Brief Report

When Mediterranean Artisanal Fishers Protect Coastal Ecosystems

Cornelia E. Nauen *

Posted Date: 19 September 2024

doi: 10.20944/preprints202409.1512.v1

Keywords: small-scale fisheries; restoration; co-creation

Brief Report

When Mediterranean Artisanal Fishers Protect Coastal Ecosystems

Cornelia E. Nauen

Mundus maris asbl, 3, avenue de Tervueren, 1040 Brussels, Belgium

Abstract: According to EuroStat data recorded landings of fisheries products from European waters were estimated at about 6 million tons in 2001, down to 3.2 million tons in 2022. Gradual decline slowed after the entering into force of the reform of the European Common Fisheries Policy (CFP) end 2013, but was followed by a steeper decline after 2018 [1]. This casts some doubt on claims that the resources are nowadays better managed, even if a warming ocean provokes measurable poleward migration of species. Within this general picture, the broad-brush landscape is influenced by policy applications more in favour of industrial exploitations and regulatory and market environments making it very hard for many small-scale fishers (SSF) to remain in business, let alone attract younger successors for generational transition. In crowded marine spaces it is a challenge to allocate access rights fairly between fisheries, exclusion zones for resource and habitat protection and much needed ecosystem recovery [2] platforms for fossil exploitation, wind farms, underwater cables and recreational uses. Two examples of local initiatives with recovery potential in the Mediterranean are briefly presented. They are spearheaded by artisanal fishers, who seek to restore spawning grounds and other coastal habitats as a way to procure enough fish and other complementary activities to secure their livelihoods in the future and supported by local scientists and nature conservation organisations. While promising, this is still rather the exception. Here it is argued that trust-building between artisanal fishers, conservationists and scientists, and greater systemic support to SSF by governments increase chances for the urgently needed structural shifts that can reverse the on-going decline in biodiversity and ocean productivity which all aspire to.

Keywords: small-scale fisheries; restoration; co-creation

Key Contribution: Fisheries do not have a good image among the European public. Public policies are tilted in favour of industrial fisheries with minimal consideration in EU member states when it comes e.g. to allocating catch quota or ensuring favourable regulatory conditions to small-scale or artisanal fisheries which typically use gear with low impact on the environment. The present contribution illustrates two examples; where small-scale fisher groups spearhead environmental recovery to trace pathways for their own future through investment into marine commons

1. Introduction

In many international meetings official discourses point to a constantly improving fisheries resource situation, especially where management structures based on scientific advice are involved [3–6]. In combination with sometimes hyped expectations of ocean production as the 'last frontier' for food [7] energy [8] transport [9] and minerals [10,11] spur a rush into big international investments into the 'Blue Economy'. This has become the catch-all buzz word for huge extractive industries and many countries.

Such an optimistic push towards more investment and attention to the long neglected ocean might be a welcome moment of relief in times of a swelling chorus of warnings about climate disruption with recent emphasis on species mass extinctions [12–14]. But what do statistical accounts and scientific reviews tell us in relation to empirically observed crisis signs about fisheries in ports, markets and conversations, particularly with small-scale fishers in Europe? Can these sources of

 doi:10.20944/preprints202409.1512.v

information help with bridging the cognitive dissonance with some of the official proclamations? And moreover, is there common ground between mostly production-oriented mindsets of fishers and environment conservation motivations of civil society organisations?

According to EuroStat data recorded landings of fisheries products from European waters were estimated at about 6 million tons in 2001, down to 3.2 million tons in 2022. Gradual decline slowed after the entering into force of the reform of the European Common Fisheries Policy (CFP) end 2013, but was followed by a steeper decline after 2018 [1]. This casts some doubt on claims that the resources are nowadays better managed, all the while a warming ocean provokes measurable pole-ward migration of species on top of other stressors. These doubts were corroborated by a recent workshop organised by Low Impact Fishers of Europe (LIFE) about the emergency in the Baltic Sea [15].

Based on a new methodology of catch time series in support of fisheries management [16] a scientific review of the evidence [17] suggests that the regeneration capacity of overexploited stocks is prone to over-optimistic projections. This is based on a reanalysis of publicly available data of 230 well-known exploited fish species. The authors conclude that 85% more stocks than currently recognized have likely collapsed below 10% of maximum historical biomass.

A major contributing factor to misinterpretation of the signs in the ocean is the deployment of overly complex models with many parameters based on guestimates rather than empirical data. They overestimate the biomass of highly or overexploited species and their regenerative capacity [18]. The authors show that a simpler two-parameter model based on observations is more robust [16]. They recommend a more precautionary advice to management by combining ecosystem principles, such as taking out only what can be replaced through regrowth, letting juveniles grow to reproductive size, protecting particularly spawning grounds from fishing, and not fishing prey species as hard as their predators.

