction and the later Turkish workstream

The location of a marine rule determines the legal route and enforcement competence. Greece's official mapping presents six-nautical-mile territorial-sea limits in the Aegean. A Paros proposal must therefore be GIS-tested against baselines, territorial waters, inter-island geometry, Natura boundaries and any wider jurisdictional area before its legal instrument is chosen.

Phase 4 boundary rules

- An environmental designation does not resolve or prejudice maritime delimitation questions.
- A fisheries measure must state whether it relies on coastal-state, flag-state, EU or international competence.

- A vessel track must be matched to a legally defined zone and time period before any compliance conclusion.
- Fishing activity, illegality, stock impact and economic harm require different evidence.

The detailed Turkish analysis remains Phase 6. Phase 4 contributes only the institutional scaffold: precise coordinates, jurisdiction, vessel class, data source, applicable rule, competent authority and evidential threshold. This prevents geopolitical claims from being imported into the Paros assessment without vessel, stock or enforcement evidence.

Legally realistic policy routes for Paros

These are not recommendations yet. They are legally plausible routes to be tested against the local ecological, fishing, tourism and enforcement evidence. A future scenario may combine them-for example, a small no-take core, targeted no-anchor sites and improved general-law enforcement-without requiring one uniform restriction across the entire study area.

Decision rules for the Paros scenario phase

Phase 4 establishes the gate through which a policy option must pass before it is compared for ecological effectiveness, social equity or economic durability.

Evidence priorities before scenario design

- Official GIS layers for GR4220025, EPM 8B proposed zones, territorial waters, habitats and port jurisdiction.
- Paros-specific professional and recreational fishing effort, grounds, gear, season and access data.
- Anchoring density, vessel type, Posidonia condition and mooring capacity by site and season.
- Port Authority and NECCA operational data: patrol hours, assets deployed, incidents, referrals, sanctions and response times.
- Current project licences, wastewater/discharge data, diving and tour-boat permits, and ownership/employment distribution.

Overall legal-institutional judgement

The Greek and European framework is capable of supporting an ecologically strong and socially differentiated marine regime around Paros-Antiparos. The framework is not self-executing. Its effectiveness depends on converting broad obligations and approved studies into precise, interoperable rules delivered by several institutions.

What is established

- GR4220025 is an operative marine SPA and activates meaningful Natura duties.

- Greek law can create graduated, strongly protected marine zones; Gyaros is a current legal precedent.
- Existing fisheries, spearfishing, navigation, diving and project rules already constrain some activities.
- NECCA and the Central Aegean Management Unit provide a formal management and monitoring node; HCG provides the critical policing chain.

What remains open

- The final legal status, maps and operational arrangements of the Southern Cyclades park process.
- A verified Paros-specific decree and management plan, if any, following EPM 8B.
- Local enforcement capacity, baseline compliance and sanction follow-through.
- The instrument-authority chain for each candidate Paros scenario.

The next project phase can now evaluate fisheries, employment and tourism with a legally correct baseline. It should not assign benefits or costs to restrictions that do not yet exist, and it should not treat current general law as effective without compliance evidence.

Fisheries, employment, tourism and distribution

The socioeconomic causal chain

The central analytical error in MPA advocacy is to jump from protection to prosperity. At least seven links intervene. Failure at any link can produce ecological improvement without improved local welfare.

Ban et al. (2019) found positive wellbeing observations in 51% and negative observations in 31% of the coded MPA evidence; positive and negative outcomes frequently coexisted. Community involvement and CPUE often aligned with positive outcomes, while increased costs and conflict aligned with negative outcomes. The review also found that credible before-after control designs were rare. This is a warning against both optimism and pessimism based on a single outcome dimension.

Fisheries recovery, spillover and catch

The strongest socioeconomic pathway begins with credible protection and ecological recovery, then moves through adult or larval export to fishing grounds. Mediterranean evidence supports this mechanism in some cases, especially under strong protection and enforcement, but it does not establish universal compensation.

What is supported

- Spiny-lobster work around Columbretes documented adult export to adjacent fisheries over bounded distances (Goñi et al., 2006).
- Torre Guaceto combined a protected core, controlled local access and fisher involvement with higher reported artisanal CPUE (Guidetti et al., 2010).
- In Corsica, a zoning change that restricted spearfishing over a limited area coincided with higher artisanal CPUE and stronger target-group response (Rocklin et al., 2011).

What is not supported

- That every species spills over at commercially relevant rates.
- That every displaced vessel can reach or legally use the benefiting boundary.
- That increased CPUE produces higher profit after fuel, time, maintenance, labour and price changes.
- That aggregate landings or value identify household distribution or employment quality.

Displacement, mobility and transition time

The immediate effect of a closure is spatial. Effort may move, intensify near a boundary, shift to another species or gear, exit the fishery or continue illegally. These responses determine both ecological leakage and social cost.

The Hawaii displacement study by Stevenson et al. (2013) is particularly instructive: effort moved farther from ports and travel costs rose, yet CPUE, market and mobility conditions moderated aggregate wellbeing effects. Its importance lies not in direct transfer to Paros, but in demonstrating that the same closure can create a cost for one dimension and an offsetting benefit in another.

Global effort modelling similarly shows that placement relative to current fishing activity can dominate the resulting redistribution. Because satellite data under-observe small-scale and recreational activity, it cannot substitute for confidential local ground mapping.

Employment, equity and local legitimacy

Employment is not a single count. A credible assessment records crew numbers, full-time equivalents, wages, contract duration, insurance, safety, age, residence, gender, ownership and seasonal underemployment. It also distinguishes work created in monitoring or tourism from secure livelihoods lost in fishing.

The distribution ledger

Co-management can strengthen legitimacy when local knowledge affects design, authority is genuine, representation is broad and outcomes are reviewed. It is not a waiver of ecological boundaries, nor is consultation evidence that costs have been fairly allocated. The relevant question is whether affected users can influence implementable choices while scientific limits and public accountability remain intact.

