# Climate Change Adaptation Plan - Calanques MPA

## MPA ENGAGE

Pauline Vouriot

Version 1
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# IDENTIFICATION

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| **Project Number** | 5MED18_3.2_M23_007 | **Acronym** | MPA Engage |
| **Full title** | MPA Engage: Engaging Mediterranean key actors in Ecosystem Approach to manage Marine Protected Areas to face Climate change | | |
| **Axis** | 3.2: To maintain biodiversity and natural ecosystems through strengthening the management and networking of protected areas | | |
| **Partner Responsible** | Calanques National Park | | |
| **Contact Person** | Pauline Vouriot | | |

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| **Dissemination Level** | ☐ Internal ☒ Public | | |

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| **Description of the deliverable** | This document features the climate change adaptation options endorsed by the Calanques MPA as the end result of the participatory decision-making process. |
| **Key words** | Quintuple helix, decision-making process, public participation, climate change adaptation |



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| **DOCUMENT HISTORY** | | | |
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| **Name** | **Date** | **Version** | **Description** |
| 3.7.3 Climate Change Adaptation Plan - Calanques MPA | 20/12/2021 | 01 | Draft sent to MIO-ECSDE (Task Leader) for comments |
| 3.7.3 Climate Change Adaptation Plan - Calanques MPA | 21/12/2021 | 01 | Final report |
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# INDEX

# 1. Introduction

Climate change is dramatically affecting the Mediterranean Sea, which is warming at a rate 20% faster than the world's average. Marine Protected Areas (MPAs), despite the nature-based solution they offer to support efforts towards climate change adaptation and mitigation, they experience too, the climate change effects. In fact, several Mediterranean MPAs are already facing major biodiversity and functional alterations due to climate change, whereas others will likely face them in the next few decades. There is, therefore, an urgency to mitigate these risks and to consider adaptation options in partnership with local communities, decision-makers, civil society organizations, research bodies, and other socio-economic actors at local, national and regional level.

This document was prepared within the framework of the MPA Engage project. MPA Engage is an Interreg Med funded project that aims to support Mediterranean MPAs to adapt to and mitigate the ongoing climate change effects in the Mediterranean Sea. Participatory approaches lie at the heart of the MPA Engage project; through a participatory approach, MPA Engage monitored in a harmonized way the climate change impacts, elaborated vulnerability assessments and developed climate change adaptation action plans in 7 Marine Protected Areas located in 6 Mediterranean countries, namely Albania, Croatia, France, Greece, Italy, Malta, Spain.

# 2. Goals and objectives of the climate change adaptation plan

The overarching goal of the Climate Change Adaptation Plan is to determine those actions needed to address the climate change impacts in the Calanques NP and facilitate its efforts in achieving its conservations goals.

This report is then the first version of the action plan for climate change adaptation, laying the common vision and the first milestones, and presenting the no-regret measures from the Calanques NP managers' point of view. A more consolidated version will be updated after having finished the participatory approach process (by mid-2022), which will refine the adaptation measures proposed here. It is necessary to remind that adaptation is a continuous and iterative process, and so is the associated action plan (regarding its design and implementation).

The key objectives of the plan are:

i. Wondering about the vulnerabilities and opportunities caused by climate change
ii. Developing a prospective vision, to be shared, of the evolution of the Calanques NP under the effect of climate change (anticipate)
iii. Launching a local dynamic around climate change adaptation and setting the first milestones of a long-term strategy
iv. Adopting a new positioning and a change in the management approach of the Calanques NP, thinking together about present and future uses
v. Bringing the modest contribution of the Calanques NP to the wider issue that is climate change (at local, national and regional levels)
vi. Communicating differently on the Calanques NP and asserting the Calanques NP role within the local territory
vii. Identifying the Calanques NP as a pilot site for the monitoring of climate change impacts (trends and uncertainties) in the Mediterranean MPA network

The Calanques NP began to work on its climate change adaptation plan after several years of local participatory approaches intended to build thematic operational management plans, themselves part of the MPA framework document (The Charter). Many topics have already been discussed and argued with local stakeholders during these processes, for most of the human activities (diving, nautical activities, tourism, professional and recreational fishing) and for the general scientific strategy of the MPA.

In this context, building another action plan and carrying out an umpteenth participatory approach added challenge to the task but it was a unique opportunity to give meaning to all the work already achieved till now from a climate change point of view. Indeed, climate hazards and human pressures have cumulative effects that can be synergetic or not, that is why considering them together may bring new insights. Thus, this climate change adaptation plan can be seen as cross-cutting strategy on the long-term, overlaying with all the other thematic management plans.

It is important to keep in mind that, in mature MPA (meaning MPA which implements management plans covering most issues and activities), 90% of climate change adaptation measures come from already existing management measures. The Calanques NP will then consider all the existing measures as a basis of reflexion, revisiting and prioritizing them in the light of their contribution to climate change adaptation, with the freedom to develop also new ones, specific to the climate change topic.

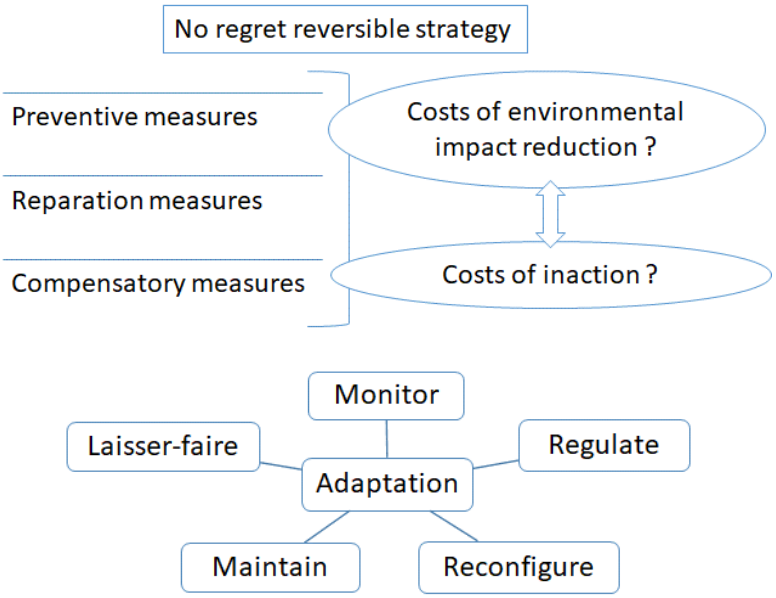


Fig.1. Thinking pattern for climate change adaptation plan

# 3. The key steps followed for the elaboration of the plan

The elaboration of the Climate Change Adaptation Plan followed a four-phase process as presented below. Within each phase a set of specific actions were undertaken. The participatory process adopted along all these phases is detailed in the available report entitled "The Quintuple Helix Participatory Approach in Calanques MPA".

- **Phase 1 – Establishment:** The overall aim of the establishment phase was to make known the intention for drafting the plan and identify the convening body responsible for the overall coordination of the planning. All parties that should be involved were identified and a core group/team with the mandate to prepare and implement the plan was established. Effort was directed to identify the stakeholders and design the stakeholders' engagement and participatory process, in line with the MPA Engage quintuple helix approach.
- **Phase 2 – Analysis and Scenarios:** The aim of the analysis phase was to establish the foundation on which the preparation of the plan and its implementation will be based. Any available information on the climate change issue impacts and vulnerabilities were collected, including information on pre-existing relevant plans. In parallel, within this stage the engagement of stakeholders was initiated.
- **Phase 3 – Setting the Vision:** The aim of this stage was to achieve the engagement and consensus building with the stakeholders and the wider community on the action plan based on the findings from the phases 1 and 2. Within this stage stakeholders were engaged in the identification of the key problems and issues for the plan to deal with and set the course for the eventual 'shape' of the plan and its implementation by reviewing the proposed scenario (from Phase 2).
- **Phase 4 – Designing the Future:** The aim of this stage was the actual drafting and finalization of the local climate change adaptation plan, which will contribute in shaping the future of the MPA. Within this stage stakeholders were engaged in the finalization and final adoption of the local plan.