The excessive extractions by industrial fleets use destructive fishing methods such as bottom trawling and large-scale long-lining. The rush continues to more powerful and more expensive technologies to trace resources further down [19] when coastal resources reached or exceeded the limits of their production capacity. This is often accompanied by dubious or criminal practices [20] suggesting that 20 to 32% of seafood imports into the US were illegitimate [21]. As the biggest market for fish and seafood imports the EU is equally prone to imports from such illegal, unreported and unregulated (IUU) fisheries. The fleets engaged in IUU fisheries are often subsidised, at last count at USD 22 billion per year [22] and would likely reduce or stop their otherwise uneconomical operations, thus allowing much needed respite. Stopping harmful subsidies to long distance fleets is thus another necessary measure, unfortunately so far resisted by some countries in the World Trade Organization (WTO) despite a mandate to do so (Sustainable Development Goal 14.6).

The science alone may not suffice to bring about a healthier balance between regenerative capacity of marine ecosystems and extractions when small-scale fishers are in a tie and see no alternatives to make ends meet in the short-term. In this setting, the valuable efforts of the SSF Cluster on the RISE UP for the OCEAN platform [23] towards more collaboration and co-creation between small-scale fishers and conservationists is still the exception.

In the following, two examples of precautionary practices by small-scale fishers in southern Europe are given which aim to restore the resources on which they depend. The fishers' initiatives are, among others, supported by smaller environmental organisations alert to social issues. The brief accounts given here are based on several years of interaction with the leaders of the initiatives.

Their pro-activity and willingness to seek alliances outside their profession to make their voices heard could augur well for collaboration with authorities in charge of fisheries management and spell support also as part of implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the context of Food Security and Poverty Eradication [24]. These SSF Guidelines celebrated their 10th anniversary in 2024 at the SSF Summit in Rome [25] though they tend to be invoked rarely, if at all, by European governments in relation to European small-scale fisheries.

2. The 'Casa Dei Pesci' along the Coast of Tuscany

 doi:10.20944/preprints202409.1512.v

The first example concerns the case of small-scale fishers in Tuscany, Italy, epitomised by decades of conflict with trawl fishers making often nightly incursions into the three mile zone legally reserved for coastal fishers with fixed gear. The leader of these coastal fishers is Paolo Fanciulli in Talamone in Grosseto Province, who gained public fame for his many appearances in tv and other media coverage, where he sharpened his profile as a defender of marine life and low impact fisheries. This almost epic struggle evolved as time went by and the resource competition became more acerbic. He happily shares his story during a visit.

He compares the destruction inflicted by destructive bottom trawls on the *Posidonia* meadows, the once abundant nurseries for commercial species and significant carbon sinks, with burning down a forest on land to catch a boar. The trawlers should stay out of that zone and fish in waters deeper than 50 meters, but years of heavy fishing near population centres have thinned the resources and made incursions into the nearshore waters a temptation difficult to resist. For a long time, the coast guard also tended to turn a blind eye treating all fisheries as a social valve for people with little or no alternatives to earn their living. Filing complaints from coastal fishers against the trawlers did not make friends with them either.

Necessity being the mother of invention, for the coastal fishers and Paolo Fanciulli it was a matter of either giving up or opening new sources of income in the face of rising costs and shrinking resources. They came up with a multi-pronged approach to protect their lives as fishers that meant so much to them.

A first step was to convince the government in Rome to licence boats with the required safety standards to take tourists out on fishing and bathing trips. In parallel to the development of agri-tourism on farms, this was called pescatourism with the twin effect of earning additional cash income for the fishers, while giving tourists at least a basic understanding of low impact fishing, the flavour of eating fresh quality fish and the need for responsible harvesting [26]. The clearly positive interaction with hundreds, if not thousands of domestic and foreign tourists over the years, reflected in five-star reviews in Trip advisor, not only helped raise awareness about the urgency of protecting coastal resources, but also created valuable opportunities to tap into other ideas and professional experiences during and after the fishing trips.

Another step then consisted in beefing up protective measures around Talamone, along the coastline of the Maremma Regional Park on land. The concept of creating a 'House of the Fish' – La casa dei pesci – consisted of seeking to prevent bottom trawling by sinking concrete obstacles while creating artificial habitats for juvenile fish protection. The first artificial reefs were laid out with the authorisation of local authorities and some financial help of a European project. One of the visitors on a fishing trip happened to be the owner of the Michelangelo quarries in Carrara who was so enchanted by the idea of the House of the Fish as to offer 100 blocks of marble to extend the protection. The marble formed 200 million years ago out of calcareous skeletons of marine organisms, petrified and later uplifted in the convulsive movement of plate tectonics forming the Apuan Alps [27]. It thus came from marine life and was to go back to the sea for protection of today's marine life. The creative twist was to invite sculptors to transform the raw blocks weighing mostly between 10 and 15 tons into pieces of art before sinking them into Talamone Bay to form an underwater museum from some pieces and scattering the others along the coast [28,29].