Recreational fishing and spearfishing

Mediterranean recreational fishing is inadequately recorded but can remove targeted species, interact with professional gears and weaken legitimacy where rules differ. Spearfishing is distinctive because it selectively targets visible, often larger and higher-trophic fish; the global review by Sbragaglia et al. (2023) found substantial biological concern but sparse socioeconomic measurement.

Paros measurement requirements

- Separate shore angling, boat angling, spearfishing and any other permitted methods.
- Estimate participation, trips, locations, species, size, weight and release mortality by season.
- Measure overlap with professional target species and nursery or spawning areas.
- Record residents, second-home users and visitors separately where feasible.
- Pair ramp, shore and field surveys with calibrated diaries; licences or social-media observations alone are insufficient.

The Corsican result shows that professional-recreational allocation can affect catch outcomes, but it cannot be imported mechanically. Local effort, target overlap and compliance must be known before

deciding whether a spearfishing restriction, a seasonal closure or a uniform no-take core is the fairer and more effective instrument.

Greek fisheries baseline and its limits

ELSTAT's 2024 Sea Fishery Survey describes a contracting, labour-intensive fleet. It provides essential national and Cycladic context but not the Paros baseline required for an impact assessment.

Inshore fisheries therefore account for a larger share of value than volume. This cautions against treating tonnage as economic importance. Yet the figures do not reveal Paros vessel origin, grounds, landings, trip cost, first-sale price, buyer, crew or household dependence. The "Cyclades fishing area" is not a municipal Paros landing statistic.

Tourism: benefit and pressure

Tourism creates revenue, employment, education and possible conservation finance. It also causes anchoring damage, diver contact, wildlife disturbance, boating pressure, waste, wastewater demand and crowding. The net result depends on ecological capacity, allocation, ownership, leakage and public cost.

The tourism review by Casimiro et al. (2023) found only seven economically quantified studies among 98 included records. At Medes, substantial dive revenue coexisted with allocation and enforcement conflict; ecological work indicates that quotas alone may not remove diving pressure. At Zakynthos, the COVID interruption created a natural experiment demonstrating a direct tourism-disturbance pathway for loggerhead turtles. At Ustica, controlled field evidence showed direct anchoring damage to Posidonia.

Conservation finance and fiscal carrying capacity

A protected area creates recurrent public obligations: staff, boats, fuel, patrols, ecological monitoring, data systems, mooring maintenance, waste management, rescue and rule review. Establishment funding is not financial sustainability.

The fiscal ledger

In the Chilean fee study by Gelcich et al. (2013), 97% of respondents stated willingness to pay, yet estimated fees covered only 10-13% of running costs. This demonstrates both revenue potential and its limit. A visitor fee can diversify finance; it cannot be treated as a full substitute for stable public funding.

Transition and local-value instruments

A fair transition must begin before restrictions take effect and must be linked to measured dependence. The objective is neither to freeze existing pressure nor to promise that every user can be made whole, but to avoid imposing concentrated, unmeasured costs in exchange for speculative future benefits.

Greece's EMFAF programme provides a relevant financing architecture, including specified forms of fisheries and local-development support. Regulation (EU) 2021/1139 permits support for temporary or permanent cessation only under defined conditions. A closure therefore creates a policy question, not a legal promise of compensation.

The potential link to Paros's local food economy and Slow Food work is worth testing. It remains a hypothesis: traceability, species, season, restaurant purchasing, first-sale price and fisher margin must show that value is retained locally without raising extraction pressure.

Paros-Antiparos transfer test

The Phase 4 legal baseline constrains the options. The operative SPA is not a blanket no-take, no-anchor or no-diving regime. Socioeconomic effects must therefore be attached to a specified legal instrument and activity rule, not to the abstract existence of a protected designation.

Monitoring specification

Twenty-four local data needs are recorded in the matrix. The minimum viable baseline is smaller but still substantial. It should cover at least one full fishing and tourism year before implementation, with seasonal repetition and a credible comparison or phased design where feasible.

Local testimony is indispensable for identifying grounds, costs, conflict, identity and hypotheses. It is not a substitute for catch, effort, ecological or enforcement data. Confidentiality is particularly important: publishing fine-grained fishing-ground maps could create commercial or compliance harms.

Decision rules

- No income claim without cost and local-retention data.
- No employment claim without full-time-equivalent and job-quality measures.
- No spillover claim without species, distance, access and time-path evidence.
- No tourism-benefit claim without ecological pressure and public-cost accounts.
- No equity claim based on an island-wide average.

Conclusions and research hand-off

The socioeconomic evidence neither justifies nor defeats marine protection around Paros-Antiparos. It changes the question. The relevant choice is not between “conservation” and “jobs”, but among designs that allocate ecological risk, access, transition cost, tourism opportunity and public expenditure differently.

What Phase 5 establishes

- Strong protection can create ecological and fishery benefits under appropriate biological, spatial and enforcement conditions.
- Those benefits are conditional, delayed and unevenly distributed; displacement and transition costs can be immediate.
- Tourism is simultaneously a potential revenue source and a pressure that must be capped, regulated and fiscally accounted for.
- Greece’s national statistics and EU financing framework provide context and possible tools, not a Paros forecast or entitlement.
- The Paros local diagnostic must measure professional and recreational effort, trip economics, tourism pressure, local retention and management cost before scenario appraisal.

The next agreed workstream is Phase 6, the evidence-bounded Aegean and Turkish transboundary assessment. Phase 5’s distinction between vessel presence, fishing activity, illegality, displacement and ecological effect should govern that work. The Paros baseline specified here will then feed Phase 7 and the subsequent scenario comparison.

Regional fisheries governance context

Paros-Antiparos lies within a wider Aegean ecosystem in which stocks, products, vessels, data and enforcement consequences can cross governance boundaries. Regional cooperation and comparative control therefore matter, but national fleet size, vessel flag or an isolated track cannot measure fishing mortality around Paros.