# 4. Key facts and figures on climate change in the Calanques MPA

## CLIMATE HAZARDS SCENARIOS

- Sea surface temperature increase

+ 0.95° C since 80's in Marseille-Riou
+ 1 to + 3° C by 2100 in Calanques NP

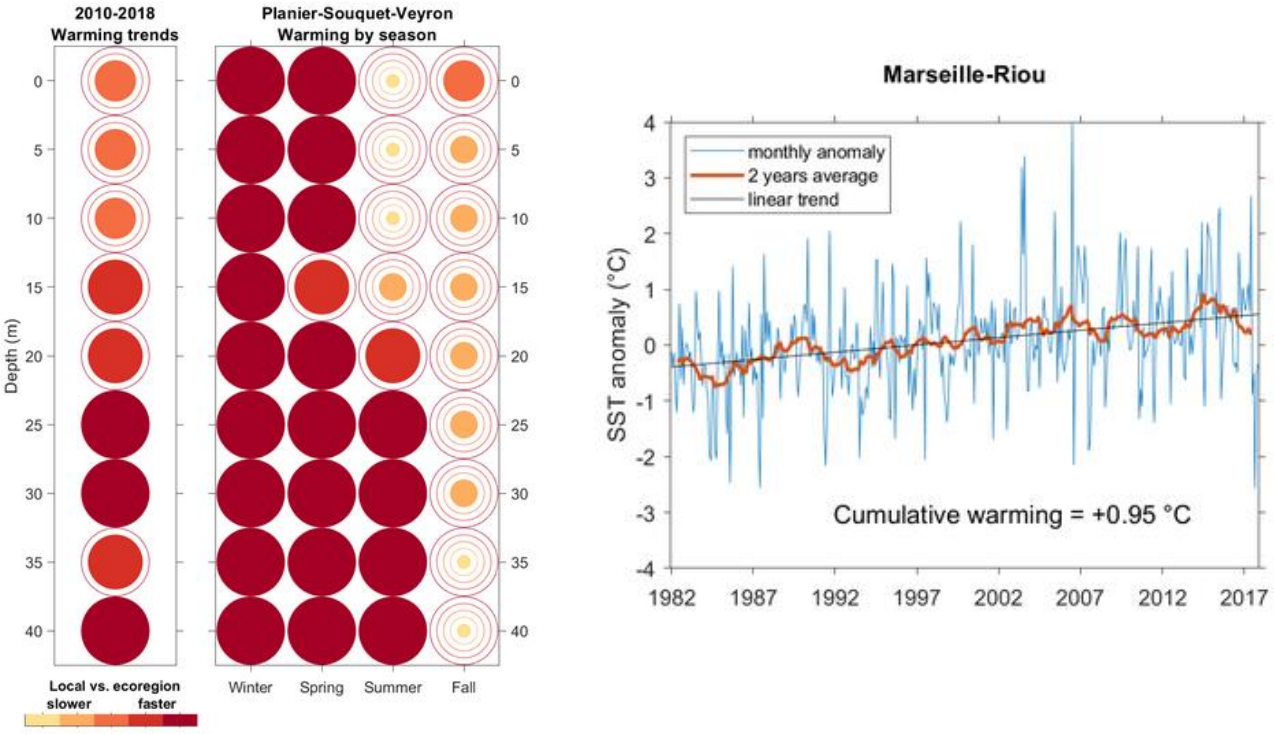


Fig.2. Recorded warming along the water column (depth) in Planier-Souquet-Veyron on the period 2010-2018 [left] & Sea surface temperature anomaly increase in Marseille-Riou since on the period 1982-2017 [right]

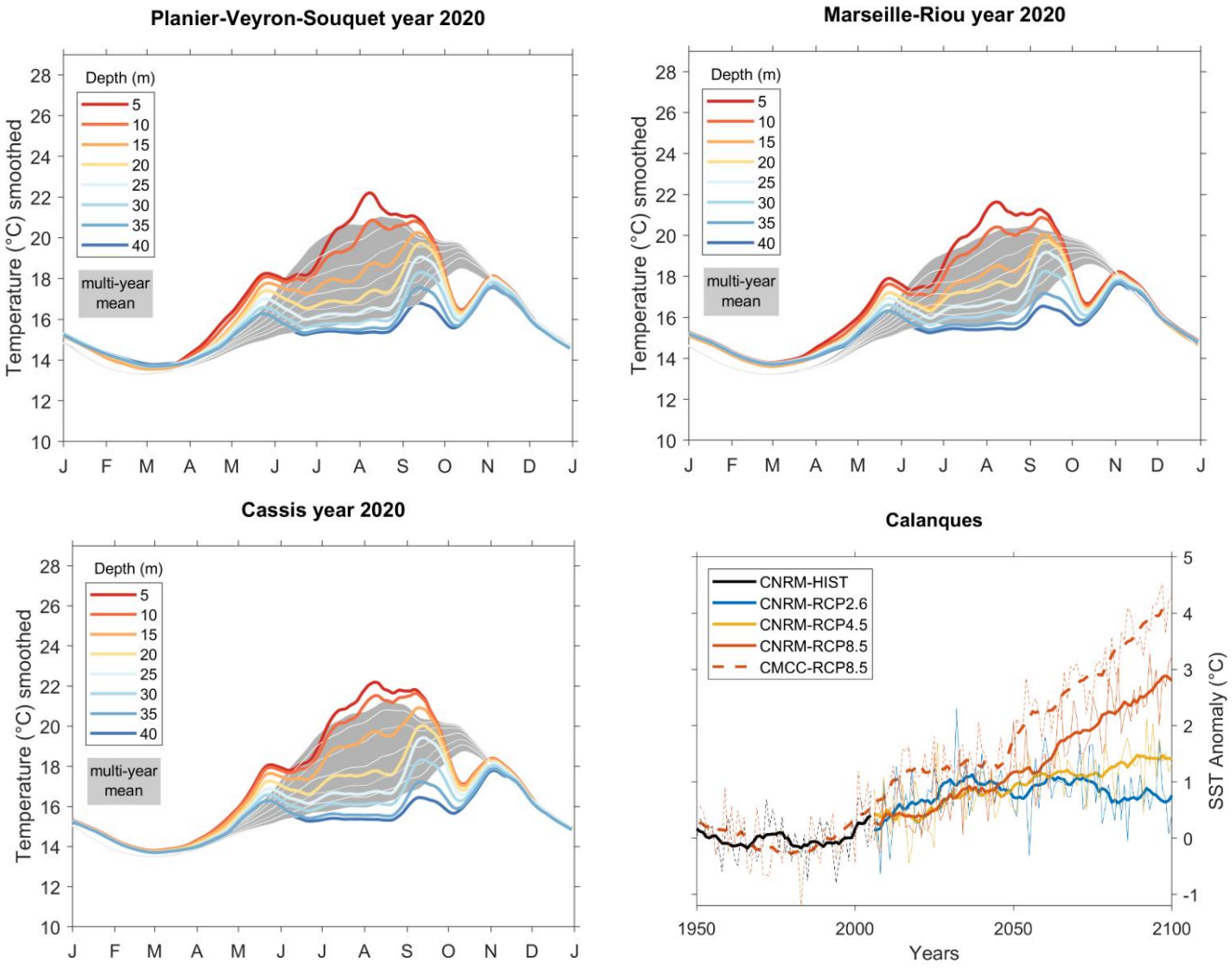


Fig. 3. Annual cycle of temperature at different depth in the in the Calanques NP, at 3 different sites (Cassis, Marseille-Riou, Planier-Veyron-Souquet). And projected sea surface temperature anomaly increase in the Calanques NP in different climate change scenarios (IPCC -GES emissions) [bottom right].

- Marine heatwaves increase (in number of days)

Up to 4 times more days by 2100

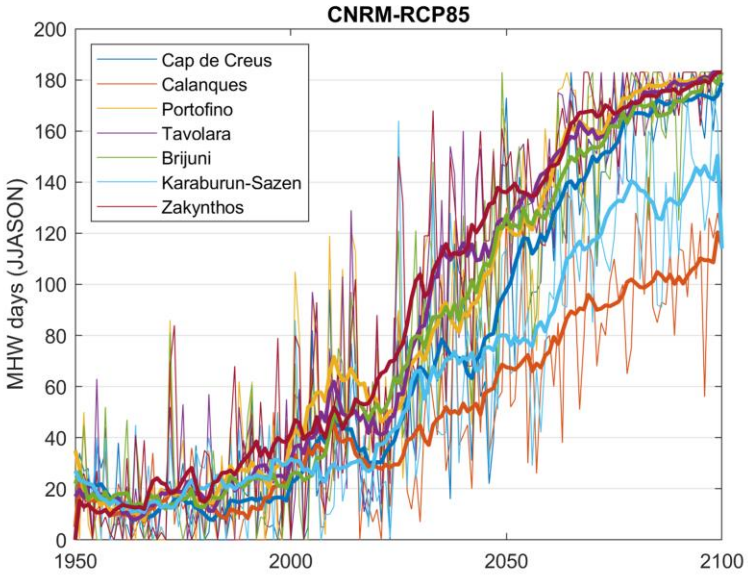


Fig.4. Projected marine heatwaves (MHW) days over the warm period (JJASON) of each year under climate change scenario 8.5.

