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Cooperation and adaptation to climate change: the case of sea turtles from a transcale perspective

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ABSTRACT: The rate of biodiversity loss (terrestrial and marine) is among the nine critical environmental thresholds associated with subsystems or biophysical systems of the planet, beyond which the Earth system would undergo unsustainable, abrupt and irreversible environmental changes. This factor is profoundly influenced by climate change and anthropic practices, elements that are leading to the reduction and fragmentation of habitats and the development of a series of important physiological repercussions within the species most affected by these phenomena. Among these, the so-called keystone species and umbrella species are certainly of great interest, i.e. those species that are fundamental for the balance and survival of the ecosystems that host them, and can therefore, by their presence or absence, act as indicators of the wellbeing of these biomes. In this context, the policies implemented on a national and international scale by political actors and the presence of centres specialised in the protection and care of these wild species are fundamental. Therefore, taking these considerations as a starting point, this research, through the observation and mapping of the phenomena that are affecting sea turtles, aims to emphasise how top-down policies mixed with bottom-up actions - with a view to safeguarding them by mitigating the impacts of anthropogenic practices and thus compensating for the impacts of modernity - can be considered not only as actions to mitigate the impacts of the anthropocene, but also as a first step towards a return to cooperation between humans and other animals as a method of adaptation, resilience and resistance of the Earth's inhabitants to climate change.

KEYWORDS: cooperation, animal geography, political ecology, climate change, biodiversity

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1. INTRODUCTION

The continuous degradation and constant reduction of natural habitats, coupled with the selective disappearance of certain predator species, have led, on one hand, to the numerical increase of species generally preyed upon and, often today, considered invasive, and on the other hand, have driven many wild species, in search of food, to leave the residual ecological niches ideally destined for them and to reach urban areas, which are effectively domains and territories exclusively human. These factors are thus linked to the disruption of ecosystem balances caused by human action, which, when faced with a perceived emergency, generally intervenes through new acts of violence and domination, rather than through the rebalancing and restoration of disturbed ecological systems, within a perspective that, therefore, exacerbates and formalizes spatial conflicts triggered precisely by the humans who feel harassed and/or harmed by these species. This line of thinking, connected to the concept of human exceptionalism (Srinivasan & Kasturirangan, 2016), stands in stark contrast to the healing of the

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“metabolic rift” of Marxian memory (Marx, 1980) and, therefore, to the characteristic of the Earth as oikos, the home of all living beings present upon it (hence the term 'ecology': study of the home). As suggested by Redpath et al., (2014), the human group likely misidentifies certain animal species as antagonistic. It is precisely by considering them as such that it transforms issues of cohabitation/coexistence and their perception into conflict, which is currently becoming “one of the most challenging issues in wildlife conservation” (Sabuhoro et al., 2023, p. 1). This perception, therefore, which "masks the underlying human dimension” (Redpath et al., 2014, p. 222) both in terms of anthropogenic impacts on habitats and in terms of human-human conflicts (animal rights/environmentalists vs. other interest groups), not only fails to consider the complex webs underlying the process of spatial production - which, as Tsing (2015) emphasizes, is inherently multispecies - but currently seems to limit the likelihood of finding effective solutions and moving toward a new alliance based on cooperation.

However, the dimension just described does not appear to be the only one in play since not all wild species are regarded as antagonistic by the human group. Although the anthropocentric perspective still prevails, some species, considered keystone or umbrella species and thus essential for the balance and survival of the ecosystems they inhabit, capable, through their presence or absence, of serving as indicators of the well-being of such biomes, are protected at various levels by specific regulatory instruments.

Starting from the two concurrent trajectories present within today's society - one of a productive nature, which sees nature and its inhabitants (both human and non-human) as resources to be exploited indefinitely, and the other, in contrast, aimed at restoring balance and reconciling these three elements - the present contribution, through the protection systems implemented at both global and local levels for marine turtles, a species on which the relevant geographical literature has focused little so far (Tisdell & Wilson, 2001; Campbell, 2007; Anderson et al., 2013; Ramírez-Cover, 2013; Havice et al., 2018; Nurhayati et al., 2022; Darmawan & Takewaka, 2024; Nur et al., 2024), aims to emphasize how top-down policies combined with bottom-up actions - in a conservation perspective linked to the mitigation of the impacts of human practices and thus compensating for the effects of modernity - can be considered not only as actions mitigating the impacts of the Anthropocene but also as a first step toward the return to cooperation between humans and other animals. It is a method of adaptation, resilience, and resistance of Earth’s inhabitants to climate change, aimed at the possible realization of constructive relations of cooperation and coexistence, deep and beneficial for all living beings, as, within a damaged planet, an alliance with other species is essential " to rebuild places of refuge; only in this way will it be possible to achieve a partial and solid recovery and reconsolidation of the Earth in biological, cultural, political, and technological terms” (Haraway, 2019, p. 146).

2. METHODS AND DATA

This research was conducted through an exploratory study, both desk and field-based. More specifically, the desk research involved a thorough collection and analysis of secondary data gathered from databases, academic journals, websites, and social media platforms (Facebook, Instagram, etc.). This initial level of analysis was complemented by direct investigation. In particular, the latter included interviews with key informants and participation, during the years 2018-2019, in the monitoring activities of nesting sites organized by the Sea Turtle Recovery Centre (STRC) of the Museum of Natural History of Salento (MSNS). The results of this investigation also enabled the creation of specific cartographic material produced using QGIS software (Figure 1 and Figure 2).

This study is situated within the field of animal geography and thus contributes to the body of research that considers animals as spatial actors and agents within territorial dynamics. The adopted approach is grounded in critical posthumanism and political ecology—frameworks that move beyond the nature/culture dichotomy to analyze multispecies relations and power dynamics that traverse ecological and social systems in an integrated manner.