Local relevance and claim boundary

No evidence identified by the cut-off establishes Turkish fishing as a quantified cause of ecological decline around Paros-Antiparos. Vessel presence is not equivalent to fishing; fishing is not automatically illegal; illegality is not evidence of population-level effect; and regional stock connectivity does not by itself locate a causal pathway to the central Cyclades.

Operational implication

The local diagnostic therefore gives priority to proximate and verifiable pressure vectors: professional and recreational fishing, spearfishing, anchoring and boating, visitor use, wastewater, runoff and coastal development. Transboundary activity may enter the pressure ledger only as a monitored external hypothesis supported by species-specific biology, verified vessel activity, applicable jurisdiction and an explicit evidential chain. The detailed regional assessment is retained in Appendix A.

Paros-Antiparos local diagnostic

Study system and provisional survey strata

The companion matrix divides the system into 12 provisional survey strata. This is a sampling device designed to cover bays, open coasts, ports, settlement interfaces, islets, fishing grounds and reference conditions. It is deliberately not a map of preferred protection zones.

Boundary discipline

- Each polygon must carry a source, version, date, legal status and confidence field.
- The statutory Natura area and current EUNIS inventory differ slightly; both values must remain traceable rather than silently reconciled.
- Ecological-use boundaries may extend beyond a designation; legal measures may not.
- Sensitive fishing-ground and wildlife data should be aggregated for public reporting.

Existing protection and planning baseline

GR4220025 is an operative Special Protection Area under the Birds Directive. The current EUNIS factsheet records SPA status since October 2002, a July 2020 Standard Data Form update, 25,698.74 hectares and 91% marine coverage. The statutory KYA 50743/2017 list records 25,681.31 hectares. The small difference is a source/version issue, not evidence of ecological change.

Ecological assets: what is known and missing

The local ecological inventory is fragmented. Regional sources and project activity identify Posidonia, reefs, soft bottoms, seabirds, sensitive taxa and invasive species as plausible or known conservation features. Only a subset has direct, standardised local observation, and few have repeated condition data.

The basin-scale Posidonia map is valuable as a survey prior, not a decision-scale local condition map. Likewise, a restoration project establishes activity and a monitoring opportunity; it does not establish system-wide recovery without public outcome data.

Direct biological evidence and witness observations

The 2011 alien-megabiota survey

No contemporary, peer-reviewed, depth-stratified ecological baseline for the Paros-Antiparos marine system was identified by the evidence cut-off. Katsanevakis's survey of 14 randomly selected coastal sites between 7 and 17 July 2011 used standardised one-hour snorkelling transects from the surface to 10 metres. It recorded eight established alien species, including dusky spinefoot (Siganus luridus) at all 14 sites, together with invasive algae, seagrass and invertebrates. The dataset is a valuable historic snapshot of shallow-water alien megabiota. It is not a baseline of current ecosystem condition, fish biomass, demersal stocks, deeper habitats or benthic integrity.

Dated witness evidence

The evidential restraint does not make the observations unimportant. It protects their value: they identify locations, endpoints and lived concerns that a formal baseline should test rather than overwrite.

Professional, recreational and spearfishing pressures

Fishing is an obvious candidate pressure, but local magnitude is not presently quantified. Paros appears in official landing infrastructure and national statistics provide Greek context; neither supplies a current local fleet-gear-ground-trip-catch series. Regional Cyclades studies describe gear and catch composition but cannot be substituted for Paros in 2026.

Minimum common denominator

All segments should be compared through effort, removals, spatial overlap, target species, selectivity and distribution-not vessel count alone. Confidential ground and economic data can be collected under privacy-preserving aggregation.

Confidential fishing-ground protocol

Participatory ground mapping should be collected through consented individual interviews using a common analytical grid. A 1 x 1 km grid is the starting resolution; cells should be merged to 2 x 2 km or suppressed where sparse participation, rare grounds or distinctive trip patterns could reveal a vessel, household or commercially sensitive location. Raw coordinates and identity keys should be stored separately under a named data custodian with role-limited access.

Public maps should report a cell only where at least five independent contributors are represented and no single contributor dominates the disclosed effort. Cells failing either rule should be pooled with neighbours or withheld. Exact routes, seasonal micro-grounds and interview-level records should never be published. The threshold is a provisional disclosure safeguard and should be reviewed by the project ethics and data-governance process before collection begins.

Spatial conflict should be quantified through the share of each fleet segment's trips, fishing time, catch and gross margin associated with a candidate area, not by map density alone. Sensitivity tests should compare results at alternative grid resolutions. Participatory maps are evidence of use and dependence; they are not ecological condition maps and cannot determine a protection boundary by themselves.

Boating, anchoring, diving and tourism

The Municipal Port Fund documents seven port zones-Parikia, Naousa, Piso Livadi, Alyki, Ambelas, Antiparos and Pounta-and tariff categories spanning small craft, day boats and professional and private recreational vessels. Board agendas confirm active berth and day-boat administration. This establishes a substantial management domain, not an ecological pressure rate.

The baseline should count vessel-days and vessel-nights by class across peak, shoulder and off seasons; observe anchoring location, duration and bottom type; and combine operator logs, port records, shore/drone counts and tracks. AIS cannot supply the missing small-craft denominator by itself.

Wastewater, runoff and coastal development

DEYA Paros reports wastewater-treatment plants at Marpissa, Naousa and Parikia, with investment and expansion activity. These records are important: they identify loads to quantify, potential response

capacity and priority receiving environments. They do not demonstrate current marine pollution or ecosystem recovery.

Climate, invasives and causal confounding

Mediterranean warming and marine heatwaves can alter survival, recruitment, distribution, disease and habitat condition. Alien species can change grazing, competition and community structure. These processes can interact with fishing, pollution and habitat disturbance. A local decline cannot therefore be assigned to one human use without measuring these covariates.