The Casa dei pesci also entails collaboration with a team of Siena University headed by Letizia Marsili testing various devices to keep macrofauna out of the trammel nets and gill nets. The return of turtles and dolphins as such is already an indicator of some early effects of the protective measures. A more detailed narrative of the struggle to protect the ecosystem and use it responsibly has been published in book form by two journalists [30].

Mundus maris sent an intern for a few days in July 2022 to take some fish measurements on tourist fishing trips in order to check how many fish were removed and whether fish caught in the gill nets had reached sexual maturity. The species diversity and size ranges are summarised in Table 1. A few specimen of by-catch like undersized rays, stingrays and puffer fish were released, though not always very promptly. A few purple dye murex gastropods (*Bolinus brandaris*) exceeding minimum reproductive size also got caught up in the nets.

 doi:10.20944/preprints202409.1512.v

Table 1. Species diversity in set net catches in Talamone, 13 – 18 July 2022. Lm = length at first maturity and Lmax = maximum length from FishBase.org, TL = total length, SL = standard length, temperature of surface water varied between 23 and 25°C.

Species English Common Name (Italian Common Name in Tuscany)	Species Scientific Name	Number of individuals	Size range in catches [cm]	Lm total length, Lmax [cm]	Gear	Depth range [m]
Gilthead seabream (orata)	*Sparus aurata*	10420	25 - 70	33-40 TL	Gillnet, 1500m, 40mm	8.5 – 13
Common dentex (dentice)	*Dentex dentex*	2025	40 - 100	34.6 TL	Gillnet, 1500m, 40mm	8.5 – 13
Shi drum (ombrina)	*Umbrina cirrosa*	3226	38 - 104	? TL	Gillnet, 1500m, 40mm	8.5 – 13
Sand steenbras (mormora)	*Lithognathus mormyrus*	6423	28 - 55	17.4 TL	Gillnet, 1500m, 40mm	8.5 – 13
White seabream (sarago)	*Diplodus sargus*	2119	24 - 45	? TL	Gillnet, 1500m, 40mm	8.5 – 13
Salema (sarpa)	*Sarpa salpa*	724	26 - 51 SL	16.5	Gillnet, 1500m, 40mm	8.5 – 13
Common pandora (fragolino)	*Pagellus erythrinus*	1022	27 - 60 SL	13-16	Gillnet, 1500m, 40mm	8.5 – 13
Blackspot seabream (besugo)	*Pagellus bogaraveo*	237		31.4 SL	Gillnet, 1500m, 40mm	8.5 – 13
Atlantic horse mackerel (sugarello)	*Trachurus trachurus*	220, 25		21-30 TL	Gillnet, 1500m, 40mm	8.5 – 13
Surmullet (triglia)	*Mullus surmuletus*	616	22 - 40 SL	15-26	Gillnet, 1500m, 40mm	8.5 – 13
European flounder (pesce passera)	*Platichthys flesus*	2010	15 - 60 TL	14-30	Gillnet, 1500m, 40mm	8.5 – 13
Turbot (rombo)	*Scophthalmus rhombus*	133		41-55 SL	Gillnet, 1500m, 40mm	8.5 – 13
Red scorpionfish (scorfano rosso)	*Scorpaena scrofa*	220		? TL	Gillnet, 1500m, 40mm	8.5 – 13
Grey triggerfish (pesce balestra)	*Balistes capriscus*	435	40 - 66 TL	13-29.7	Gillnet, 1500m, 40mm	8.5 – 13
Bluefish (serra)	*Pomatomus saltatrix*	238		30 TL	Gillnet, 1500m, 40mm	8.5 – 11

The nets were usually shot and then hauled up on the same half day trip, thus were out fishing for only a rather short time. The species with the highest abundance in the sample were gilthead seabream and sand steenbras. The former were all undersized, while the latter were around optimum size for sustained high catches. In multi-species assemblages it is difficult to avoid this situation. In many species the smaller sizes are closer to the coastline in shallow and rather warm waters, especially where there are still Posidonia patches, while big specimen are often found deeper down, where cooler water contains more dissolved oxygen. The modest quantities extracted though are unlikely to affect the rebuilding of the population in the protected inshore area and juvenile fish of different species can be seen when diving around the sculptures. The mesh size is in conformity with the regulation, but an increase would support faster regrowth and recovery.

 doi:10.20944/preprints202409.1512.v

The active promotion of environmental awareness through pescatourism has been a key feature amplified by extensive national and international media coverage. Despite some frustrations for failure to enforce the fishing rules more systematically the constant attempts to engage with authorities at different levels, a series of activities with schools as well the strategic involvement with well-known sculptors and local companies have enabled a broad-based public support for the Casa dei pesci and Paolo Fanciulli. This was certainly also a major factor of protection for the coastal fishers during the times of open conflict with the trawlers.