3. MARINE TURTLE RECOVERY CENTRES (STRCs): A GLOBAL SCALE ANALYSIS

The link between human activities and the rise in global temperatures, which has been considered an "unequivocal" fact since the late 19th century (Hartmann et al., 2013, p. 198), is now well established (IPCC, 2023, p. 42). The IPCC (Intergovernmental Panel on Climate Change) has set a limit of maximum global temperature increase of 1.5°C relative to pre-industrial levels, beyond which conditions on the planet would no longer be "liveable". However, as of today (2011-2020), an increase of 1.1°C has already been reached compared to that period (IPCC, 2023) [see Note 1], while six out of the nine planetary boundaries identified as critical to maintaining a "safe operating space for humanity" have already been surpassed (Rockström et al., 2009a, 2009b; Steffen et al., 2015) [Note 2]. Among these critical environmental thresholds, associated with subsystems or biophysical systems of the planet, beyond which the Earth system would experience unsustainable, rapid, and irreversible environmental changes, is the rate of biodiversity loss (both terrestrial and marine) [Note 3], which is currently 100 times higher than its natural rate (Barbiero, 2011), leading toward what has been identified as the sixth mass extinction (Ceballos et al., 2015; Braje & Erlandsonb, 2013; Lewis & Maslin, 2019). Specifically, it is estimated that between 11,000 and 58,000 animal species go extinct each year (Dirzo et al., 2014), while climate change has been identified as the cause of the extinction of entire populations of more than 1,000 plant and animal species (WWF, 2022).

Among the impacts identified by the IPCC, should the temperature limit be reached or exceeded, are the increase in the frequency of marine heatwaves, with a subsequent heightened risk of oceanic biodiversity loss (also due to mass mortality events); short-term risks of biodiversity loss (ranging from moderate to high for forest ecosystems and kelp and seagrass ecosystems, and from high to very high for Arctic sea ice, terrestrial ecosystems, and warm-water coral reefs); degradation of permafrost; continuous sea level rise and the increased frequency and intensity of extreme events involving seawater inundating coastal human settlements, damaging infrastructure in these areas, with submergence and loss of low coastal ecosystems, expansion of soil salinization, and cascading risks for livelihoods, health, well-being, cultural values, food and water security (IPCC, 2023, pp. 98-99).

Among the species at risk in this context are also those of the *Cheloniidae* and *Dermochelyidae* families, which include the seven existing species of sea turtles [Note 4], all listed in the International Union for Conservation of Nature (IUCN) Red List. Due to their ecosystem functions, they are considered "umbrella species" for coastal and marine habitats and, due to their charisma, "flagship species", meaning they can attract public interest, thereby facilitating the implementation of conservation and habitat protection practices, thus serving as a driving force for conservation and simultaneously symbolizing ecosystem well-being (Frazier, 2005).

Currently, sea turtles are included in the following regulatory references (ISPRA, 2013):

- Washington Convention (1973; Appendix I: "Species that are severely threatened with extinction and for which trade is strictly prohibited");
- Bern Convention (1979; Appendix I: "Migratory species that are in danger");
- Bonn Convention (1979; Appendix II: "Migratory species that have an unfavorable conservation status and require international agreements for their conservation and management");
- Habitat Directive 92/43/EEC on the conservation of natural and semi-natural habitats and of wild fauna and flora (1992; Annex II: "Animal and plant species of community interest whose conservation requires the designation of special areas of conservation"; Annex IV: "Animal and plant species of community interest that require strict protection");
- SPA/BIO Protocol (1995; Annex 2: "Endangered or threatened species");
- Regulation (EC) No. 1967/2006 on management measures for the sustainable exploitation of fishing resources in the Mediterranean Sea, amending Regulation (EEC) No. 2847/93 and repealing Regulation (EC) No. 1626/94 (2006; Article 3).

This regulatory framework has enabled the creation of specific Recovery and First Aid Centers (STRCs; Figure 1), often real monitoring and research hubs at the local scale, with the aim of both

rehabilitating and releasing into the wild sea turtles found at sea or stranded on the shore, as well as monitoring their nesting sites, when present, which during the summer characterize certain coastal stretches: securing the area, potential relocation to a more suitable location (this happens when the nest is too close to the shore), biometric analysis, guiding the hatchlings to the sea after birth (in case of severe light pollution), and nest inspection.

In this regard, it should be noted that due to the rising seawater temperatures, specifically referring to the Mediterranean Sea, the nesting range is shifting increasingly northwest, extending its limits to new regions of southern and central Italy (Bentivenga et al., 2010; Marzano, Nannarelli & Scarafino, 2010; Garofalo et al., 2016; Carlino et al., 2020; Hochscheid et al., 2022; Mancino, Canestrelli & Maiorano, 2022). Furthermore, the increase in temperatures, combined with sand color, influences the sex of the hatchlings, leading to a higher number of female births (Laloë et al., 2014; Tanner et al., 2019).

An example of this is certainly the nesting boom that characterized the Salento region of Lecce during the summer of 2024, with a total of 81 nests recorded out of 104 for the entire region (48 of which were in Ugento, making it the leading municipality in Italy for the number of deposits; see the following paragraph). This phenomenon of nesting has significant economic, social, and cultural implications, as it represents both a major attraction for the beaches involved and an opportunity for raising awareness and developing specific knowledge within the local community.

The discovery of a nest and the subsequent actions of securing and monitoring it allow for direct contact with another species, enabling the local community to learn about its specific characteristics through information provided by the operators. An alien species thus becomes, for the local community, something to care for and protect, producing an additional impact: the beach, understood both as a public space and as a liminal space (Preston-Whyte, 2004), gains another factor of characterization in the development of a sense of place by the users.