- Sea level rise and acceleration

+ 20 cm since the end of 19th in Marseille
+ 37 à + 90 cm by 2100

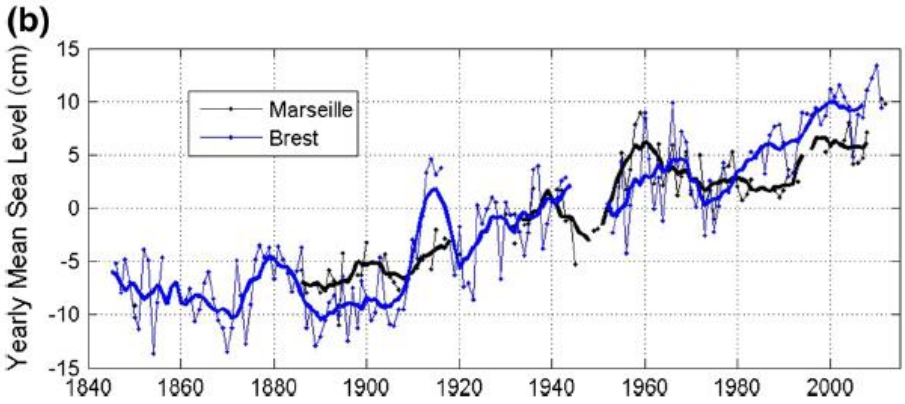


Fig. 5. Yearly mean sea level time series at Marseille (black) and Brest (blue) and 5-years running averages (thick lines), Wöppelmann et al. 2014

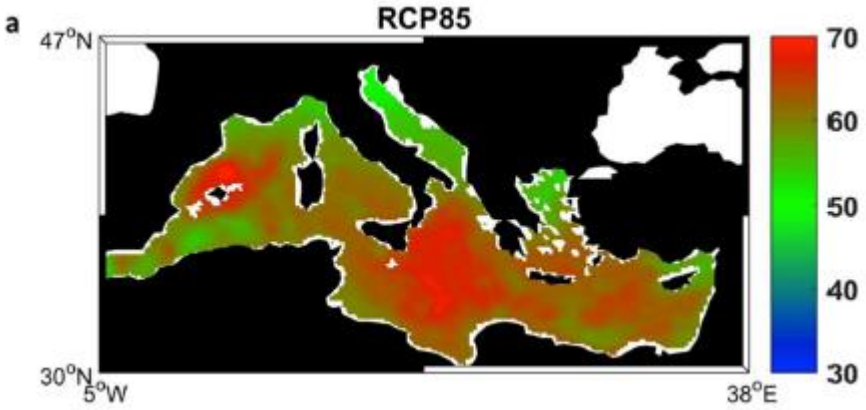


Fig. 6.Projected Mediterranean sea level rise averaged in (2080-2099) with respect to present climate (1980-1999), Jordà et al. 2020.

- Salinity increase and changes in marine currents

+ 0.48 à + 0.89 psu d'ici 2100 and water stratification

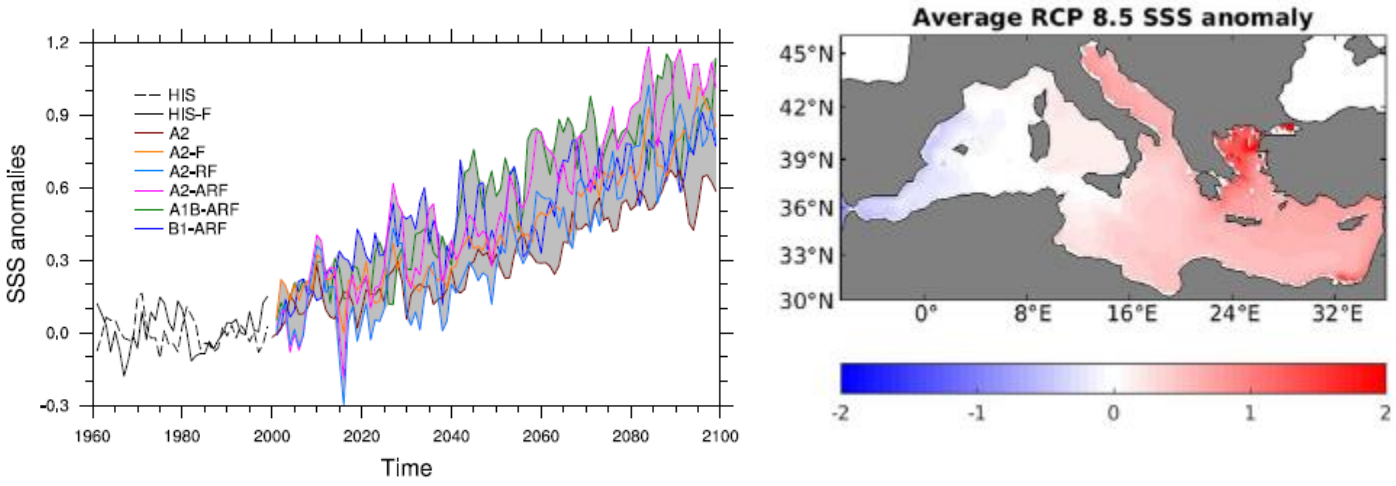


Fig. 7. Yearly mean time series of sea surface salinity anomalies (vs. 1961–1990) averaged over the Mediterranean basin [left]. Adloff et al., 2015. And average sea surface salinity anomalies (psu) for the RCP8.5 runs [right]. Soto-Navarro et al. 2020

- pH decrease and acidification

-0,25 à - 0,46 units of pH by 2100 (Goyet et al. 2016)

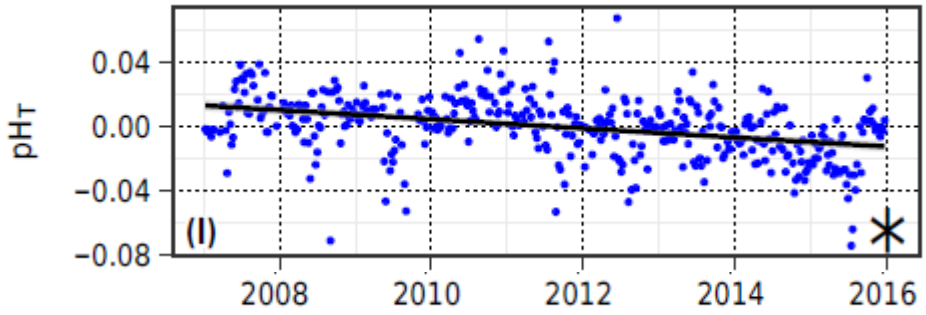


Fig. 8. Anomaly trends for seawater carbonate chemistry (pHT) at Point B, 1m, in the Bay of Villefranche-sur-mer. Regression slopes are drawn ±SE (standard error, in grey) and noted with a star for significance at α=0.05. Kapsenberg *et al.,* 2017.