Especially the underwater museum and the idea that art work protects nature has captured the imagination of the many. The Casa dei pesci went beyond the mostly utilitarian approach to sink artificial reefs in order to protect the coastline or create new habitat and provide protection for coastal marine assemblages in drives to keep harmful trawlers out and repopulate coastal stretches to sustain both fish and fishers [31,32]. Even though the physical extend of the statues of the underwater museum grouped together nearest to Talamone would not suffice to recovery the Tuscan coastal ecosystem, the marbles of the Michelangelo quarries shaped into beautiful sculptures by committed artists spoke to the resonance of the arts with the public. The underwater museum also transports a deep-seated understanding that small-scale fishers, when they see themselves as the guardians of the marine ecosystem in the best tradition of maritime culture, can transmit a caring vision of low impact fisheries of the future.

3. Amorgorama on the Greek island of Amorgos

The second example is located further east in the Mediterranean, in Amorgos, the most eastward of the Cyclades islands which bears witness of the Cycladic Civilisation (5200 to 4000 BP). Today, the island's about 2000 inhabitants live largely of summer tourism [33]. Because of the mountainous terrain of the island agriculture could not extend beyond rather small patches. Conversely, fishing always played a major role out of the two major ports of Katapola and the large bay in the basin of Aegiali. The northern and eastern part of the island is mostly accessible only from sea. Public records on catches in the past do not exist as taxation was only introduced some ten years ago.

However, the small-scale fishers have seen their numbers decline as resources in the vicinity of the island dropped to perhaps a third of what they were 40 years ago according to the head of the Professional Fishing Association of Amorgos (Croessmann, pers. Comm.). In the past, they produced enough to sell their catch in Athens. But nowadays, the quantities have shrunk such that local marketing prevails. Most of the time, they fish for direct marketing to local clients that place orders so that landed fish is practically already sold. Prices at first sale have been rather stable, but costs for fuel and equipment have increased. The major effect was that a number of retired fishers have not been replaced by their sons or other youngsters. Unlike in some other places in windy Amorgos the diversification or cross-subsidies e.g. from renting rooms to tourists during the summer season with the help of wives and other family members is not an easy option to prolong operations.

While not yet affected by invasive species as much as what is documented for Turkiye [34,35] and Cyprus [36] the majority of past coastal species around Amorgos have thinned out or disappeared from the catches. Some of the new arrivals, such as the invasive lion fish have good food quality when precautions are taken in catching them. To prevent being stung by the poisonous spines, specimens are handled with gloves and spines cut off. So far, lion fish has not yet been marketed actively, but that could well be an option if the population increases. The species principally targeted in gill nets, trammel nets and longlines at present are listed in Table 2.

Table 2. Economically important fish species targeted by the fishers in Amorgos as reported by M. Croessmann of the Professional Fishing Association of Amorgos; Lm = length at first maturity and Lmax = maximum length from FishBase.org, TL = total length, SL = standard length.

Species English common name	Species scientific name	Lm in total length, Lmax [cm]	Principal gear in Amorgos	Comment

 doi:10.20944/preprints202409.1512.v

Red mullet	*Mullus barbatus*	11.5 38 TL	Gill nets, trammel nets	Highly priced, mostly in summer in depth around 80m
Surmullet	*Mullus surmuletus*	15-26 40 SL	Gill nets, trammel nets	Less highly priced, on muddy ground ~40m
Common pandora	*Pagellus erythrinus*	13-16 60 SL	Bottom longlines, trammel nets	Economically important
Blackspot seabream	*Pagellus bogaraveo*	31.4 70 SL	Bottom longlines, trammel nets	Economically important
Common dentex	*Dentex dentex*	34.6 100 TL	Bottom longlines, trammel nets	Economically important
White seabream	*Diplodus sargus*	? 45 TL	Bottom longlines, trammel nets	Economically important
Bogue	*Boops boops*	13.6 40 TL	Gill nets, trammel nets	Low priced, locally popular food fish
Frigate tuna	*Auxis thazard*	29.5 65 FL	Gill nets up to 50 mm mesh size, close to the coast from surface to 30m	Late summer to spring, feeding on small fish near the coast
Atlantic bonito	*Sarda sarda*	37.8 91 FL	Gill nets up to 50 mm mesh size, close to the coast from surface to 30m	Late summer to spring, feeding on small fish near the coast, most valuable of the small tunas
Little tunny	*Euthynnus alleteratus*	41.8 122 TL	Gill nets up to 50 mm mesh size, close to the coast from surface to 30m	Late summer to spring, feeding on small fish near the coast

The fisher association has currently still 40 members with 21 vessels. It was founded in 2003 with members who are permanent residents of the island to seek coping strategies for a range of changes gaining momentum. Almost all fishers are in the second half of their lives. Beyond the love for the freedom of life as a fisher, they cover essential functions for the island which has no hospital, neither an airport or regular ferry connection directly to the Greek mainland, nor a coast guard post. It is not a rich place, but the inhabitants feel a strong attachment to their place and way of life on the island.