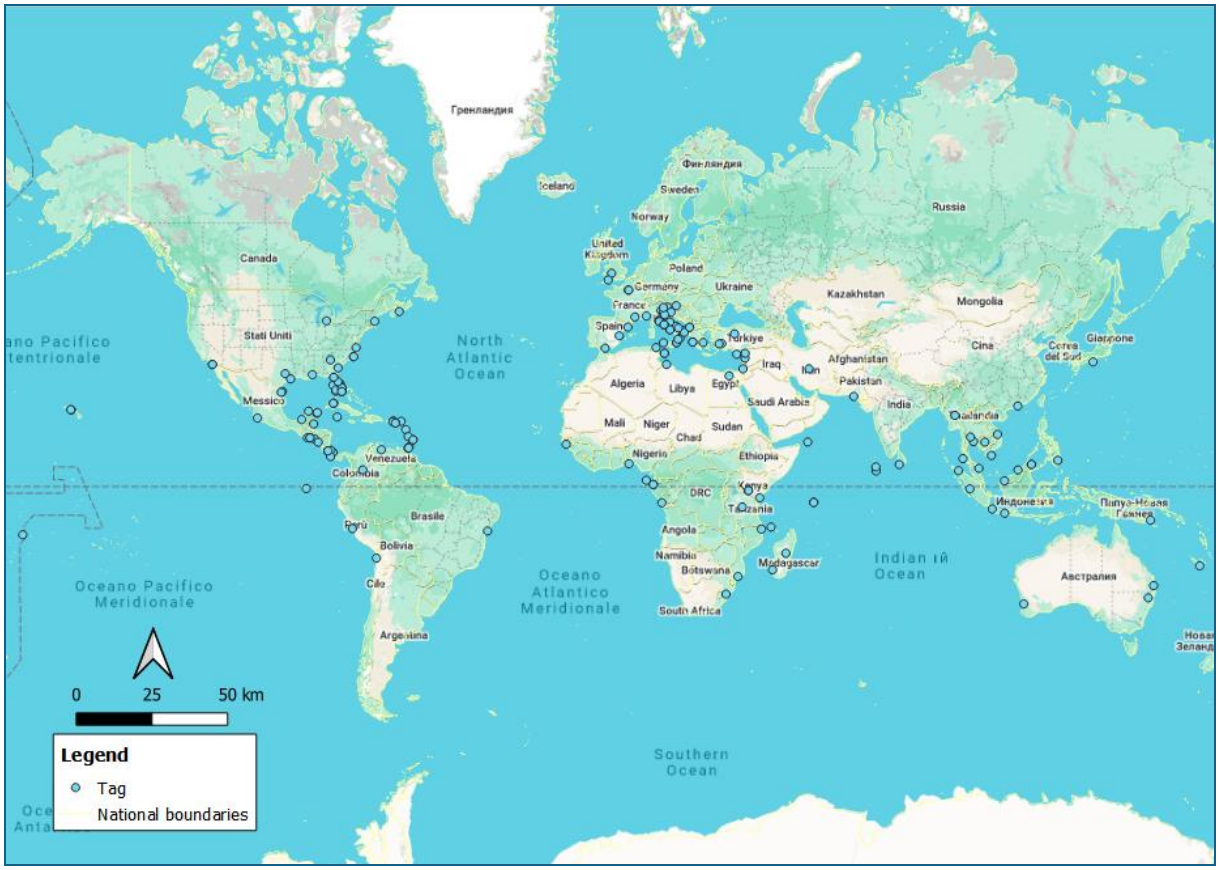

Figure 1. Mapping of Tag series present on a global scale.
Source: Own processing through QGIS software.

Regarding the global distribution of such centers, it is important to highlight that the data in the inventory of tags, which are plastic or metal labels that STRCs must attach to each rehabilitated and

released turtle, and which are updated by the Archie Carr Center for Sea Turtle Research (ACCSTR), has allowed for a mapping, albeit partial, of STRCs and research projects (also promoted by various institutes) worldwide [Note 5]. This has resulted in 1,371 tag series held and associated with 174 institutions, 24 of which are located in Italy (currently, there are 23 STRCs in Italy, not all of which are listed in the aforementioned inventory; Figure 1 and Figure 2).