## SOCIO-ECOLOGICAL VULNERABILITIES INDICES

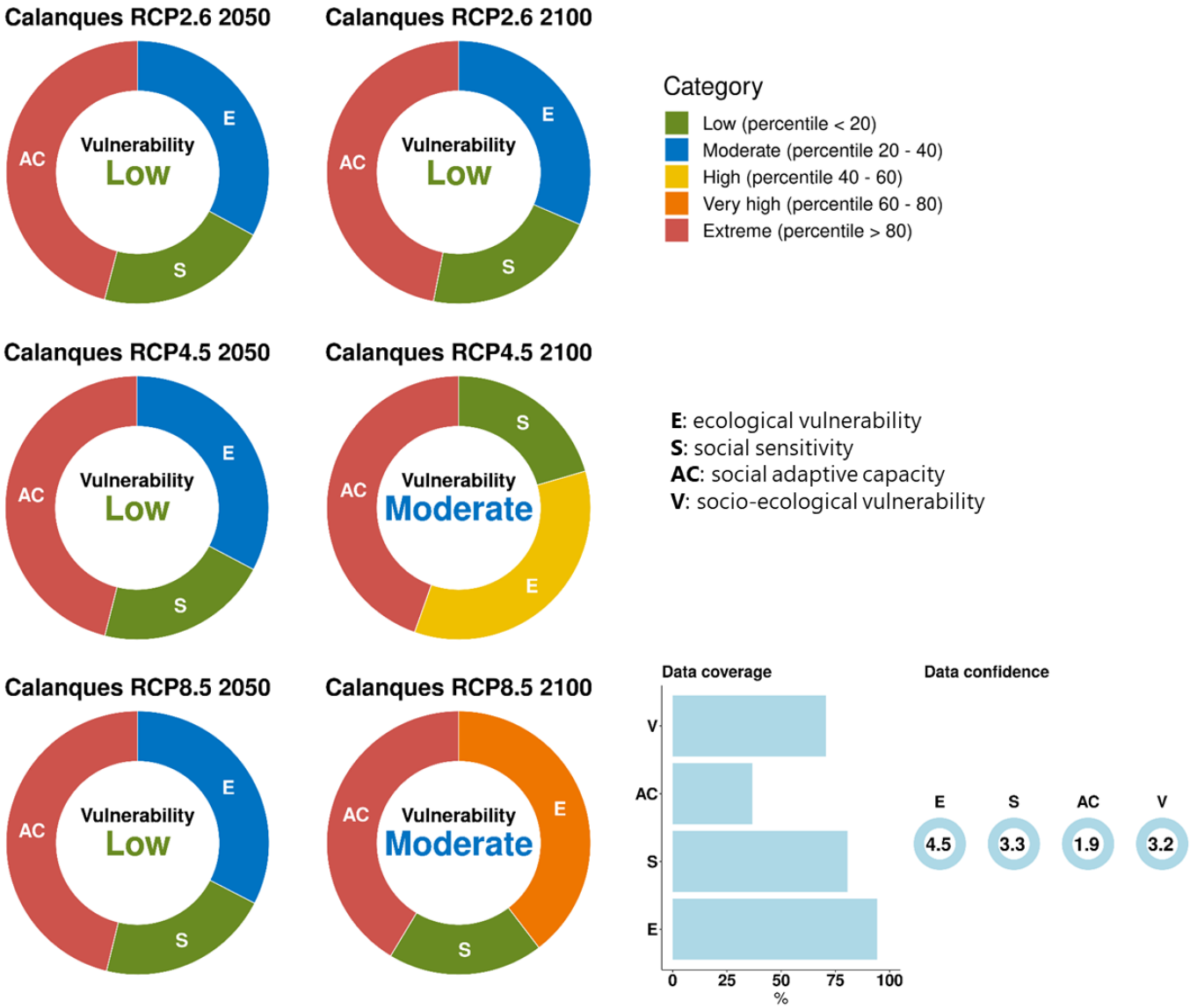


Fig. 9. Socio-ecological vulnerability index of the Calanques NP. Quality indices included for both 2050 and 2100 are the same

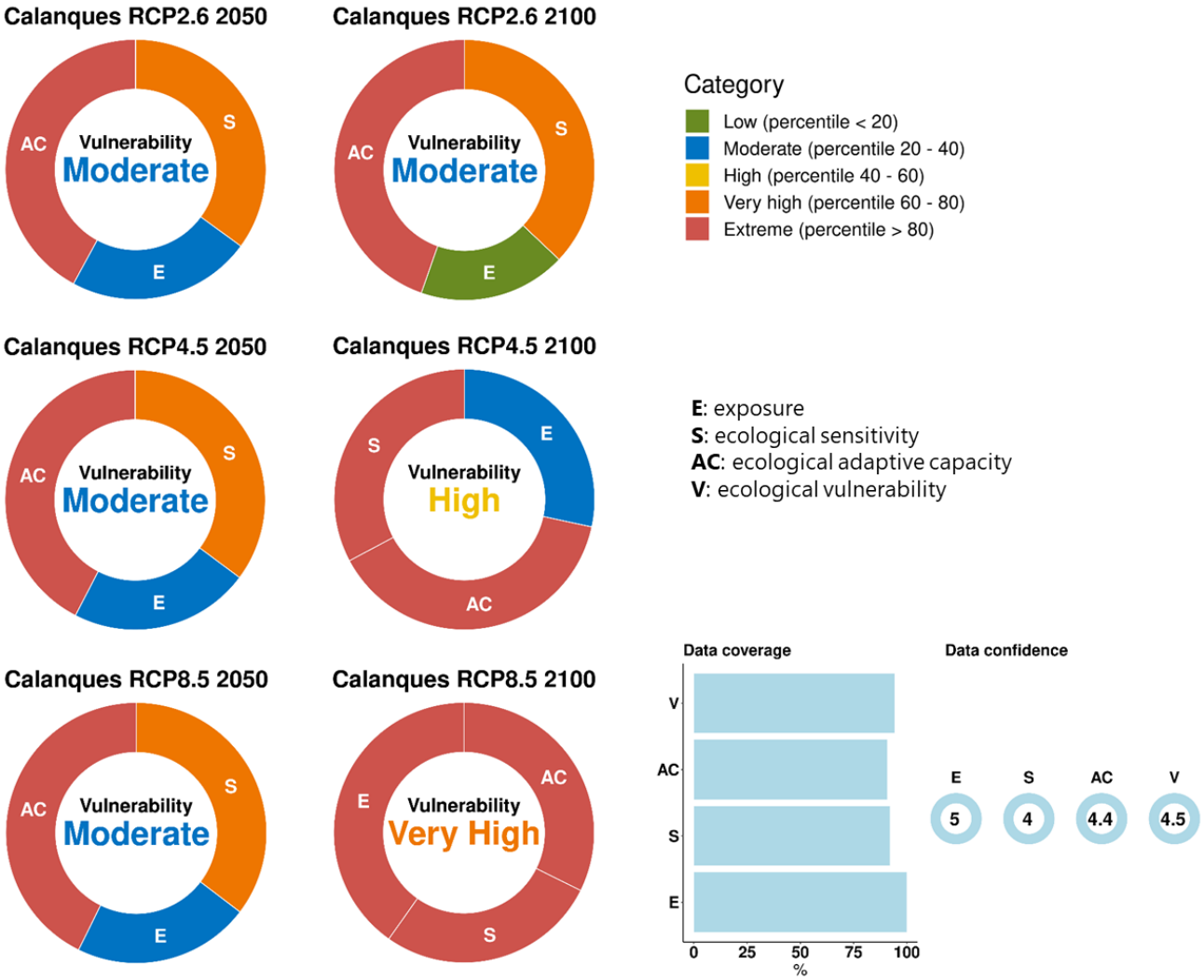


Fig. 10. Ecological vulnerability index results. Quality indices included for both 2050 and 2100 are the same