Faced with shrinking resources and a flood of mostly plastic garbage spoiling the shorelines and nets as well as seeking ways to preserve the traditional fishing boats, called 'Kaiki', the fishers have been debating their options for several years. After lengthy deliberations and facing the lack of young successors when retiring they opted for action to create alternatives to the steady decline.

Amorgorama is a project by the Professional Fishing Association of Amorgos cofounded with the artist Florian Reiche to tackle plastic pollution and overfishing around their island in the Aegean Sea. The project aims to pay fishermen to collect waste from inaccessible beaches and to pause fishing during the spawning season of local fish [37].

The **association** presented a concept years ago to the *Ministry of Rural Development* in Greece to mitigate the effects of both overfishing and plastic pollution. The plastic gets swept in large quantities

 doi:10.20944/preprints202409.1512.v

onto beaches, particularly during the stormy weather in winter. The fear was and still is that not only is the plastic pollution an aggression towards the beauty of the coastal areas. It is also well known that intensive mechanical stress in combination with the sun's radiation will break up the material into smaller and smaller fragments that are taken up as microplastic by marine organisms and eventually end up in humans too. The initial effort was to seek support for payment of compensation for a fishing stop during the spawning period of most fish species in April and May. In turn, to justify the payment that allows fishers to still earn a living, they proposed to use their vessels and equipment during this period for collecting garbage. The idea was to address two major problems in one go. However, the Ministry did not endorse the request for support from the European Maritime and Fisheries Fund (EMFF).

Given the urgency, the association started implementing its initiative in 2021 and continued in 2022. In parallel, the fishers filed a proposal with the Ministry for a five-year master plan along four lines of action as outlined on the website [37]:

1. Pause fishing during April and May, the most significant months for fish reproduction.
2. During this time, clean coasts that are not easily accessible by land.
3. Progressively, switch fishing gear into a more sustainable form (larger mesh size of nets and bigger hooks to avoid catching juveniles).
4. Create three Fisheries Restricted Protected Areas (FRAs) along the coastline of the island of Amorgos (no-take zones).

In the first 'round' in 2021, more than half the fishers accepted to use their traditional Kaiki or other boats to clean the inaccessible bays of the island of plastic. This was accompanied by a public call for crowd funding and garnered support from the Municipality of Amorgos, the Cyclades Preservation Fund, and Enaleia, an organisation running several projects with fishers to address recovery of resources and plastic clean-up in order to make the marine ecosystem sustainable through circular and social economy solutions. Taking action also attracted three young new members to the association and was covered extensively by newspapers, radio and national television. This affected both the motivation of the fishers and the perception the broader public had about them.

The success drew additional support for the 2022 campaign, notably from the **Hellenic Ministry of Environment and Energy, the Blue Marine Foundation with world-wide experience in marine protected areas, and Prasino Tameio, the Greek Green Fund which serves to strengthen development through the protection of the environment and serving the public and social interest.**

The results of the two garbage collection drives in 2021 and 2022 were astounding and demonstrated clearly the scale of the challenge:

- **38 missions** for garbage collection with no fishing during the fish spawning period
- Collection of more than **1200 large bags of litter**, plus many very big items.
- More than **15 tons of plastic dispatched** for recycling, of which **60-65%** will eventually be recycled.
- Recycling of more than **3 tons** of fishing nets and ropes.

The Ministry of Rural Development and Food is supportive of the initiative. In September 2022, key partners representing the central government, local authorities, academics, environment organisations and the fisher association had concluded their deliberations about the strategic plan for protected fishing area around Amorgos and signed a Memorandum of Cooperation for the Amorgorama Initiative. The memorandum lies down the steps needed over the next years by all signatories in pursuit of the twin objective of restoring the reproductive capacity of the local marine environment and supporting the livelihoods of the local fishers.

Condition for accepting the strategic plan of the fishers was a one-year research project by a team from the Agricultural University in Athens headed by Stefanos Kalogirou. The study was funded for the most part by the Blue Marine Foundation (BMF). The Cyclades Preservation Fund (CPF) co-funded. Thus in 2023, the researchers, supported by the fishers, carried out a thorough assessment of the environmental and resource situation around the island. The findings are yet to be formally published, but the internal report to the ministry and the association recommends the establishment of three strict no-take zones where local fish spawn, all year round. They also confirm that the

 doi:10.20944/preprints202409.1512.v

compensation of the fishers during the spawning season, when all fishing around the island should stop, is a necessary investment. The researchers also recommend to budget for five years of support, the time they estimate as sufficient for the recovery of the resource under conditions of strict protection. Without the compensation the fishers would not survive the five years economically. This modest compensation payment is to be funded by the foundations intent on signing a Memorandum of Understanding to this effect with the fishers, once the fishers' strategic plan is formally recognised by a Decree to be signed by the Prime Minister after technical and legal clearance through the responsible institutions.