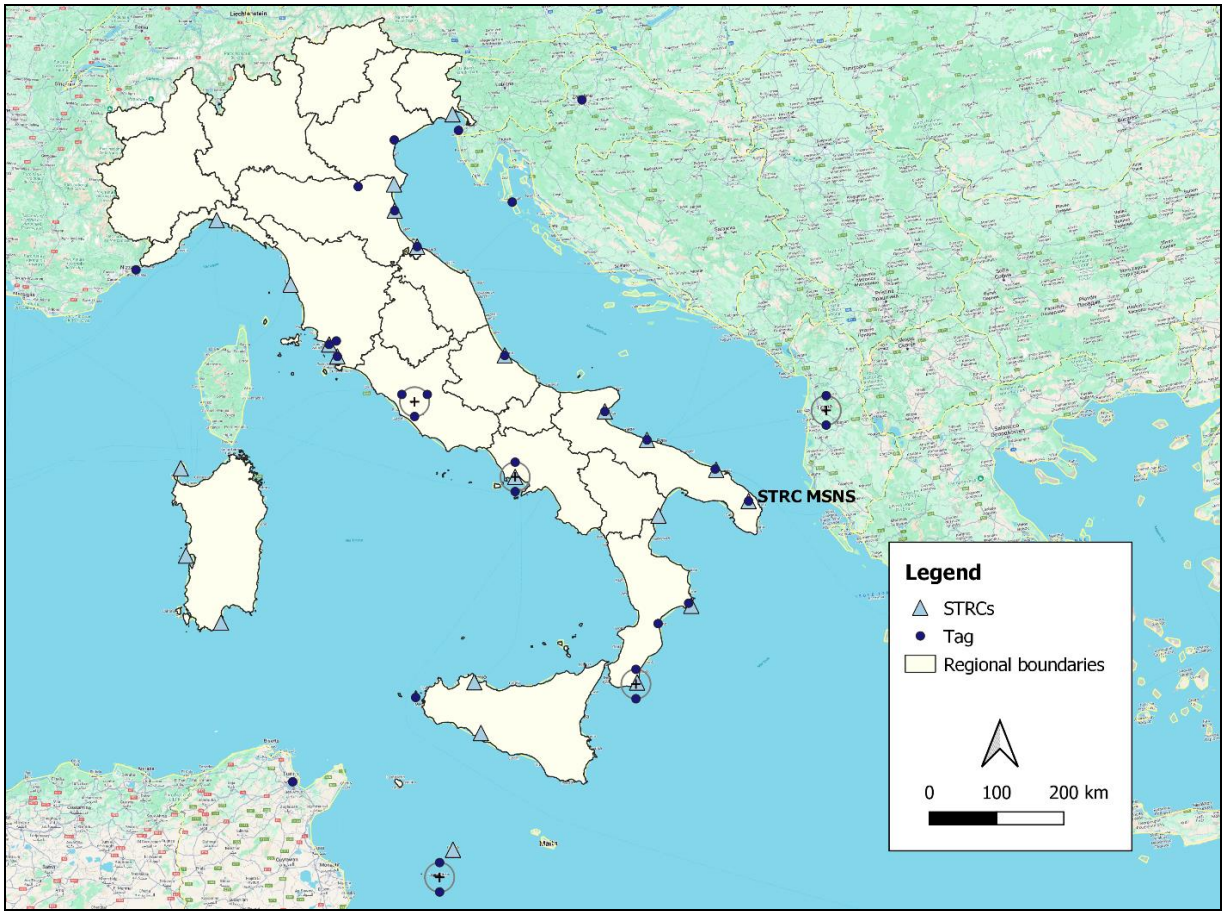

Figure 2. Mapping of CRTMs present in Italy and tag series.
Source: Own processing through QGIS software.

4. THE SEA TURTLE RECOVERY CENTRE (STRC) OF THE NATURAL HISTORY MUSEUM OF SALENTO: A LOCAL CASE STUDY

The Sea Turtle Recovery Centre (STRC) of the Museum of Natural History of Salento (MSNS; Calimera, Italy; Figure 2) was established in 2017 (becoming fully operational in 2018), to rehabilitate and release into the wild sea turtles found at sea or stranded on the shores of the Salento region, as well as monitoring their nesting sites discovered during beach monitoring activities and/or reported by citizens during the summer period (Figures 3 and Figure 4).

Figure 3. Ward of STRC and two sea turtles in the recovery centre.
Source: Author's photograph.

Figure 4. *Caretta caretta* nesting site.
Source: Author's photograph.

The role of this facility, both within the local area and at a broader regional scale, is undoubtedly fundamental to the conservation of this species. This observation is attributable to the various intervention strategies implemented, which characterize the STRC of the MSNS as a cross-cutting actor within the Local Territorial System: a) rehabilitation function and reintroduction to the wild; b) monitoring and management of nesting sites; c) scientific research; d) networking operations; e) design and promotion of targeted communication campaigns and specific events.

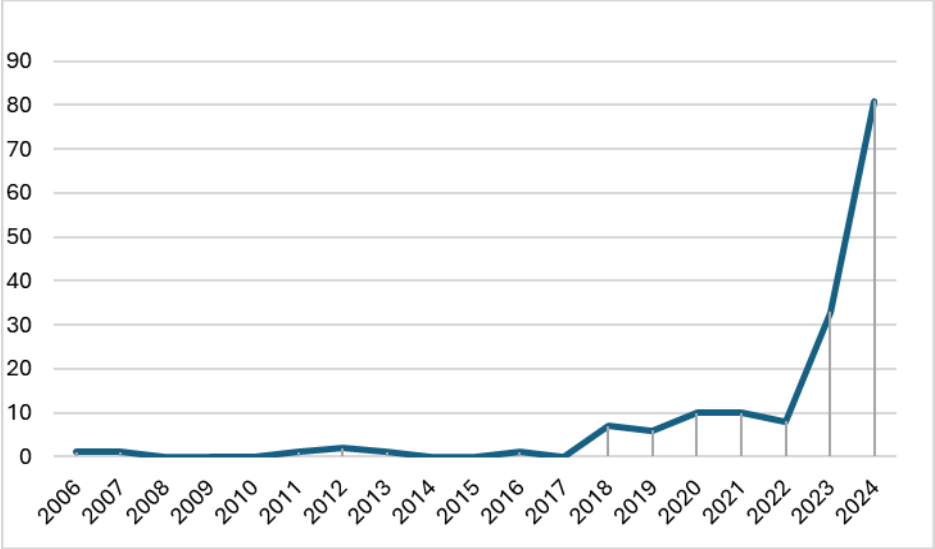

Figure 5. Recorded nesting events in Salento (2006-2024).
Source: Author's elaboration.

For the period 2018-2022, the data on the admissions to the STRC registered a steady increase, reaching a peak of +102% in 2022. This increase is likely attributable to two factors: on one hand, the establishment of an organizational network between the STRC, coastal municipalities, the Coast Guard, and environmental associations operating in the province of Lecce (which has allowed for the improvement and strengthening of monitoring activities); on the other hand, the design and development of awareness campaigns aimed at enhancing basic knowledge, engaging local communities, and facilitating communication between citizens and relevant authorities (Carlino et al., 2020). Another significant initiative in this regard was the recruitment of "Seaturtle Watchers" starting in June 2020, a network of

volunteers who, under the coordination and training of the Centre, provide support to the STRC's activities. This support became crucial during the nesting and hatching period, particularly due to the exponential increase in the number of nests recorded since 2018 and the extension of the nesting season, both of which are correlated with rising temperatures (Figure 5).

More specifically, the specimens cared for by the center during the aforementioned period numbered 220, of which 29% were admitted for anthropogenic causes (ingestion of hooks and lines: 17%; entanglement in nets and/or plastic debris: 6%; collisions with boats: 5%; intentional killing: 1%), and 71% for natural causes (cold stunning: 46% and/or debilitation: 25%). These percentages, however, are heavily influenced by the phenomenon of cold stunning, hypothermic stunning that primarily affects juvenile specimens (hatchlings), causing weakness and inactivity (Christiansen et al., 2016). Without this factor, admissions due to anthropogenic causes would account for 53%, while those due to natural causes would account for 47%. This exclusion from the total count is possible because the marine turtle species treated at the center (*Caretta caretta* and *Chelonia mydas*) reach sexual maturity between the ages of 16 and 28 (Casale et al., 2009; Van Hautan et al., 2018), which, from an ecological standpoint, makes younger specimens unsuitable for the species' perpetuation and thus for its survival, unlike adults, on which data shows a high impact from anthropogenic practices.