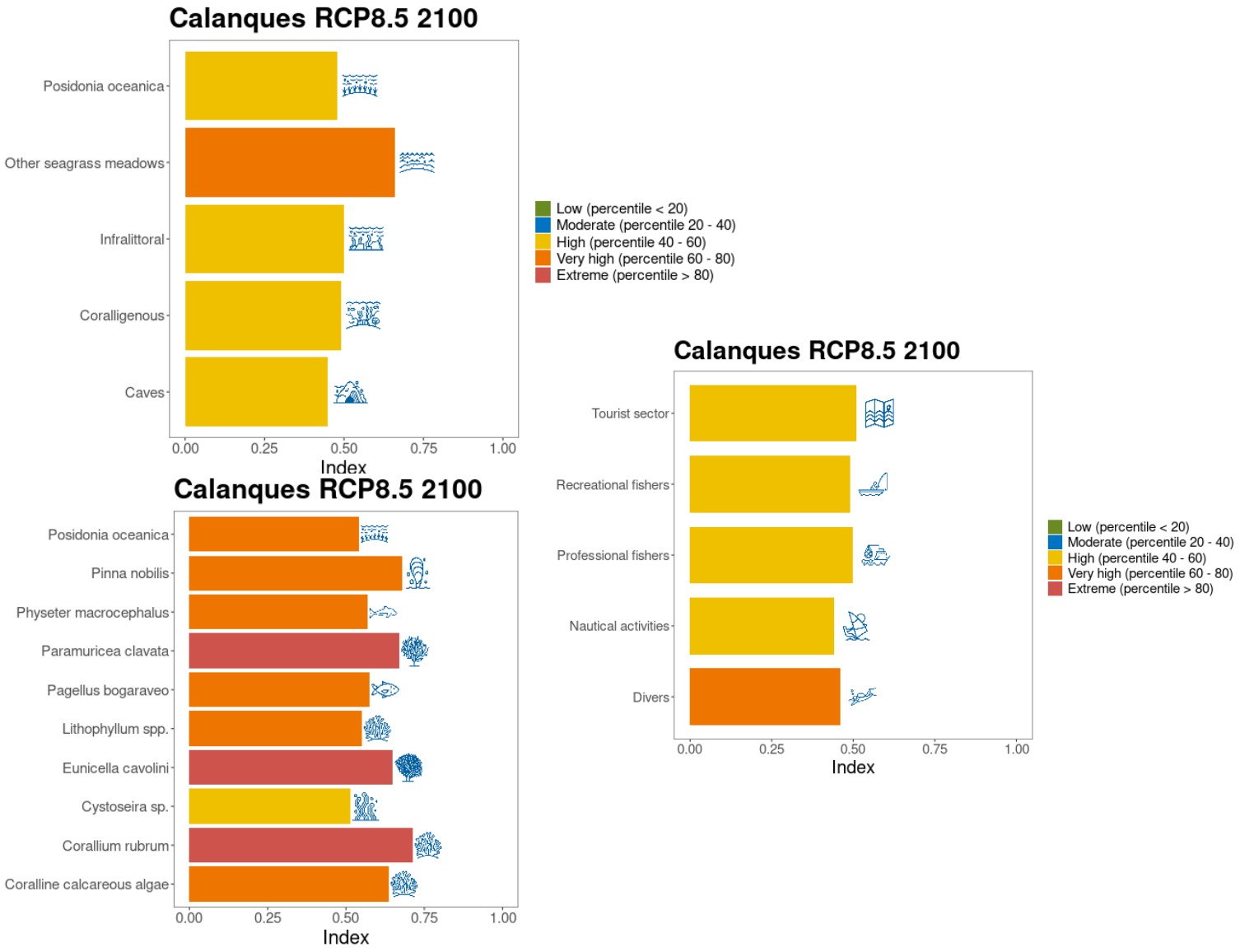


Fig. 11. Habitat, species and users vulnerability indices for the RCP8.5 scenario (pessimistic one).

## INDICATORS FROM MONITORING AND CITIZEN SCIENCE

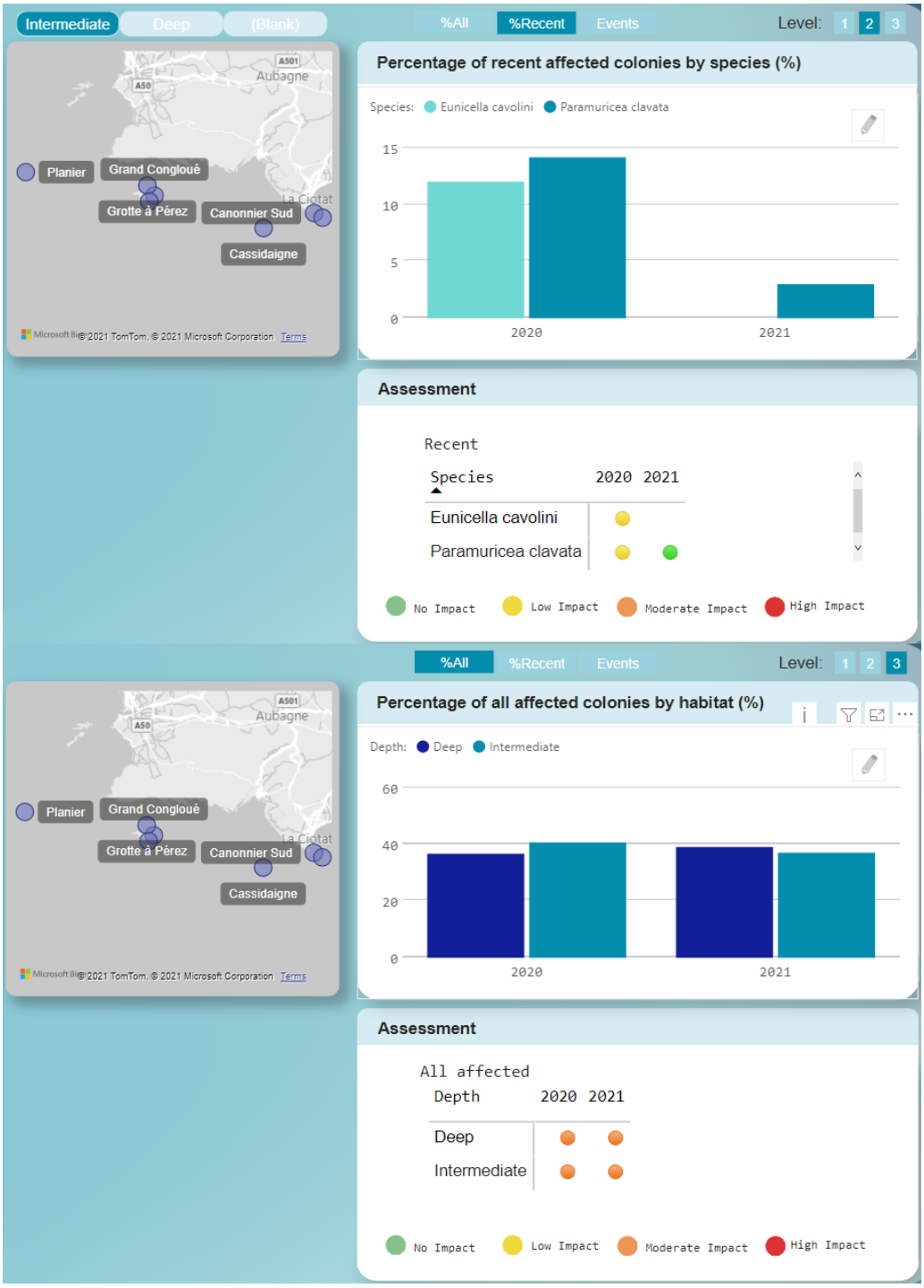


Fig. 12. Recent mortality data and assessment for *Paramuricea clavata* and *Eunicella cavolini* across site and depth ranges (top), and all mortality data and assessment across species and site by depth ranges (bottom). Yearly mean percentages of affected colonies by mass mortalities.


Fig. 13. Value of tropicalization index per year at each sampling site (top panel). Color-coded summary of tropicalization assessment is provided (bottom panel).

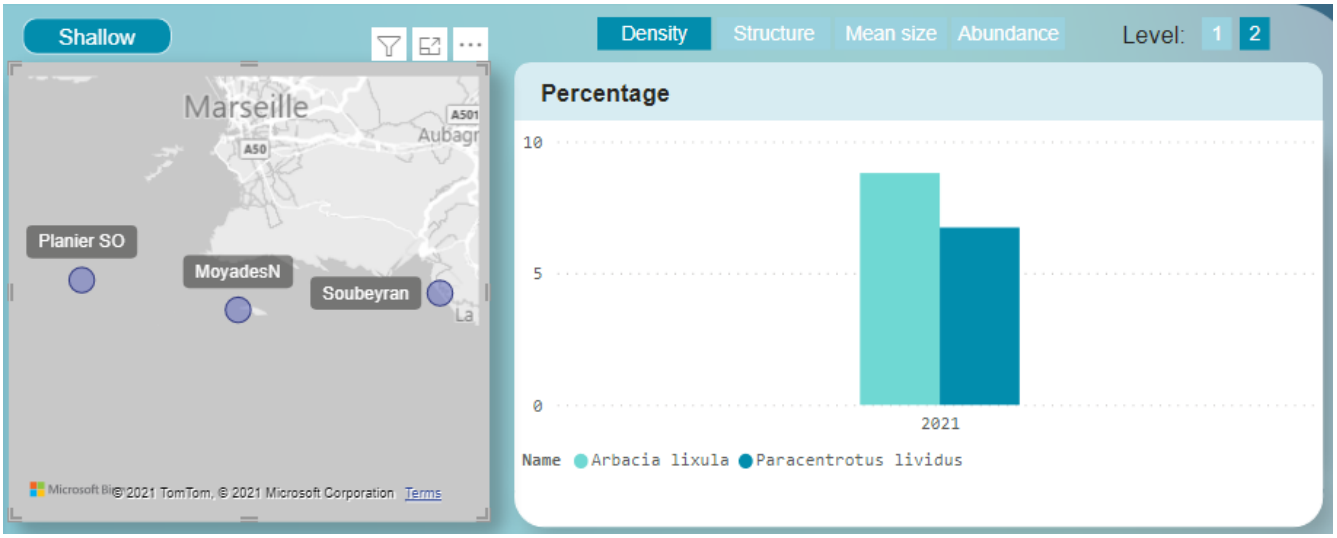


Fig. 14. Density of the species *Arbaxia lixula* and *Paracentrotus lividus* expressed in percentage per quadrat.