As part of the implementation conditions, the fishers accept equipping their vessels with VHS monitoring devices, documenting the species composition and quantity of catches and reporting the data to the Ministry. A small financial allocation is expected to analyse these data in addition to rough monitoring of how the ecosystem changes altogether over the five years covered by the plan. The Ministry through dispatch of the coast guard is necessary to take on surveillance responsibilities around the island in addition to tracking licenced fishing boats in order to enforce the rules of the strategic plan.

The no-take zone and the closed season during the major spawning period in April and May is supposed to apply also to fishers from other islands. Subject to implementing all elements of the plan, the Ministry estimates that the fishers should have stabilised their income possibilities after implementing the five-year master plan and not require further subsidies.

The fishers are already taking steps for more selective and lower impact fishing. The long-line fishing starting usually in August and predominant during winter months will adopt a minimum hook size 12 with the entry into force of the legislation expected for 1 January 2025. The smaller the number, the bigger is the hook. Bigger hooks catch bigger fish. This rule will apply to all fishers, not only to fishers from Amorgos.

Gill nets used to have mesh sizes of 24 mm or smaller for red mullet in deeper waters down to around 80 meters or even deeper. The fishers realise that a larger mesh size is necessary for resource recovery. It would, however, fail to catch the economically important red mullet, which may fetch between 25 and 30€/kg when fresh (Croessmann, pers. Comm.). To promote resource conservation and reduce catches of juveniles of other species, under the Amorgorama initiative, fishers were paid a 30% subsidy already since 2021. That meant indeed that those few initially adopting bigger mesh sizes did not catch red mullet. But they also caught much less, what they call 'tragana' or 'stones', the calcareous red algae of the Corallinales taxon which form "maerl-type" biological communities, with bryozoans, cnidarians, polychaetes, brachiopods, sponges, ascidians, and bivalve mollusks. These tend to extend to depths of 120 meters under favourable hydrodynamic conditions. Together with seagrass meadows formed on soft bottoms by Mediterranean seagrass *Posidonia oceanica* down to about 40 meters depth, these "maerl-type" habitats are biodiversity hot spots. Catching less 'tragana' means a lot less work in cleaning up the nets, a major advantage. The number of fishers adopting nets with a bigger mesh size is thus increasing every year.

Other valuable species of sparids are caught with bottom long-lines and trammel nets spread out over the summer months, while smaller members of the tuna family are caught closer to the coast with large meshed set nets from late summer through spring.

The changes adopted to their own practices testify to the proactive role of the Amorgos fishers in recovering the environment on which their livelihood depends. It also noteworthy that most of those fishers not participating in the plastic clean up still stop fishing during the spawning period in April and May e.g. by using this time for maintenance and repair of their kairis.

The agenda of the 'Our Ocean' Conference in Athens, 15-17 April 2024, had reducing marine plastic pollution as one of four priority areas [38]. It also gave room for initiatives to bring about resource recovery from overfishing and other stressors, particularly in the wide-ranging programme of side events. In this vein, the prime minister of the country announced a ban on destructive bottom trawling throughout Greek waters. The initiative of the Professional Fishing Association of Amorgos was held up as an example to follow elsewhere in Greece.

 doi:10.20944/preprints202409.1512.v

The Ministry of Rural Development recognises that close surveillance by the coast guard will be necessary to ensure that all fishers, including those from outside Amorgos, respect the no-take zone throughout the year and refrain from fishing in April and May. Legislation is in preparation to create a reliable basis for the implementation of all key measures of the 5-year plan outlined above. The fishers are conscious of the attention of fishers on other islands and the wider public their initiative receives and the great responsibility to make it work together with the partners who have signed the 2022 memorandum. Meanwhile they seize every opportunity of fisheries related meetings in neighbouring countries around the Mediterranean to share their experience and encourage similar, locally adapted initiatives. The mission is to help improve the health of marine ecosystems and trace pathways for fishers, not only as extractors of resources, but rangers overseeing continuous improvements of the common good.

4. Discussion

The two examples are noteworthy on several accounts. First and foremost, finding their very survival as coastal fishers questioned, both groups with strong leadership took innovative initiatives to remain to the extent possible the masters of their destiny rather that victims of larger trends. This was not always whole-heartedly supported by national and regional administrations right from the beginning. After all, prevailing policies favour industrial exploitations with their 'modern' appeal and economies of scale, even if scale in the Mediterranean is unlike that in northern temperate waters or upwelling areas. This has left little room even for small-scale fisher communities with traditions of self-rule reaching back several hundred years [39,40].