In addition to being an operational center, the structure also serves as a research center. The data collected through recovery, rehabilitation, and monitoring activities are analyzed and shared with other institutions, and over time have led to several publications. The networking activities developed by the center have been particularly fruitful. Currently, the STRC of the MSNS has established various agreements and collaborations with research institutions, organizations, and associations, both at the local, national, and international levels, through which numerous research, cooperation, and awareness projects have been carried out over time. Among these, the NEMO – Mediterranean Coastal Communities project and Blue Tyre are particularly noteworthy. The former, launched in 2014, funded by the Italian Cooperation and implemented by CIHEAM Bari, in collaboration with the Lebanese Ministry of Agriculture and key stakeholders in the Tyre coastal community (Tyre Nature Coast Reserve, Tyre Municipality, Tyre Municipalities Union, GAL TYROS, Mosan Center, Fishermen's Union and Cooperative), aimed to "create sustainable development for Mediterranean coastal communities in the fishing, agriculture, and tourism sectors" [Note 8], with active participation from STRC in the creation of the Sea Turtle Exhibition, a permanent exhibition area dedicated to marine turtles managed by the Tyre Nature Coast Reserve, aimed at raising awareness among both insiders and outsiders about the importance of turtle conservation, with particular emphasis on threats from human activities. The latter, led by the Municipality of Tricase with the participation of the *Cooperazione nei Territori del Mondo* association, the Department of Biological and Environmental Sciences and Technologies at the University of Salento, the *Magna Grecia Mare* Association, and the *Naturalia* Cooperative (currently managing the MSNS), funded by the Italian Agency for Development Cooperation, aims to promote sustainable and resilient coastal development in the coastal and marine area of Tyre, Lebanon. This 36-month project, launched in 2021, targets local institutions and communities to "implement measures for adaptation and prevention of climate change risks and provide marine-coastal waste management and environmental monitoring services" [Note 9]. Among the planned actions was the creation of an environmental observatory and a marine turtle recovery center within the Tyre Coast Nature Reserve. In this context, the researchers and operators from the STRC of MSNS have structured several moments of discussion and training with the local community, both in Tyre and in Salento, to share experiences and best practices.

The structure is also part of the AdrioNet network – the Adriatic-Ionian Network for coordination among Sea Turtle Rescue Centers – created to coordinate and standardize intervention methods and protocols, share management experiences, establish common data collection rules to conduct broader and more significant scientific studies, enhance its influence with decision-makers, and, similarly, implement information campaigns targeting citizens to promote programs and initiatives aimed at safeguarding turtles and, more generally, biodiversity and the good conditions of the Adriatic and Ionian Seas in all their components [Note 10]. To date, the network includes six centers: Torre Guaceto Marine Protected Area, Cetacean Study Center Onlus, "Luigi Cagnolaro" Pescara STRC, MSNS STRC, WWF Molfetta STRC, Cetacea Foundation Onlus, Rimini/Riccione Center, and WWF Bosco Pantano Oasis.

Another significant aspect of this specific case study concerns the development of events and projects aimed at raising awareness both among the visitors to the MSNS, where the STRC is located, and more broadly among the general public. Among these, we can certainly highlight the initiatives of reintroducing rehabilitated specimens into nature, the creation of a life cycle exhibition dedicated to marine turtles within the museum's exhibit paths (Figure 6), and an open rehabilitation room, both inaugurated in 2021, as well as educational workshops for schools and families.

Figure 6. Exhibition hall dedicated to sea turtles at the MSNS.
Source: Author's photograph.

5. CONCLUSIONS

Due to their intrinsic characteristics, which are related to both their evolutionary history, their distribution range, and their life cycle, sea turtles currently serve as an important bioindicator of the effects of climate change on coastal and marine ecosystems (Hawkes, 2009; Patrício, 2021).

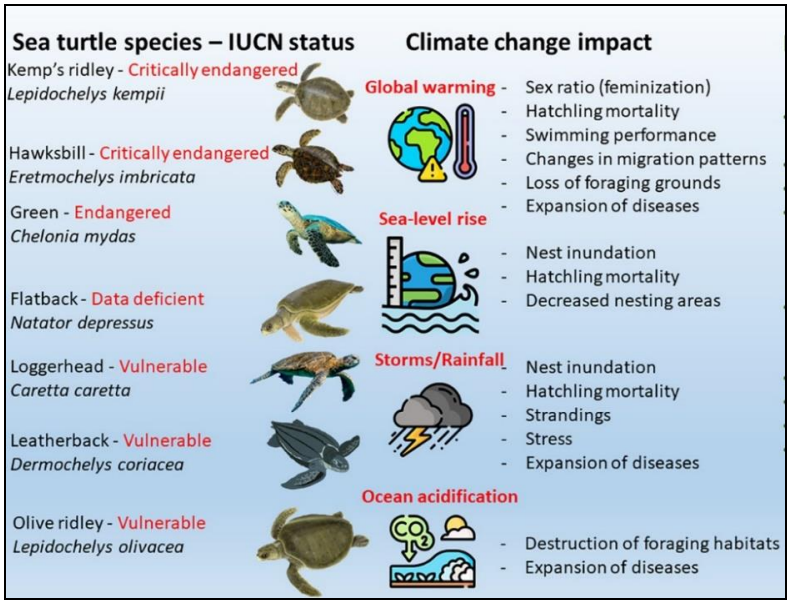

Figure 7. The major effects of climate change on sea turtles.
Source: Simantiris, 2024.

More specifically, climate change, particularly concerning phenomena such as sea level rise, extreme weather events, temperature increases, and ocean acidification (Simantiris, 2024; Figure 7), is recognized as one of the five threats identified for all seven species by the Marine Turtle Specialist Group (MTSG) of the Species Survival Commission (SSC) of the IUCN [Note 11].