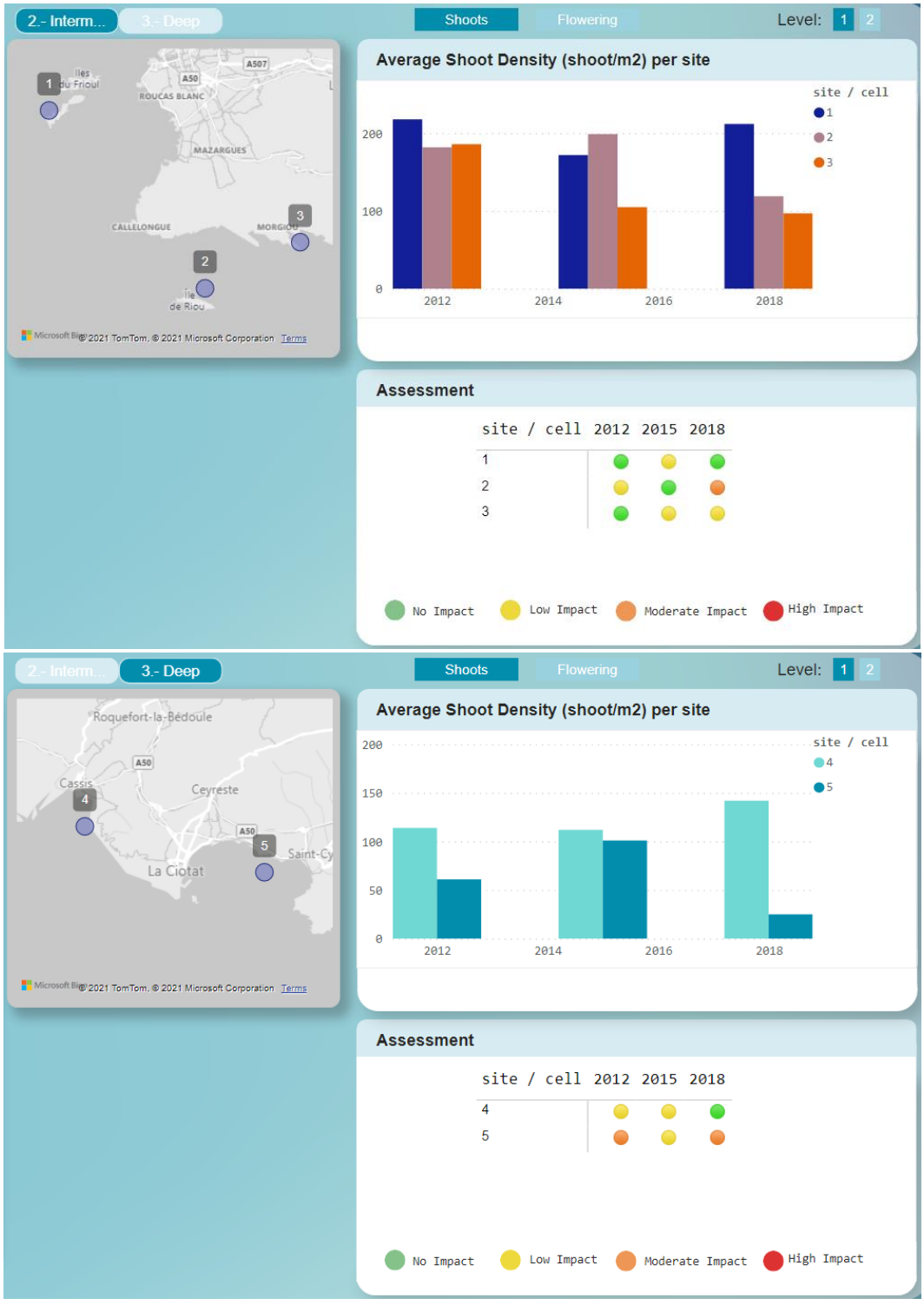


Fig. 15. Mean number of shoots/m2 in the monitored sites per each depth range (intermediate and deep) during the period 2012-2018 and assessment shown in the bottom panel.

## EXISTING MANAGEMENT PLANS

The **public reception strategy** of the Calanques NP is declined in different master plans:

- the **master plan of anchorage organisation**, which rethinks the hosting of nautical activities on the Calanques NP territory in coherence with the reality of these activities and their dynamics, and with the preservation of ecological stakes;
- the **master plan of recreational activities coherence**, which aims to find a balance between the protection of the Calanques NP fragile territory and the sustainable experiences of all recreational activities (freedom and responsibility);
- the **master plan of access**, which organize the access to the main entrances of the Calanques territory;
- the **master plan of interpretation**, which give a coherence to the discovery of the Calanques NP.

Those master plans were analysed to extract the relevant measures concerning the marine environment (species and habitats) and the users.

The **strategy for managing and decreasing the number of visitors** was created recently, in response to the attractiveness of the territory after the COVID-19 crisis and the very large number of visitors (about 3 millions, both local and tourists), which represents a heavy burden on the Calanques NP, whose initial and main vocation is the preservation of biodiversity. This operational action plan will help to prevent the potential human pressures on climate change vulnerable habitats and species, with some orientations about limitations of the number of visitors/users.

The **scientific strategy** of the Calanques NP is based on a systemic approach of biodiversity functionalities and of socio-ecological interdependencies in order to understand and manage sustainably its territory and heritage. By focusing on ecological solidarity issues, this scientific strategy considers the action of humans in interaction with other species in a shared environment, constituting nature. It is a guide for actions and for strategic vision of the MPA managers, highlighting the strong links between research and management (network). It is declined in large orientations to which the climate change adaptation belongs and the operational strategy associated that should be designed soon will share some objectives with the climate change action plan.

The **objectives document of Natura 2000 site** (« Calanques et îles marseillaises - Cap Canaille et massif du Grand Caunet ») aims to preserve/conserve habitats of community interest and heritage species, to improve the water quality and to limit and monitor the spread of invasive alien species, for the marine part of the Calanques NP. These general objectives and measures will be used to develop adaptation measures.

The **master plan of seascape** is the framework of the territorial project which aims to feed a common vision among maritime stakeholders. Its main objectives are to maintain the dynamics of life and the ecological balance, to maintain ecosystem services through a balance between attractiveness and protection, to develop a common culture around seascapes, and to assert a shared governance. This document constitutes a very good frame to work on the adaptation plan design. It can be also completed to have a climate change dimension (as it is not validated by the final governance body yet) and its articulation with the climate adaptation plan is crucial and must be flowing. Most of its actions fit climate change adaptation measures.

# 5. Priority actions to address climate change in Calanques MPA

In this section, the priority actions/responses which are considered by the Calanques NP managers to be undertaken for climate change adaptation are presented in the format of tables.

Adaptation responses can be of three types: increase adaptive capacity, reduce consequence or both. They are divided into seven thematics:

- ✓ Knowledge acquisition
- ✓ Posidonia / Coralligenous / Infralittoral habitats
- ✓ Diving sector
- ✓ Professional & recreational fishing
- ✓ Coastal tourism / Navigation sectors
- ✓ Horizontal & cross-cutting
- ✓ Ecological transition

They are also assigned to one or several of the following categories:

- ✓ Capacity Building & Awareness Raising
- ✓ Economic
- ✓ Protection & Restoration
- ✓ Regulation & Governance
- ✓ Research & Monitoring
- ✓ Technological

Each response is declined into one or several measures (more or less precise). Each measure is then featured with a number, a description, the target group, the expected results, the lead and those who should be involved in the implementation, a timeframe and performance indicators when possible (used to measure achievement of outputs or outcomes).

In total 36 adaptation responses and 78 measures have been developed based on our knowledge of climate change in the Calanques NP, which need further prioritization during the participatory process and maybe trimming.

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Knowledge acquisition** | | | | | | | | |
| Develop scientific research on climate change in the territory | 1.1 | Develop partnerships with researchers with the aim of deepening knowledge on the resilience and adaptation of species/habitats, refuge areas | Link with the scientific strategy and focus of some of the Calanques NP funding on these research priorities | Scientists | Applied research projects | Calanques NP PCS | Calanques NP CS | |
| | 1.2 | Co-finance a thesis on the development of indicators of the climate change impacts on the 3D structure of coralligenous habitats and on the optimisation of analyses using deep learning | | Scientists | Applied research projects | Calanques NP PCS | Calanques NP CS | 2022-2025 |
| | 1.3 | Acquire missing knowledge on the ecological status of marine habitats and species most vulnerable to climate change | | Scientists | Applied research projects | Calanques NP PCS | Calanques NP CS | |
| | 1.4 | Develop a reflexion on the quantification of ecosystem services | | Scientists | Management advices | Calanques NP PCS | Calanques NP CS | |
| | 1.5 | Integration of climate change and its impacts into the Marine Blue framework under consideration | | Scientists | Management advices | Calanques NP PCS | Calanques NP CS | |
| | 1.6 | Launching an internal dynamic to work on terrestrial climate change impacts and adaptation | | Calanques NP managers | Starting the process of the climate change adaptation plan building | Calanques NP PCS | Calanques NP CS | |
| Maintain the sea temperature observatory | 2 | Make the partnership agreement with OSU Pythéas durable and ensure its management | Purchase and progressive renewal of old data loggers potential addition of a line of data loggers in AMA around the Frioul archipelago (Cap Caveau or Tiboulen de Frioul) | Scientists | Long-term data series | Calanques NP PCS | OSU Pythéas diving department | 2022-2025 |