By reaching beyond their profession in both cases, Casa dei pesci and the Professional Fishing Association of Amorgos, garnered early on ideas and broader support through their steadfast work and the extensive media coverage they received. Despite their relatively small membership they thus achieved a high visibility. Through their creative defence of their traditional culture, but also recognising that they themselves needed to implement changes in their own operations, they opened opportunities for additional environmental improvements and broader partnerships. These offer hope to overcome ultimately destructive approaches narrowly focused on extraction efficiency and private appropriation of profits which undermine the very existence of the common pool resource system essential not only for food production, but also for climate stabilisation and more [39].

Such partnerships are, however, not as common as one might assume when, in principle, the need for productive and healthy ecosystems and resources is central to concerns by fishers, scientists and conservationists. But fishers often harbour mistrust, particularly towards big environmental NGOs, which are more listened to by governments and admitted to various national and international meetings, while coastal fishers are not sitting at the table. Scientists are also not always welcome, particularly when their research is perceived as only being used to latch more restrictions onto fishers and complicate their lives.

This was corroborated during the recent SSF Summit, 5 to 7 July in Rome, where researcher Pip Cohen reported results of her study on broad trends in funding on marine environment protection and climate. Of the approximately USD 1.2 billion spent by ocean philanthropy in 2020 she found that only about USD 100 million or 8.3% went to support SSF and coastal communities. The lion's share was handled by six big international NGOs. She had found similar conditions in relation to climate change. At best 1% of the funding was handled directly by small-scale fishers and Indigenous Peoples. That found a strong echo among the representatives of small-scale fishers and Indigenous Peoples and their organisations in the meeting.

Yet, in both cases shortly presented here, through concrete cooperation, trust was built between coastal fishers, scientists and smaller environmental organisations sensitive to the social and economic challenges of the fishers and approaching the relationship in a listening and support mode. That helped develop concrete steps by the fishers e.g. to increase mesh sizes, curb losses of fishing materials and looking for ways to reduce unintended catches of turtles, dolphins and juveniles of commercial and invertebrate species. Mutual respect and joint development of technological and operational adjustments favouring resource recovery were key ingredients of increasing success.

 doi:10.20944/preprints202409.1512.v

Trust is more generally a major factor in the capacity to act on rules and principles across non-homogeneous groups or populations to tackle what has been termed 'the implementation gap' [40].

Finally, it is interesting to note that in neither example do the fishers show great awareness for gender dimensions of their struggle so far. Yet, in the case of the Casa dei pesci the lead scientist supporting their efforts to protect macro-fauna and the first author of the book about them are women and that a lot of background support work is provided by women in the families or surroundings. This is even more evident in Amorgos, where key financial supporters are women headed organisations, nicely illustrated by the photo about the signing ceremony on the Amorgorama website [37]: the men are sitting at the table and the women who were the key enablers are standing overseeing the scene. This suggests considerable potential for broadening the initiatives, once women in and in support of the fishery become more broadly recognised as important, trustworthy allies. This is documented in the growing literature casting light on the multiple roles of women throughout history in fisheries, including as protagonists, albeit often not in the limelight [41–44].

5. Conclusion

The take-home message from these two cases of pro-active artisanal fisher groups is that taking responsibility and building broad alliances can reverse the race to the bottom dominating contemporary fisheries. Their initiatives are particularly timely in today's context of multiple overlapping crises that can only be effectively addressed by more cooperation at all levels. Fighting for the common good and the health of the ocean is an essential undertaking, though not one for the faint-hearted. It is nothing short in these cases of re-imagining their own livelihoods as the guardians of the environment. Their example is an invitation to many others to back up aspirational statements with action.

Funding: No external funding has been received for this research.

Acknowledgments: Special thanks are due to Paolo Fanciulli of Casa dei pesci and Michalis Croessmann of the Professional Fishing Association of Amorgos for generously sharing information and insights into the ups and downs of their initiatives. Any remaining errors are of the author.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Eurostat, 2024. https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=583760 (consulted 2 May 2024)
2. European Commission, 2024. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters_en (consulted 2 May 2024)
3. Mundus maris, 2019. FAO Symposium on Fisheries Sustainability. https://www.mundusmaris.org/index.php/en/review/other/2309-fao-sust-en
4. Mundus maris, 2024. Take home from EU Ocean Days, Brussels, 5 to 8 March 2024. https://www.mundusmaris.org/index.php/en/review/other/2918-take-home-from-eu-ocean-days-brussels-5-to-8-march-2024 (consulted 2 May 2024)
5. FAO, 2023. The State of Mediterranean and Black Sea Fisheries 2023 – Special edition. General Fisheries Commission for the Mediterranean. Rome. https://doi.org/10.4060/cc8888en
6. Hilborn, R., Amorosoa, R.O., Anderson, C.M. et al., 2020. Effective fisheries management instrumental in improving fish stock status. *Proc. Natl. Acad. Sci. U.S.A.* 117, 2218. https://www.pnas.org/doi/epdf/10.1073/pnas.1909726116
7. Free, C.M., Cabral, R.B., Froehlich, H.E. et al., 2022. Expanding ocean food production under climate change. *Nature* **605**, 490–496. https://doi.org/10.1038/s41586-022-04674-5
8. Bedard, R., Jacobson, P.T., Previsic, M. et al., 2010. An Overview of Ocean Renewable Energy Technologies. *Oceanography* 23, no. 2:22–31. http://www.jstor.org/stable/24860707.
9. Sirimanne, S.N., Hoffman, J., Juan, W., Asariotis, R., Assaf, M., Ayala, G., Benamara, H., Chantrel, D., Hoffmann, J. and Premti, A., 2019. Review of maritime transport 2019. In: United Nations conference on trade and development, Geneva, Switzerland (Vol. 9).