Causal design implication

One full year is the minimum for seasonal use and pressure. Ecological claims require multiple years and, where a measure is introduced, a before-after design with matched reference sites. If a full BACI design is impossible, the report should state exactly which counterfactual is missing and narrow the claim accordingly.

Institutions, enforcement and information flow

The legal-institutional chain is identifiable but local delivery remains insufficiently measured. NECCA can coordinate management and monitoring; HCG and Port Authorities are central to detection and sanctions; fisheries authorities, municipalities, the Port Fund and DEYA control other instruments and data. The diagnostic found mandates more readily than deployable capacity or outcome rates.

Minimum governance output

A public annual dashboard should distinguish activities observed, inspections performed, breaches confirmed, cases resolved, ecological indicators measured and gaps in coverage. Sensitive exact locations can remain protected while aggregate denominators and outcomes are reported.

Social legitimacy and distribution

No representative Paros-Antiparos survey was found that measures perceptions of marine condition, preferred rules, trust, expected costs, benefit ownership or willingness to participate across fishers, residents, workers, tourism operators and visitors. This is not a peripheral gap. It directly conditions compliance, fairness and the durability of any measure.

Integrated pressure adjudication

The diagnostic does not produce a league table of causes. It identifies which mechanisms are credible, which local exposures are measured and where a claim would be decision-relevant. High visibility is not high evidence; high mechanism confidence is not high local magnitude.

Priority data gaps and sequencing

Thirty gaps are specified in the companion matrix. The following first tier has the greatest effect on scenario choice and should begin before the final Phase 8 conditional comparison.

Data governance

A data-management plan should precede confidential collection. It must specify identifiers, metadata, calibration, QA, storage, access, privacy, publication, version control and rules for changing the protocol. Fisher grounds and household economics require strong confidentiality; public ecological and enforcement summaries require reproducible denominators.

Minimum baseline and monitoring protocol

The baseline combines ecological state, use intensity, institutional delivery and distribution. No single survey can answer all four. Twelve linked modules are defined in the companion matrix.

Time and counterfactual

- Use one complete year as the minimum seasonal pressure/use baseline.
- Continue ecological and institutional indicators across multiple years.
- Select matched reference sites before intervention; preserve identical methods and calibration.
- If an intervention starts before baseline completion, record the interrupted design and narrow causal claims.

Phase 8 decision gates and hand-off

The diagnostic leaves nine core decision gates open and one partially open. Phase 8 can still compare bounded options, but it must not convert these unknowns into zeros or point estimates.

What Phase 8 may now do

- Compare no-new-designation, targeted measures, small no-take cores, multiple-use zoning and broader protection as explicit policy packages.
- Attach every package to its legal route, pressure pathway, beneficiaries, costs, enforcement design, recurrent finance and monitoring indicators.
- Use ranges, sensitivity tests and reversal conditions where local parameters are missing.
- Preserve neutrality: the evidence may support a larger MPA, narrower measures, strengthened existing instruments, or a staged combination.

Scenario comparison and adaptive pathway

The five policy packages

S0 is deliberately not a passive status quo. It requires a common GIS, baseline monitoring, denominator-based enforcement and public reporting. It is the minimum credible counterfactual against which added protection must be judged. S1 consists of separate, receptor-based controls; it does not assume that an anchoring problem implies a fisheries closure or that wastewater problems can be solved by drawing a marine boundary.

S2-S4 represent increasing spatial and institutional ambition. Their ecological potential may be greater, particularly if local fishing mortality, system-scale connectivity or multiple interacting uses prove important. Their costs, displacement risks and dependence on durable public capacity also rise. The comparison therefore separates ultimate potential from present readiness.

Evaluation criteria and qualitative comparison

The five packages are compared qualitatively across ecological fit, legal feasibility, operational capacity, distribution, recurrent finance, reversibility and robustness to alternative local diagnoses. No ordinal or cardinal score is assigned because the decisive local parameters remain unmeasured. S3 could align ecological, fisheries and tourism controls, but its present implementability and finance are unverified. S2 and S4 remain especially sensitive to unknown habitat geometry, fishing dependence, connectivity and delivery capacity. No option dominates every other option across every criterion.

Sensitivity to competing local diagnoses

The conditional ordering changes with the diagnosis. S1 is most appropriate when pressures are spatially localised, anchoring is important, recreational fishing is material or land-sea controls dominate. S3 becomes plausible when evidence establishes substantial system-wide fishing or cumulative pressure and when legitimacy, staffing and finance can be secured. S4 becomes more defensible only when connectivity and representation require broader protection. S0 remains the necessary foundation and may remain the only deliverable package where enforcement and finance are weak, but it is not presumed sufficient as a final strategy.

Decision gates: what may begin now

Only S0 is ready as a complete package, because it does not require a new conservation geometry. S1 is conditional component by component: a no-anchor pilot may proceed only after habitat, exposure, legal, safety, mooring-capacity, maintenance and enforcement questions are answered; a seasonal

fisheries closure has a different evidence and legal chain. S2-S4 are deferred at package level, although their design and costing should continue.

Scenario-specific assessment

No new designation - strengthened baseline

Enforce existing fisheries, navigation, pollution, licensing and Natura obligations; establish the common GIS, monitoring, patrol and public-reporting system; no new protected-area designation.

Analytical judgement. S0 has the strongest legal, fiscal and reversibility profile, and it is the correct immediate foundation. It is weaker on ecological fit and targeted pressure reduction. If monitoring shows continuing damage that existing rules cannot address, S0 becomes an inadequate final strategy rather than a neutral default.

Targeted spatial and temporal measures

Mapped anchoring exclusions with ecologically placed moorings; seasonal or gear-specific fisheries controls; recreational-fishing and spearfishing rules; speed, route or visitor-use limits; receiving-water and coastal-project controls, each tied to a demonstrated pathway.

Analytical judgement. S1 is the least-regret provisional pathway because rules can be matched to receptors and revised as evidence develops. It is especially strong for Posidonia anchoring, visitor-use pressure, recreational-fishing controls and land-sea measures. Its weakness is fragmentation: cumulative effects and ecological connectivity may exceed a patchwork of small controls.