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Knowledge acquisition** | | | | | | | | |
| Monitor the abundance and distribution of cold and warm water species (native or invasive) | 3 | Implement FVC monitoring and an environmental watch | | Calanques NP managers | Long-term data series | Calanques NP PCS | Calanques NP CS | |
| Monitor the sea urchins populations | 4 | Implement sea urchins monitoring | | Calanques NP managers | Long-term data series | Calanques NP PCS | Calanques NP CS | |
| Establish a monitoring programme for *Lithophyllum byssoides* to sea level rise | 5 | Implement a periodic monitoring of Lithophyllum byssoides (every 10 year) | Assess the alive L. byssoides trottoirs and trampling decrease on them following recent restrictions<br>Previous monitoring carried out in 2016 | Calanques NP managers / Scientists | Coastal linear of alive L. byssoides trottoirs | Calanques NP PCS | Calanques NP CS | 2026 |
| Monitor the status of benthic invasive alien species | 6.1 | Implement an environmental watch of benthic invasive alien species | Extension of the distribution of identified species (e.g. Rugulopteryx okamurae, Asparagopsis armata, Caulerpa cylindracea, etc.), new NIS (BIOLIT citizen science programme), partnership with research institutes to study their impacts | Calanques NP managers | Early detection of new NIS | Calanques NP PCS | Calanques NP CS | |
| | 6.2 | Design a response procedure to new invasive NIS detection | Decision tree or series of instructions | Calanques NP managers | Better responsive management or monitoring | Calanques NP PCS | Calanques NP CS / Local authorities | |

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Posidonia / Corraligenous / Infralittoral habitats** | | | | | | | | |
| Monitor the status of *Posidonia oceanica* meadows, including depth limit and flowering events | 7 | Implement environmental watch | TEMPO monitoring sustainability | Calanques NP managers | | Calanques NP PCS | Calanques NP CS | |
| Monitor the *Pinna nobilis* resettlement | 8 | Implement environmental watch | Pinna rudis also monitored | Calanques NP managers | | Calanques NP PCS | Calanques NP CS | |
| Reinforce the implementation of existing regulations on anchoring and/or prohibit anchoring activities on Posidonia meadows to reduce seagrass fragmentation. | 9.1 | Ban on anchoring in shallow waters (<30m) for vessels over 24m | | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.2 | Establishment of ZIM (no mooring zones) | Marking to plan | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.3 | Establishment of ZMA (authorised/mandatory mooring zones) | Marking to plan | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.4 | Establishment/expansion/modification of ZIEM (no motorized vessels zones) | Marking to plan | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.5 | Creation of ZMEL (mooring and light equipment zones) | | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.6 | Installation of mooring boxes (for large ships) | | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.7 | Diving ecological mooring (reinforcement of existing capacities or equipment of new sites) | | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| | 9.8 | Set up an advisory committee on the organisation of moorings to monitor the implementation of the SGOM and its adaptation over time | participative, cohesive dynamics, global vision of the management of uses | Socio-economic actors | | Calanques NP PUA (SGOM) | | |
| Monitor the status of coralligenous communities and impacts | 10 | Implement mass mortality monitoring, photogrammetry and an environmental watch + CIGESMED protocol (health status of coralligenous habitats) | RECOR monitoring sustainability | Calanques NP managers | | Calanques NP PCS | Calanques NP CS | |
| Implement restoration activities targeting protected, endangered and rare species | 11 | | To develop | Calanques NP managers | | Calanques NP PCS | Calanques NP CS | |
| Strengthen efforts to reduce human pressures on habitats and species most vulnerable to climate change | 12 | | To develop, increase regulatory restrictions where necessary and surveillance measures/means (e.g pollution) | Socio-economic actors / Local authorities | | Calanques NP managers (PCS+PUA) | | |

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Diving sector** | | | | | | | | |
| Sensitize divers about the effects of climate change on marine ecosystems. | 13.1 | P4.1 Set up a "diving" commission to make it a regular forum for exchange and co-construction | Information to be provided on the naturalist issues related to the practice | Socio-economic actors | | Calanques NP PUA (SCSN) | | 2022 |
| | 13.2 | P4.2 Propose training sessions and awareness-raising tools for diving instructors | Promoting and develop the tools developed :<br>- diving charter<br>- kit of committed sportsmen and women designed for instructors proposed by the CPIE Atelier bleu / La Ciotat ;<br>- MPA Engage underwater brochures for environmental monitoring<br>- video and submersible booklet on diving for the PAMM-Méditerranée Occidentale (DIRM Med and OFB) | Socio-economic actors | | Calanques NP PUA (SCSN) | | |
| | 13.3 | P4.3 Make the rules of good practice known and remind people of prohibited sites at embarkation points. | Knowledge of diving charter and of the reasons for prohibitions & regulations | Socio-economic actors | | Calanques NP PUA (SCSN) | | |
| Engage divers in participatory monitoring of the impacts of climate change | 14.1 | Make the POLARIS partnership agreement with Septentrion Environnement durable and ensure its management | Ensure the continuity and strengthen citizen science already engaged in order to amplify and support the MPA capabilities to detect and quantify the ongoing ecological changes (e.g. invasive species, mass mortalities, population declines)<br>Content of parterhsip | Socio-economic actors / Citizens | | Calanques NP PCS/PUA (SCSN) | | 2022-2025 |
| | 14.2 | Developp a partnership with the local CODEP13 of FFESSM to increase citizen science activities | Through marine biology group and CROMIS tool | Socio-economic actors / Citizens | | Calanques NP PCS/PUA (SCSN) | | 2022 |
| | 14.3 | Implement LEK monitoring with diving clubs and promote an environmental watch | in current format and in revisited format with the waterproof tablets disttributed to diving clubs | Socio-economic actors | | Calanques NP PCS | | |

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Diving sector** | | | | | | | | |
| Improve knowledge of the activity in the Calanques NP | 15.1 | P1.1 Establish an inventory of dive sites and their typology | exploration, training, initiation, minimum level, etc. | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| | 15.2 | P1.2 Set up a more accurate system for measuring the number of divers on emblematic sites and in NTZ | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| Avoid congestion on the most emblematic dive sites and regulate the number of divers | 16.1 | P2.1 Identification of the most frequented and vulnerable diving sites | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| | 16.2 | P2.2 Development and implementation of measures to regulate the use of the most popular and vulnerable sites (e.g. Moyades, Planier, Ile Verte) | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| | 16.3 | P2.3 Reaffirmation of existing prohibited sites and readjustment of perimeters | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| | 16.4 | P2.4 Examination of a system for identifying the vessels of commercial or para-commercial diving operators | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| Organise a sustainable "Calanques NP" diving offer aimed at all levels of practice | 17.1 | P3.1 Strengthen "ecological anchorages" for the activity in line with the measures of the master plan of anchorage organisation | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |
| | 17.2 | P3.2 Make the Calanques NP diving offer known (particularly service providers with the Calanques NP Spirit label) | | Calanques NP managers | | Calanques NP PUA (SCSN) | | |

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Professional & recreational fishing** | | | | | | | | |
| Access the knowledge of local fishermen (professionals and recreational) to detect signals of ecological change and engage them in regular monitoring activities. | 18 | Implement LEK monitoring with fishermen and promote an environmental watch | in current format with some representatives of recreational fishing federations and in revisited format with the waterproof tablets disttributed largely | Socio-economic actors | | Calanques NP PCS | | |
| Develop targeted research actions aiming to fill in the information gaps related to key species targeted by professional fishers. | 19 | Participate in research projects as pilot site | e.g. Connectmed | Calanques NP managers | | Calanques NP PCS | | |
| Improve the knowledge of the fishing activities (both recreational and professional) | 20 | Fishing effort study | | Socio-economic actors | | Calanques NP PUA | | |
| Remove the fishing ghost nets and lines in the Calanques NP | 21.1 | Establish a sustainable partnership with Palana Environnement | to remove them and promote the valorization of them (recycling) | Socio-economic actors | | Calanques NP PCS/PUA | | |
| | 21.2 | Encourage the management of the GHOSTMED programme at the scale of the French Mediterranean coast | currently carried out by the MOI (research institute), could be transfered to the OFB for example | Scientists / Local authorities | | Calanques NP PCS/PUA | | |
| Encourage the versatility of fishermen | 22 | Support the diversification of fishermen's activities (fishing gear, seasons, target species, secondary activities) | development of pescatourism (tourist excursions to discover the fishing trade) or of passenger transport activities | Socio-economic actors | | Calanques NP PUA | | |
| Sustainable marine cooking | 23.1 | Promote sustainable fishing activities and undervalued local speicies consumption | added value of their products, species caught but not sold, PESCOMED project | Socio-economic actors | | Calanques NP PUA | | |
| | 23.2 | Promote the consumption and commercialization of warm-water species of either native or exotic origin | anticipate commercial value, development of new sales channels and receipies. | Socio-economic actors | | Calanques NP PUA | | |
| Reinforce the partnership with fisheries associations for implementing adaptive management measures | 24 | Fisheries Committee actions | PESCOMED project appropriation of MPA benefits special focus on the use of natural resources. | Socio-economic actors | | Calanques NP PUA | | |
| Apply regulations for professional and recreational fishing | 25.1 | Surveillance of No-take-Zones | improvment (automatic video monitoring) | Calanques NP managers | | Calanques NP PPE | | |
| | 25.2 | Possible extension of the marine core area of the Calanques NP to the Frioul archipelago | extending the recreational fishing regulations to this area | Calanques NP managers | | Calanques NP PCS/PUA | Calanques NP CS | |
| | 25.3 | Improvment of recreational fishing regulations | better consideration of species biology and migration periods in the guide for recreational fishermen | Calanques NP managers | | Calanques NP PCS/PUA | Calanques NP CS | |