As highlighted in the previous sections, the establishment of STRC both globally and locally represents a blend of top-down policies and bottom-up actions, thus forming a new bridge between humans and other animals. In this context, the concept of care, in its many forms, becomes predominant and serves as a potential tool for implementing adaptation and mitigation actions in response to climate change.

However, this state of affairs is undermined by the broader context, as these centers partially see their efforts thwarted when the rehabilitated animals are released into an environment that remains degraded, within an overexploited territorial context, and a culture driven by anthropocentrism and an extractivist economy.

This contradiction, however, highlights how STRCs still hold significant potential for change—not only as spaces for interaction between different species (humans and sea turtles) but also as producers of new symbolic and material places of interaction and awareness, where trans-species alliances are experimented with. These alliances, as suggested by Lorimer (2007), represent novel relational configurations in which animals are not mere recipients of care and protection, but active subjects in the co-construction of shared landscapes, the co-production of space, and the transformation of environmental governance practices. In this sense, the notion of trans-species alliance should not be understood as merely rhetorical, but rather as a genuinely geographical category—one that can activate both theoretical and practical reflections on the role of nonhuman life forms in territorial processes. By intersecting concepts such as place, scale, network, and landscape, it contributes to problematizing the exclusively human status of spatial and environmental actions and, more broadly, to rethinking geography as a multispecies field of study. From this perspective, it emerges as a socio-ecological and territorial practice that enables us to imagine new forms of coexistence in times of ecological crisis. Building alliances thus means envisioning new modes of ecological territoriality in which the human is no longer at the center, but part of a broader constellation of agents, memories, relationships, and interdependencies. It calls for a reconfiguration of geography not as a discipline centered solely on the human, but as a multispecies field capable of interpreting and accompanying territorial transformations driven by complex interspecific relations. It is in these hybrid spaces—such as STRCs —that new territorial narratives emerge, capable of re-signifying human action through the lens of care, responsibility, and coexistence.

As evidenced by the local case study, the establishment of such centers can lead to the development of specific projects, including thematic pathways and other scientific and outreach initiatives. These initiatives, also through the use of mass media and particularly social media platforms [Note 12], allow for the raising of awareness among visitors and the general public regarding the importance of biodiversity, the impacts of climate change on it, and its protection and conservation.

In this regard, it is worth noting that, from the very first findings, the nests discovered along the Salento coast have never been subject to acts of vandalism. On the contrary, they have become an attraction for the local community and, consequently, an appealing element for the beaches on or near the nesting areas. The analysed case study highlights how these structures potentially possess a dual dimension of awareness and intervention, both local and transnational, through the concept of transcalarities, which, even through the use of citizen science, helps engage citizens and expand their territorial presence.

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Use of AI tools declaration
The author declares they have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflicts of interest

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

NOTE

1. In particular, 2024 was the first year with an average temperature 1.5° higher than the pre-industrial period (source: https://climate.copernicus.eu/global-climate-highlights-2024).
2. The planetary limits identified by Rockström et al. [19, 20] are: climate change, rate of biodiversity loss (terrestrial and marine), interference with the nitrogen and phosphorus cycles, global freshwater use, land-use change, chemical pollution, ocean acidification, stratospheric ozone depletion and atmospheric aerosol load, of which the first six are exceeded to date.
3. According to Article 2 of the 1992 Convention on Biological Diversity (CBD), "biological diversity" is defined as: "all forms of variability among living organisms, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (ONU, 1992).
4. *Dermochelys coriacea* (leatherback turtle), the only species belonging to the family *Dermochelidae*; *caretta caretta*, *chelonia mydas* (green turtle), *natator depressus* (or flat-backed turtle), *lepidochelys kempii* (kemp's turtle), *lepidochelys olivacea* (olive turtle) and *Eretmochelys imbricata* (hawksbill turtle), the latter species belonging to the *chelonidae* family (Figure 7).
5. It should be emphasised that the inventory (https://accstr.ufl.edu/resources/tag-inventory/), which includes the tag series, the tag manufacturer and style, the ocean basin where the tags were used and the reference organisation, may not be exhaustive as it is limited to external tags and does not include PIT tags. Specifically, it includes all tag series issued by ACCSTR since the 1950s, when Archie Carr began distributing tags, and all tag series issued by the Cooperative Marine Turtle Tagging Program (CMTTP) originally issued by NMFS and now by ACCSTR. The inventory also includes tag sets that researchers have submitted for inclusion in the database. In addition, other tag sets that the Centre knows have been used but for which it does not have complete data are also listed (accstr.ufl.edu/resources/tag-inventory).
6. "Seaturtle watcher. Un anno di attività da guardiani delle tartarughe marine", a documentary that won the Earth Day 2022 Award at the Cefalù Film Festival, "for having documented with a film the securing of some sea turtle nests on the beaches of Torre San Giovanni in the province of Lecce. For the beautiful images with which it shows the general public the care that was given to 450 small sea turtles for four months" (festivalcinemacefalu.it; Retrived from: https://festivalcinemacefalu.it/index.php/2022/04/22/il-premio-speciale-earth-day-a-seaturtle-watcher-di-andrea-fiorito/).
7. Retrieved from: https://www.seaturtlewatcher.com/
8. diari.aicstirana.org; see https://diari.aicstirana.org/2017/05/10/porto-palermo-e-il-progetto-nemo/
9. www.ctm-lecce.it; see https://www.ctm-lecce.it/it/causes/blu-tyre-partenariato-locale-per-lo-sviluppo-marino-e-costiero-sostenibile/
10. Retrieved from: https://www.tartalife.eu/it/nasce-adrionet-una-svolta-epocale-la-tutela-delle-tartarughe-e-del-mare
11. These threats are both anthropogenic and natural and concern: bycatch from fishing activities, coastal development, pollution (plastic waste, fishing-related waste, chemical pollutants, etc.) and pathogens, direct capture and illegal trade (food, oil, leather, jewellery) and climate change.
12. The CRTM of the MSNS is present both on Facebook ("Centro Recupero Tartarughe Marine - Museo di Calimera": 8299 likes and 9782 followers, creation date: 13.05.2020) and on Instagram ("crtm_calimera": 1,584 followers and 165 posts, the first dated 02.06.2021). Data updated as of: 03.02.2025.