Small no-take-core pilot

One or more scientifically selected, time-bounded no-take cores with surrounding targeted controls, matched reference sites, confidential fishing-ground assessment, transition safeguards and pre-specified expansion or exit rules.

Analytical judgement. S2 supplies the clearest local test of strict protection, but only if the core is ecologically meaningful, enforceable and accompanied by a credible counterfactual. Costs arrive immediately while ecological and fishery effects may take years. Entry requires confidential fishing-ground dependence, a transition package, funded patrols and pre-specified exit or expansion rules.

Zoned multiple-use protected area

No-take cores, authorised-use zones, anchoring and tourism controls, professional and recreational fishing rules, co-management, dedicated surveillance, recurrent finance and integrated monitoring.

Analytical judgement. S3 best integrates fisheries, anchoring, tourism, navigation and conservation objectives. Comparative evidence shows that multiple-use MPAs can perform, but performance is more dependent on staffing, rules and local context than under well-enforced no-take protection. Under present Paros evidence, its administrative ambition exceeds verified delivery capacity.

Broader connected protection network

A larger connected network designed for habitat representation, ecological connectivity and climate resilience, with substantial strict-protection components and compatible management of adjacent uses.

Analytical judgement. S4 offers the strongest theoretical response to representation, connectivity and climate resilience. It also carries the largest unresolved access, finance and enforcement burden. It cannot remove heatwaves, invasives or external fishing mortality, and it must be reconciled with the still-evolving Southern Cyclades legal process.

Legal and enforcement architecture

Greece possesses legal mechanisms capable of creating strong marine zones, but no single instrument automatically regulates professional fishing, recreational fishing, spearfishing, anchoring, boating, diving, tourism and pollution. Every scenario must assemble the competent instrument and authority for each activity. Natura status creates conservation and assessment obligations; it is not by itself a no-take, no-anchor or no-dive rule (Habitats Directive, Article 6; Phase 4, 2026).

Professional-fisheries restrictions must follow the appropriate Common Fisheries Policy and national route and specify which vessels, gears, species, seasons and transit conditions are affected. Measures touching other Member States' interests may require EU procedures. Municipal participation is important but cannot substitute for competent fisheries or environmental authority.

Fisheries, livelihoods and distribution

Inside-reserve recovery and spillover are credible mechanisms, not automatic welfare outcomes. Whether benefits offset lost grounds depends on species, distance, vessel mobility, fuel and time costs, prices, access rights and which fleet captures the benefit. Current Paros data cannot quantify these terms. The global wellbeing literature also shows that positive and negative outcomes can coexist within the same MPA (Ban et al., 2019).

Professional fishing, shore and boat angling, and spearfishing must remain separate. Recreational removals cannot be inferred from professional data, while an apparently small core may impose a large burden on a less-mobile vessel or a culturally important ground. A pre-designation socioeconomic baseline, confidential participatory ground map, hardship trigger and annual distribution audit are mandatory for S2-S4.

Tourism, anchoring and fiscal carrying capacity

Tourism is both a potential beneficiary and a pressure. Diving, excursions, sailing and wildlife viewing can support local employment and conservation finance; they can also generate anchoring damage, crowding, disturbance, waste and public-service costs. The most immediate evidence-based mechanism is anchoring damage to Posidonia, but local anchor-event by meadow exposure has not yet been measured (Milazzo et al., 2004; Phase 7, 2026).

- No-anchor zones require mapped habitat, safe exceptions, navigation notice and site-specific mooring engineering. Any mooring field must assess its anchoring system, installation disturbance, swing radius and chain sweep, seabed type, meltemi and storm loads, navigation safety, maintenance, carrying capacity and the risk of concentrating greywater, sewage, fuel and visitor pressure. A fixed mooring is not intrinsically low-impact.
- Visitor or operator fees may supplement management, but gross receipts must be reduced by collection and compliance costs; empirical evidence does not support assuming full cost recovery (Gelcich et al., 2013).
- Ecological capacity must be set before a fee. Revenue must never create an incentive to maximise visitor volume beyond the receptor threshold.
- Employment claims require full-time-equivalent work, wages, contract length, residence, housing pressure and local ownership, not job headcount alone.
- The recurrent public budget must cover staff, vessels, fuel, monitoring, data custody, mooring maintenance, participation and appeals over at least five years.

Adaptive monitoring, expansion and reversal

Monitoring must connect pressure to condition and condition to causal attribution. Fish biomass, catch, profit, employment and legitimacy are different outcomes. Patrol hours, infringements and compliance are likewise different. Each indicator requires a denominator and a reference period.

A pilot may expand only if it reduces the target pressure, produces an ecological response consistent with the expected time lag, does not create unacceptable displacement or hardship, and can be financed and enforced durably. It should be modified or reversed if compliance remains implausible, pressure moves to more sensitive sites, recurrent funding fails, adverse distribution exceeds the hardship threshold or external drivers invalidate the promised mechanism.

Adaptive implementation roadmap

Recommended Phase 8 policy position

- Immediate common foundation: versioned legal and habitat GIS, monitoring protocol, enforcement denominators, inter-agency case process, five-year cost model and stratified participation.

- First targeted candidates: receptor-based anchoring controls and mooring design after ground truth; full-year recreational and professional fishing ledgers; source-specific wastewater and coastal-project controls; visitor-use rules tied to ecological thresholds.
- Conditional strict-protection test: design one or more small cores only after habitat and fishing-ground evidence identifies an ecologically meaningful and socially assessable geometry.
- Escalation rule: proceed to a multiple-use or broader system only when targeted measures cannot meet a specific system-scale objective and the incremental ecological value remains material under conservative climate, finance and distribution assumptions.
- Public accountability: publish annual ecological, socioeconomic, enforcement and finance results, dissent, appeals and any deviation from the protocol.