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|---|---|---|---|---|---|---|---|---|
| **Coastal tourism / Navigation sectors** | | | | | | | | |
| Monitor the number of visitors / vessels and assess the impacts and disturbance on sensitive species and habitats | 26 | Strategy for managing and decreasing the over-visiting | load capacity on coast and at sea<br>automatic video monitoring at all the key maritime entries | Socio-economic actors / General public | | Calanques NP PUA | | |
| Engage actors in participatory monitoring of the impacts of climate change | 27 | Promote environmental watch and reporting of ecological changes | changes in vegetation growth rates (algal blooms or seagrass die-off events) through MesCalanques app | Socio-economic actors | | Calanques NP PUA/PCS | | |
| Encourage respect for regulations and other users | 28.1 | AN1.1 Elaboration in partnership of a charter for sailing in the Calanques NP | | Socio-economic actors | | Calanques NP PUA (SCSN) | | |
| | 28.2 | AN1.2 Be vigilant about access and launching points for users (lithophyllum trottoirs in particular) and dedicated practice areas. | | Socio-economic actors | | Calanques NP PUA (SCSN) | | |
| **Horizontal & cross-cutting** | | | | | | | | |
| Risk of coastal erosion and shoreline retreat | 29.1 | Establish a baseline and monitor beaches and cliffs | define the needs of monitoring in the core area and in the AMA | Local authorities / Calanques NP managers | | Calanques NP PATGP/PCS | | |
| | 29.2 | Encourage local authorities/municipalities to experiment with soft beach management in the core area and in AMA of the Calanques NP | Minimise beach nourishment and leave the coastline free to evolve or under adapted management<br>Preserve the Posidonia banks to protect against winter erosion (re-vegetat) | Local authorities | | Calanques NP PATGP/PCS | | |
| | 29.3 | Provide technical support to local authorities/municipalities and to state services working on the subject | e.g. DREAL PACA's Mon littoral platform | Local authorities | | Calanques NP PATGP/PCS | | |
| | 29.4 | Participate in raising awareness of municipalities and citizens/visitors to "soft" beach management | outputs of POSBEMED2, Charter of Commitment for Beaches with Posidonia, Mediterranean Posidonia Network (MPN), LIFE MARHA project | General public | | Calanques NP PATGP/PCS | | |

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|---|---|---|---|---|---|---|---|---|
| **Horizontal & cross-cutting** | | | | | | | | |
| Optimisation of the management capacities of the Calanques NP | 30.1 | Seek sustainable fundings to implement the measures of the climate change adaptation plan | ensure the monitoring & citizen sciences activities update tue vulnerability assessment | Calanques NP managers | | Calanques NP PCS/IF | | |
| | 30.2 | Evaluate the implementation of adaptation measures to assess the management effectiveness in the face of climate change | dashboard, link with the Calanques NP charter evaluation | Calanques NP managers | | Calanques NP PCS | | |
| Decision support tools and dialogue for adaptive management | 31.1 | Update the vulnerability assessment in 5 years | more accurate social data collected by then and update of some ecological data | Calanques NP managers | | Calanques NP PCS | | |
| | 31.2 | Organize the citizen science data treatment and valorisation | Plan the collection of the data obtained through POLARIS and online platform (MesCalanques and CROMIS) and the assessment process (integration to data templates of the monitoring tool of instance) | Calanques NP managers | | Calanques NP PCS | | |
| | 31.3 | Organize the monitoring data treatment | within the MPA staff and update of the monitoring tool | Calanques NP managers | | Calanques NP PCS | | |
| | 31.4 | Participate in the deployment / implementation of climate change adaptation strategies of local authorities | | Public authorities / Calanques NP managers | | Calanques NP PCS | | |

| Response description | Number | Measure title | Brief description | Target group | Expected result | Lead | Partners | Timeframe |
|---|---|---|---|---|---|---|---|---|
| **Horizontal & cross-cutting** | | | | | | | | |
| Raising awareness among the general public on climate change issues. | 32.1 | Develop awareness raising activities targeting MPA visitors on climate change effects and best practice responses at MPA level. | Plastic pirates campaign, Zero waste, good dees: calm/ no cigarette/ no waste<br>Organise, participate and/or promote seabed clean-up operations<br>Citizen science along the coast (BIOLIT) | General public | | Calanques NP PCS / PECDS | | |
| | 32.2 | Offer conferences, activities and events for the general public on climate change in the marine environment | Valorisation of the exhibition and awareness raising tools developed during MPA Engage<br>Roles of posidonia meadows and coralligenous habitats | General public | | Calanques NP PCS / PECDS | | |
| | 32.3 | Continue communication on social networks and in the press about climate change | | General public | | Calanques NP PCS / PECDS | | |
| | 32.4 | Develop and implement regular educational activities on climate change in the marine environment | AME, EDUCALANQUES network, schools, partnership with Lycée des Calanques<br>Youth for climate | General public / Shcools | | Calanques NP PCS / PECDS | | |
| | 32.5 | Include a section on climate change issues in the marine environment in existing training courses for local authority officers, decision-makers and socio-economic actors | | Socio-economic actors | | Calanques NP PCS / PUA | | |
| Share experiences on climate change in the marine environment and create synergies in the MPA network | 33.1 | Conduct a workshop/roundtable with neighbouring MPAs (Port-Cros NP, Côte Bleue) on the theme of climate change in the marine environment | | MPA managers | | Calanques NP PCS | | |
| | 33.2 | Participate in conferences/ seminars/ conventions on the subject of climate change in the marine environment | highlight the action of the Calanques NP<br>encourage collaboration (other managers, scientists, communities, etc.) | MPA managers | | Calanques NP PCS | | |

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|---|---|---|---|---|---|---|---|---|
| **Ecological transition** | | | | | | | | |
| Launch ecological transition actions in relation to activities/uses in the Calanques NP | 34.1 | Engage navigators to switch from diesel to low-sulfur fuels such as methane, natural gas or LNG fuels to reduce GHG emissions. | Consideration to be given to rental boats | Socio-economic actors | | Calanques NP PUA | | |
| | 34.2 | Energy transition of passenger ships | Plan de relance (600 000€) du PNCal, appel à projet en 2022 | Socio-economic actors | | Calanques NP PUA | | |
| Develop the Calanques NP exemplary nature | 35.1 | Electric motorisation of the vehicles (boats, cars, bikes) | | Calanques NP managers | | Calanques NP PUA / PATGP / Dir / IF | | |
| | 35.2 | Waste management and green office/field supplies | Improve recycling, compost, zero waste | Calanques NP managers | | Calanques NP PECDS / PATGP / SG | | |
| | 35.3 | Premises optimisation | energy balance/carbon balance towards efficiency and sobriety (reducing energy consumption); place of compensation | Calanques NP managers | | Calanques NP Dir / PATGP / IF | | |
| Participate in and encourage ecological transition actions initiated by local authorities and socio-economic actors | 36 | Provide support to ecological transition actions of local partners | city of Marseille/ Cassis/ La Ciotat, métropolis AMP, Department 13, Region Sud --> link with existing planning documents<br>Frioul maritime shuttle (hydrogen)<br>Powering the Grand Port of Marseille (electricity and hydrogen) | Public authorities / Socio-economic actors | | Calanques NP PUA / PCS / PATGP / Dir | | |