REFERENCES

Anderson, S.J., Nuernberger, S., Yamamoto, K.H., Sutton, P.C. (2013), Evaluating the Compliance of Sea Turtle Light Ordinances in Florida Using Remote Sensing. *Geography Compass*, 7, 867-878.
https://doi.org/10.1111/gec3.12088

Barbiero, G. (2011). Gaia e il simbionte umano. *Naturalmente*, *24*(3), 3-11.

Bentivegna, F., Rasotto, M.B., De Lucia, G.A., Secci, E., Panzera, S., Caputo, C., Carlino, P., Treglia, G., & Hochscheid, S. (2010). Loggerhead Turtle (*Caretta caretta*) Nests at High Latitudes in Italy: A Call for Vigilance in the Western Mediterranean. *Chelonian Conservation and Biology*, *9*(2), 283–289.
https://doi.org/10.2744/CCB-0862.1

Braje, T.J., & Erlandson, J.M. (2013). Human Acceleration of Animal and Plant Extinction: A Late Plaistocene, Holocene, and Anthropocene Continuum. *Anthropocene*, *4*, 4–23.
https://doi.org/10.1016/j.ancene.2013.08.003

Campbell, L.M. (2007). Local conservation practice and global discourse: a political ecology of sea turtle conservation. *Annals of the Association of American Geographers*, *97*(2), 313–334.
https://doi.org/10.1111/j.1467-8306.2007.00538.x

Carlino, P., Panzera, E., Potenza, L., & Oroscopi, F. (2020). Nidificazioni eccezionali della Tartaruga comune (Caretta caretta L., 1758) nella Provincia di Lecce, Puglia. In D. Ottonello, F. Oneto, P. Piccardo, S. Salvidio (Eds.), *Atti del II Congresso Nazionale "Testugini e tartarughe"*, 11-13 aprile 2019 (pp. 74–80).

Casale, P., Mazaris, A.D., Freggi, D., Vallini, C., & Argano, R. (2009). Growth rates and age at adult size of loggerhead sea turtles (*Caretta caretta*) in the Mediterranean Sea, estimated through capture-mark-recapture records. *Sci Mar*, 73, 589-595. https://doi.org/10.3989/scimar.2009.73n3589

Ceballos, G., Ehrlich, P.R., Barnosky, A.D., García, A., Pringle, R.M., & Palmer, T.M. (2015). Accelerated Modern Human-Inducess Species Losses: Entering the Sixth Mass Extinction. *Science Advances*, *1*(5), 1–5. https://doi.org/10.1126/sciadv.1400253

Christiansen, E.F., Harms, C.A., Godfrey, M.H., & Finn, S.A. (2016). 2016 North Carolina sea turtle cold stunning event. In P. Tuomi (Ed.) *Proceedings of the International Association for Aquatic Animal Medicine*. International Association for Aquatic Animal Medicine.

Darmawan, A., & Takewaka, S. (2024). Application of Aerial Photographs and Coastal Field Data to Understand Sea Turtle Landing and Spawning Behavior at Kili-Kili Beach, Indonesia. *Geographies*, *4*(4), 781–797.
https://doi.org/10.3390/geographies4040043

Dirzo, R., Young, H.S., Galetti, M., Ceballos, G., Isaac, N.J.B., & Collen, B. (2014). Defaunation in the Anthropocene. *Science*, *345*, 401-406. https://doi.org/10.1126/science.1251817

Frazier, J. (2005). Marine Turtles: The Role of Flagship Species in Interactions Between People and the Sea. *Mast 2005*, *3*(2) and *4*(1), 5–38. https://repository.si.edu/handle/10088/4043

Garofalo, L., Marzano, G., Caputo, A., Carlino, P., Olivieri V., & Lorenzini, R. (2016, September 22–25). *Locations of summer meetings...for seaturtles too! Mitochondrial characterization of Caretta caretta nestsfrom the beaches of the southern-middle Adriatic and the northern Ionian Seas*, 131-132. Book of abstracts XI Congresso Nazionale della Societas Herpetologica Italica. https://doi.org/10.13140/RG.2.2.27498.93121

Haraway, D.J. (2019). *Chthulucene: sopravvivere su un pianeta infetto*. Nero.

Hartmann, D.L., Klein Tank, A.M.G., Rusticucci, M., Alexander, L.V., Brönnimann, S., Charabi, Y., Dentener, F.J., Dlugokencky, E.J., Easterling, D.R., Kaplan, A., Soden, B.J., Thorne, P.W., Wild, M., & Zhai, P.M. (2013). Observations: Atmosphere and Surface. In T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, P.M. Midgley (Eds.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 15–24). Cambridge University Press.

Havice, E., Campbell, L.M., & Braun, A. (2018), Science, scale and the frontier of governing mobile marine species. *International Social Science Journal*, *68*, 273-289. https://doi.org/10.1111/issj.12166

Hawkes, L.A., Broderick, A.C., Godfrey, M.H., & Godley, B.J. (2009). Climate change and marine turtles. *Endang Species Res*, *7*,137-154. https://doi.org/10.3354/esr00198

Hochscheid, S., Maffucci, F., Abella, E., Nejmeddine Bradai M., Camedda, A., Carreras, C., Claro, F., de Lucia, G.A., Jribi, I., Mancusi, C., Marco, A., Marrone, N., Papetti, L., Revuelta, O., Urso, S., & Tomás, J. (2022). Nesting range expansion of loggerhead turtles in the Mediterranean: Phenology, spatial distribution, and conservation implications. *Global Ecology and Conservation*, *38*, e02194.
https://doi.org/10.1016/j.gecco.2022.e02194

IPCC (2023). *Climate Change 2023: Synthesis Report*. Retrieved from: https://www.ipcc.ch/report/sixth-assessment-report-cycle/

ISPRA (2013). *Linee guida per il recupero, soccorso, affidamento e gestione delle tartarughe marine ai fini della riabilitazione e per la manipolazione a scopi scientifici*, 89/2013. ISPRA.