This position is more than procedural caution. It is a substantive inference from the combined evidence: strong protection can produce larger ecological effects, but enforcement, legitimacy, finance and time condition those effects; partial or multiple-use protection can work, but is especially dependent on implementation; and local socioeconomic benefits cannot be presumed from inside-boundary recovery (Edgar et al., 2014; Gill et al., 2017; Giakoumi et al., 2017; Ban et al., 2019).

Limitations and Phase 9 hand-off

Phase 8 is decision-grade for sequencing, not for selecting a final polygon or estimating net present value. Its scenario judgements are qualitative and bounded by the Phase 0 protocol and Phase 1-7 evidence. They should be revised when local parameters arrive and must not be presented as survey-derived public preferences or calibrated estimates.

Phase 9 should integrate the full study while preserving the following boundaries: no numerical ecological-recovery promise without local baseline and counterfactual; no catch, income or employment promise without effort, cost and distribution data; no current legal claim without authoritative status verification; and no tourism-finance claim without ecological capacity, collection cost and public-accounting design.

A final public version should distinguish the scientific conclusion from the policy choice. Science can identify mechanisms, likely consequences, uncertainties and minimum conditions. The allocation of access, cost and risk remains a public decision that must be informed, representative and revisable.

Integrated conclusions and implementation programme

Scientific conclusion
The scientific evidence supports action, but not premature closure of the policy choice. The current least-regret strategy is to build the delivery and evidence system while using targeted, reversible controls against demonstrated pressures. Stronger spatial protection should remain designed, costed and publicly debated so that it can advance quickly if the decision gates are met.

Why the pathway is adaptive rather than merely cautious

The recommendation is grounded in asymmetric error costs. Waiting for perfect knowledge can permit avoidable habitat damage, especially where mechanisms such as anchoring on Posidonia are well established and local exposure can be mapped. Conversely, imposing a large closure before fishing dependence, displacement and enforcement are measured can concentrate immediate losses, undermine legitimacy and create a weakly implemented designation. Targeted pilots preserve learning while limiting irreversible institutional and distributive error.

Adaptive management is credible only if change rules are specified in advance. Measures should expand when the target pressure falls, ecological response is consistent with the expected lag, displacement remains acceptable and recurrent delivery is funded. They should be modified or reversed when compliance remains implausible, pressure moves to more sensitive sites, finance fails, hardship exceeds a declared threshold or external drivers invalidate the promised mechanism.

Five-year staged programme

Period	Programme	Decision output
0-6 months	Legal/GIS reconciliation; governance board; data standards; patrol and incident denominators; procurement and five-year cost model.	Authorised baseline programme and accountable delivery chain.
6-18 months	Habitat ground-truth; fish and benthic baselines; professional/recreational/spearfishing ledgers; boating and anchoring exposure; receiving-water monitoring; representative participation.	Pressure and receptor diagnosis on common denominators.

Period	Programme	Decision output
12-24 months	Implement evidence-complete targeted pilots; publish monitoring, compliance, distribution and cost results.	Continue, revise or stop each S1 component.
18-30 months	Design and consult on a small no-take-core pilot; complete fishing-ground dependence, displacement, transition, legal and finance tests.	Enact only if all S2 entry gates pass.
Years 3-5	Evaluate ecological, fishery, tourism, equity and enforcement outcomes against controls; test cumulative and connectivity needs.	Retain S1, scale S2, advance S3/S4 or return to a smaller package.

Institutional architecture

No single institution can deliver the pathway. The environmental designation and management chain must be joined to fisheries competence, Coast Guard and Port Authority enforcement, navigation and safety, municipal and utility functions, scientific monitoring and public finance. Each rule requires coordinates, notice, detection, evidence, sanction, ecological indicators, data custody and a named recurrent budget. Stakeholder participation must inform design and allocation without converting unverified preferences into ecological facts.

Distribution and legitimacy

The ethical question is not whether conservation has costs, but whether costs, access, risk and delayed benefits are allocated transparently. Small, less-mobile fishers may bear concentrated losses even when aggregate ecological benefits rise. Tourism gains may accrue to outside owners while residents absorb housing, infrastructure or ecological pressure. Annual reporting should therefore include household or vessel-segment dependence, full-time-equivalent employment, wages, local ownership, price and margin, visitor pressure, public expenditure and the waiting period before benefits are realised.

Relationship to the Southern Cyclades process

At the evidence cut-off, the Ministry reported that the draft Presidential Decree for the Southern Cyclades park had been signed on 15 July 2026 and forwarded for Council of State review; Gazette publication was not verified. It is therefore treated as prospective rather than operative. The Ministry's published July 2025 consultation map did not include Paros or Antiparos within the green park footprint. Unless a later operative map changes that geography, the park would not supply a comprehensive local Paros regime. Any final maps, zones, permitted uses, fisheries procedures, management plan, authority assignments and finance must therefore be checked before the decree is treated as locally applicable.

Limitations and research agenda

- The global evidence is strongest for exploited fishes and inside-boundary ecological metrics; benthic, non-fish, food-web and island-wide welfare outcomes are less consistently measured.
- Comparative cases are analytically selected rather than statistically representative of all MPAs.
- Greek effectiveness evidence is objective-specific and cannot yet be aggregated into a national causal estimate.
- Paros-Antiparos lacks a current system-wide ecological baseline and common-denominator use ledger.
- Scenario comparisons are qualitative, conditional judgements rather than probabilities, rankings, benefit-cost estimates or public-preference surveys.
- Rapidly changing legal instruments must be reverified before public release or implementation.

Reopening rule
Reopen the integrated judgement when operative regional law, decision-scale habitat maps, full-year fishing and boating ledgers, enforcement capacity, recurrent costs or representative distribution evidence become available. New evidence may justify either stronger protection or a narrower package.

Appendix A. Detailed transboundary and Turkish-fleet assessment

This appendix preserves the bounded regional analysis used in Phase 6. It is included for auditability and regional fisheries-management context. It is not part of the proximate local-pressure diagnosis, and it does not attribute observed or alleged ecological change around Paros-Antiparos to Turkish vessels.

What counts as transboundary pressure?

“Transboundary” is used here in a functional sense: ecological processes, fishing activity, products, data or enforcement consequences cross governance boundaries. It does not mean that every foreign vessel near an island is applying pressure to that island’s ecosystem.

These mechanisms can coexist, but they are not interchangeable. A vessel can be lawfully present without fishing; fishing can be lawful yet ecologically material; a breach can occur without measurable population effect; and a stock can be transboundary without a verified Paros pathway.

Fleet structure: compare capacity, not flags

Türkiye is a major Mediterranean and Black Sea fishing nation, but national scale is not a measure of pressure around Paros. The most comparable published Aegean-port register for 2021 counted more Greek than Turkish vessels and found both fleets overwhelmingly small-scale. National registers use different years and definitions and must not be mixed into a league table.

The management implication is not that the fleets are equivalent. Comparative work by Dereli and colleagues identifies differences in fleet segments, technical rules and species measures. The valid comparison therefore requires length, gross tonnage, kilowatts, gear, season, days at sea, grounds and catch-not a national flag or vessel total.

Shared stocks and biological connectivity

Aegean management units simplify administration; biological populations do not necessarily follow them. Phase 6 therefore treats shared-stock status as a species-specific scientific question rather than an automatic consequence of geography.

The 2021 anchovy assessment is a useful warning: incomplete Turkish survey integration prevents confident treatment of the Greek part of GSA 22 as a complete stock. It supports cooperation and uncertainty reduction. It does not locate a causal pathway to the central Cyclades.

Rules and regulatory asymmetry

Greek and Turkish fisheries are subject to different domestic legal systems, while Greece is also bound by the Common Fisheries Policy. Both states participate in GFCM regional measures. Differences in mesh, gear, season, protected species, authorisation and monitoring can affect comparative pressure and compliance, but a rule difference is not itself evidence of an infringement.

GFCM's 2025 compliance outcome placed Türkiye in category 1 for reporting and transposition. That is an institutional result; it is not proof that every vessel complied. Conversely, a regulatory gap or lower monitoring coverage is not proof of illegal activity. Compliance claims must remain measure-, vessel- and event-specific.

Jurisdiction and the illegality test

The Aegean's maritime disputes make precise legal framing essential. This report records the two states' official positions but does not adjudicate them. Both currently apply six-nautical-mile territorial seas in the Aegean. Within verified Greek territorial sea, unauthorised foreign fishing is unlawful. Outside national jurisdiction, Turkish fishing is not automatically illegal; flag-state, GFCM, ICCAT and other applicable rules may govern it.

AIS, VMS and the monitoring hierarchy

Satellite and terrestrial tracking are indispensable leads, not self-interpreting proof. Public AIS carriage and reception vary, and many small vessels are absent. Algorithms infer fishing-like behaviour from movement; they do not directly observe gear deployment, catch, legal authorisation or ecological effect.

Paolo et al. estimated that 72-76% of global industrial fishing activity was not publicly tracked during 2017-2021. That global estimate is not an Aegean rate, but it demonstrates why public AIS cannot be treated as the complete universe. GFCM's 2026 programme to deploy advanced VMS on more than 850 vessels-mainly from Türkiye's industrial fleet-can improve control, subject to access, interoperability and coverage rules.

Incident evidence: what the record supports

The incident register includes reports from the northern, eastern and central Aegean between 2018 and July 2026. It is an event record, not a prevalence estimate. Cases were retained where they illuminate evidence types or legal tests, including official denials, contested locations and unresolved conduct.

The evidence gap is not a reason to dismiss fisher testimony. It is a reason to create a standard incident packet and resolution trail. Testimony can identify where and when to investigate; authority records, sensor fusion and legal disposition determine whether a case becomes a confirmed infringement.

Trade, IUU risk and product traceability

Market controls offer a second evidence route. The EU IUU Regulation requires catch certification for fishery products entering the Union and permits risk-based verification. Implementing rules and GFCM/ICCAT vessel and catch-document systems can help link product, species, flag, vessel and trip. They do not make nationality itself a risk proxy.

Current claim boundary

- Turkish-origin seafood sold in Greece is not thereby illegal or ecologically damaging.
- A claim that a particular product was illegally caught requires vessel-trip-product traceability, the applicable measure and authority verification.
- A July 2026 political claim about approximately 70 tonnes per month of hake imports was not corroborated by a customs or CATCH dataset in this review; it remains a verification item.
- Catch-certificate audits can complement at-sea control but cannot identify unreported domestic or non-export activity automatically.

Cooperation without prejudicing maritime positions

Technical cooperation does not require either state to abandon its legal position. The practical objective is to improve biological knowledge, rule comparability and event resolution while preserving explicit jurisdictional safeguards.

GFCM's joint-management and inspection architecture, including species-specific work such as the Mediterranean dolphinfish plan, provides a route for cooperation. Bilateral scientific protocols can go further where a stock or incident type is especially relevant, provided data governance and non-prejudice clauses are explicit.

The Paros-Antiparos relevance test

The current evidence establishes several regional mechanisms and monitoring needs. It does not establish Turkish fishing as a quantified local pressure. Scenario analysis must therefore separate what is known, plausible and absent.

Phase 7 evidence specification

Phase 7 must create the local denominator against which transboundary claims can be tested. A one-off AIS screenshot or media report cannot replace the following linked datasets.

At minimum, the local baseline should cover one full year and preserve seasonal variation. Ecological inference will require multi-year observation and an explicit counterfactual. Incident data should be

published annually in aggregate form with confirmed cases, unresolved events and data-coverage limitations separated.

Conclusions and Phase 7 hand-off

Phase 6 reaches a bounded but actionable conclusion. Greek and Turkish fleets operate within the same regional ecosystem, exploit some connected or shared resources, and are governed by partially different rules and monitoring systems. Those facts make cooperation and comparative control necessary. They do not identify the flag responsible for an observed ecological trend around Paros.