Laloë, JO., Cozens, J., Renom, B., Taxonera, A., & Hays G.C. (2014). Effects of rising temperature on the viability of an important sea turtle rookery. *Nature Clim Change*, *4*, 513–518. https://doi.org/10.1038/nclimate2236

Lewis, S.L., & Maslin, M.A. (2019). *Il pianeta umano. Come abbiamo creato l'Antropocene*, Torino.

Lorimer, J. (2007). Nonhuman charisma. *Environment and Planning D: Society and Space*, *25*(5), 911–932. https://doi.org/10.1068/d71j

Mancino, C., Canestrelli, D., & Maiorano, L. (2022). Going west: Range expansion for loggerhead sea turtles in the Mediterranean Sea under climate change. *Global Ecology and Conservation*, *38*, e02264.
https://doi.org/10.1016/j.gecco.2022.e02264

Marx K. (1980). *Il Capitale*. Editori Riuniti.

Marzano, G., Nannarelli, S., & Scarafino, C. (2010). Documentata nidificazione di Carettacaretta lungo il litorale leccese (Puglia). In L. Di Tizio, A.R. Di Cerbo, N. Di Francesco, A. Cameli (Eds), *Atti VIII Convegno Nazionale Societas HerpetologicaItalica* (pp. 559–562). Ianieri Edizioni.

Nur, H., Wardi, Y., & Evanita, S. (2024). Zones of Terrestrial Coastal Issues and Development Communication Strategy in Padang Pariaman Regency. *Sumatra Journal of Disaster, Geography and Geography Education*, *8* (1), 55–61. https://doi.org/10.24036/sjdgge.v8i1.600

Nurhayati, A., Putra, P.K.D.N., & Supriatna, A.K. (2022). The role of sea turtle conservation education for sustainable marine tourism based on bio-ecoregion (case study in bali, indonesia). *Geo Journal of Tourism and Geosites, 41*(2), 477–484. https://doi.org/10.30892/gtg.41219-853

ONU (1992). *Convenzione sulla diversità biologica*. ONU.

Patrício, A.R., Hawkes, L.A., Monsinjon, J.R., Godley, B.J., & Fuentes, M.M.P.B. (2021). Climate change and marine turtles: recent advances and future directions. *Endang Species Res*, *44*, 363–395.
https://doi.org/10.3354/esr01110

Preston-Whyte, R. (2004), The beach as a liminal space. In A.A. Lew, C.M. Hall & A.M. Williams (Eds.), *A companion to tourism* (pp. 349–359). Blackwell Publishing Ltd. https://doi.org/10.1002/9780470752272.ch28

Ramírez-Cover, A. (2013). Territorializzazione irregolare e conservazione delle tartarughe marine nella Costa Rica neoliberista. *Geografia umana*, *6*(1), 151–165. https://doi.org/10.1177/194277861300600110

Redpath S.M., Bhatia S., & Young G. (2014). Tilting at wildlife: reconsidering human–wildlife conflict. *Oryx*, *49*(2), 222–225. https://doi.org/10.1017/S0030605314000799

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J., Nykvist, B., de Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U. … Foley, J.A. (2009a). A safe operating space for humanity. *Nature*, *461*, 472–475. https://doi.org/10.1038/461472a

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen J., Walker B., Livermann, D., Richardson, K., Crutzen, P., & Foley, J. (2009b). Planetary boundaries: exploring the safe operating space for humanity, *Ecology and Society*, *14*(2), 32.
http://www.ecologyandsociety.org/vol14/iss2/art32/

Sabuhoro, E., Ayorekire, J., & Munanura, I.E. (2023). The Quality of Life and Perceived Human-Wildlife Conflicts among Forest Communities around the Mountain Gorilla's Virunga Landscape in Africa. *Sustainability*, *15*, 2248. https://doi.org/10.3390/su15032248

Simantiris, N. (2024) The impact of climate change on sea turtles: Current knowledge, scientometrics, and mitigation strategies. *Sci Total Environ*, *923*, 171354. https://doi.org/10.1016/j.scitotenv.2024.171354.

Srinivasan, K., & Kasturirangan, R. (2016). Political ecology, development, and human exceptionalism. *Geoforum*, *75*, 125-128. https://doi.org/10.1016/j.geoforum.2016.07.011

Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A., Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: guiding human development on a changing planet. *Science*, *347* (6223), 1259855(1-10). https://doi.org/10.1126/science.1259855

Tanner, C.E., Marco, A., Martins, S., Abella-Perez, E., & Hawkes, L.A. (2019). Highly feminised sex-ratio estimations for the world's third-largest nesting aggregation of loggerhead sea turtles. *Marine Ecology Progress Series*, *621*, 209-219. https://doi.org/10.3354/meps12963

Tisdell, C. & Wilson, C. (2001). Wildlife-based tourism and increased support for nature conservation financially and otherwise: Evidence from sea turtle ecotourism at Mon Repos. *Tourism Economics*, *7* (3), 233–249.
https://doi.org/10.5367/000000001101297847

Tsing, A.L. (2015). *The mushroom at the end of the world. On the possibility of life in capitalism ruins*. Princeton University Press.

Van Houtan, K.S., Hargrove, S.K., & Balaz, G.H. (2018). Modeling Sea Turtle Maturity Age from Partial Life History Records. *Pacific Science*, *68*(4), 465–477. https://doi.org/10.2984/68.4.2

WWF (2022). *Living Planet Report. 2022: costruire una società naturepositive*. R.E.A. Almond, M. Grooten, D. Juffe Bignoli, T. Petersen (Eds.). WWF.

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