What may enter Phase 7

- Turkish and other non-local fleet activity as a monitored external-pressure hypothesis, never as a presumed cause.
- Species-specific shared-stock pathways where biology, catch and movement evidence support them.
- A harmonised incident protocol that resolves presence, activity, legality and disposition separately.
- A complete local pressure ledger covering Greek professional fishing, recreational fishing, spearfishing, anchoring, boating and tourism alongside external mechanisms.
- A scenario constraint: local protection cannot regulate lawful or unlawful activity outside its legal reach, but monitoring, market controls and regional cooperation can reduce that governance gap.

What must remain excluded

- National fleet totals as a proxy for fishing mortality around Paros.
- AIS silence as evidence of absence, or AIS presence as proof of fishing or illegality.
- A political allegation, media account or fisher report as a confirmed infringement without the evidentiary chain.
- GSA 22 as an automatically unified biological stock, or North Aegean evidence as a direct central-Cyclades effect.

Appendix B. Evidence-synthesis methods and reproducibility

Review form and purpose

The publication is a structured integrative and scoping evidence synthesis combined with comparative, legal-institutional and socioeconomic policy analysis. It is not a new ecological field study, a stock assessment, a meta-analysis or a formally exhaustive systematic review. The evidence cut-off is 2 August 2026. The review asks what mechanisms and conditions make marine protection effective, which lessons are transferable to Paros-Antiparos, what the local record can support and what remains unmeasured.

Evidence discovery and source hierarchy

Evidence was assembled in phase-specific searches using targeted scholarly retrieval, reference-list and citation chaining, official legal and administrative searches, protected-area registers, technical datasets and local documentary sources. The retained concept groups included: full, partial and no-take protection; biomass, abundance, size, BACI designs and spillover; enforcement, staffing, compliance and co-management; livelihoods, wellbeing, equity, tourism and finance; Mediterranean and Greek effectiveness and law; Paros-Antiparos habitats, fishing, anchoring and wastewater; and Aegean shared stocks, AIS/VMS, IUU control and transboundary governance. These are reproducible concept families, not a claim that every platform query was preserved verbatim.

Peer-reviewed systematic reviews and meta-analyses were used for broad effect claims; pivotal primary studies were revisited where mechanisms, transferability or contradictions mattered. Primary legislation, Gazette instruments and official registers governed legal status. Administrative sources established announcements, infrastructure and mandates but not ecological outcomes. Media and testimony were used as leads, incident records or dated hypotheses, not as prevalence estimates or causal proof.

Eligibility and exclusion rules

Sources were retained when they addressed an explicit claim in the framework and disclosed enough about the intervention, place, period, outcome or legal instrument to determine the permitted inference. English and Greek evidence was used. Records were excluded from causal support when the intervention was undefined, the comparator or timing was irrecoverable, a legal-status claim lacked authoritative verification, or a regional or historic observation was being used as a current Paros estimate. Unsourced advocacy and repeated secondary claims were not treated as independent evidence. Evidence gaps were coded as unknown, never zero.

Screening, duplication and reviewer structure

Records were assessed in iterative phase-specific passes, first for relevance to a defined proposition and then at full-text or primary-document level when the claim was pivotal, contested or unusually transferable. Nine overlapping review families were reconciled so that repeated primary studies were not counted as independent votes. Primary studies were revisited when a result drove a policy implication or when reviews disagreed. Screening and coding were conducted within a single-author project; there was no blinded second reviewer or formal inter-rater reliability test. That constraint is part of the uncertainty, not evidence of agreement.

Comparative-case selection

The twelve cases were selected purposively rather than statistically. Selection sought variation in protection intensity, implementation, ecological setting, access, tourism, fisheries, governance, success, failure and political durability. Each case was assigned a limited evidential role. Mediterranean multi-use and inhabited archipelagic cases carry the greatest weight for spatial and institutional transfer. Tropical, remote or uninhabited cases are retained only for mechanisms such as strict-protection response, co-management, surveillance, legal durability or reversal. They do not provide local effect sizes or boundary templates.

Extraction, coding and inference discipline

Comparative records were coded for legal label; permitted and prohibited activities; implementation stage; operational capacity; ecological receptor and outcome; comparator and time; fisheries, tourism and wellbeing pathways; distribution and finance; and principal transfer limits. Legal designation, restriction intensity, implementation, compliance and ecological response were kept separate. Presence, activity, pressure, legality, ecological effect and economic effect were also treated as distinct claim levels.

Quality was appraised by domain rather than collapsed into a numerical score. The appraisal considered selection and placement bias, baseline and comparator quality, temporal coverage, measurement validity, confounding, implementation fidelity and transferability. Stronger causal weight was given to meta-analyses with transparent inclusion rules, BACI or defensible quasi-experimental designs and repeated ecological or socioeconomic measurement. Official law remained authoritative only for legal status. Historical local surveys and testimony retained value as dated observations and design leads, not current system baselines.

Scenario comparison

The five policy packages are compared qualitatively against ecological fit, legal feasibility, operational capacity, distribution, finance, reversibility and robustness to alternative diagnoses. Version 1.4 assigns no numerical score, rank or best-fit count. The comparison is a conditional trade-off analysis: a scenario becomes more or less defensible only when its stated local evidence and delivery gates are met.

Reproducibility boundary and future journal standard

The included source list and the Phase 0-9 project records provide a substantial audit trail, but direct Scopus and Web of Science exports, complete verbatim search strings, import-level deduplication counts and a formal screening-flow record were not available. Exact exhaustive-search replication is therefore impossible, and no exhaustive-systematic-review claim is made. A journal submission should append database-specific queries, export files, a deduplicated record set, title/abstract and full-text exclusion counts, a screening flow diagram, the extraction workbook, case-coding rules and independent second-reviewer agreement or adjudication.

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