10. Hein, J.R., Mizell, K., Koschinsky, A. and Conrad, T.A., 2013. Deep-ocean mineral deposits as a source of critical metals for high- and green-technology applications: Comparison with land-based resources. *Ore Geology Reviews*, 51:1-14. https://doi.org/10.1016/j.oregeorev.2012.12.001.
11. Lusty, P.A.J. and Murton, B.J. 2018. Deep-Ocean Mineral Deposits: Metal Resources and Windows into Earth Processes. *Elements* 2018; 14(5):301–306. https://doi.org/10.2138/gselements.14.5.301
12. Steffen, W., Richardson, K., Rockström, J. et al., 2015. Planetary boundaries: Guiding human development on a changing planet. *Science*, 345(6223). https://www.science.org/doi/epdf/10.1126/science.1259855
13. IPBES, W., 2019. Intergovernmental science-policy platform on biodiversity and ecosystem services. Summary for Policy Makers of the Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES Secretariat, Bonn, Germany.
14. Richardson, K., Steffen, W., Lucht, W. et al., 2023. Earth beyond six of nine planetary boundaries. *Sciences Advances*, 9(37). https://www.science.org/doi/epdf/10.1126/sciadv.adh2458
15. Mundus maris, 2024. Baltic Fisheries Emergency Meeting, Brussels, 26 June 2024. https://www.mundusmaris.org/index.php/en/review/other/2962-baltic-fisheries-emergency-meeting-brussels-26-june-2024
16. Froese, R., Winker, H., Coro, G. et al., 2023. New developments in the analysis of catch time series as the basis for fish stock assessments: The CMSY++ method. *Acta Ichthyologica et Piscatoria*, 53:173–189. | DOI 10.3897/aiep.53.105910
17. Edgar, G.J., Bates, A.E., Krueck, N.C. et al., 2024. Stock assessment models overstate sustainability of the world's fisheries. *Science*, 385:860–865. DOI: 10.1126/science.adl6282
18. Froese, R. and Pauly, D., 2024. Perspectives. Taking stock of global fisheries. Current stock assessment models overestimate productivity and recovery trajectory. *Science*, 385(6711):824-825. https://www.science.org/doi/full/10.1126/science.adr5487
19. Morato, T., Watson, R., Pitcher, T. and Pauly, D., 2006. Fishing down the deep. Fish Fisheries, 7(1):24-34. https://doi.org/10.1111/j.1467-2979.2006.00205.x
20. Selig, E.R., Nakayama, S., Wabnitz, C.C.C., et al., 2022. Revealing global risks of labor abuse and illegal, unreported, and unregulated fishing. *Nature Communications*, 13:1612 | https://doi.org/10.1038/s41467-022-28916-2
21. Pramod, G., Nakamura, K., Pitcher, T.J. and Delagran, L., 2014. Estimates of illegal and unreported fish in seafood imports to the USA. *Mar. Policy*, **48**:102-113. https://doi.org/10.1016/j.marpol.2014.03.019
22. Sumaila, U.R., **Ebrahim, N., Schuhbauer, A., et al. (2019). Updated estimates and analysis of global fisheries subsidies. *Mar. Policy*, 109. doi.org/10.1016/j.marpol.2019.103695**
23. Campaign platform 'RISE UP for the OCEAN. https://riseupfortheocean.org/ (consulted 2 July 2024)
24. FAO, 2015. Voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication. Food and Agriculture Organization of the United Nations, Rome
25. Mundus maris, 2024. Small-Scale Fisheries Summit in Rome, 5-7 July 2024. https://www.mundusmaris.org/index.php/en/projects/2024en/2976-small-scale-fisheries-summit-in-rome-5-7-july-2024 (consulted 20 August 2024)
26. Lai, M.B., Cicia, G. and Del Giudice, T., 2016. Pescatourism, a sustainable tourist experience. *Journal of Cleaner Production*, 133:1034-1042. https://doi.org/10.1016/j.jclepro.2016.05.013.
27. Bonne, K., 2020. Carrara Marble: from the sea to Michelangelo's workshop. https://www.gondwanatalks.com/l/carrara-marble/ (consulted 22 August 2024)
28. Nauen, C.E., 2021. Mundus maris supports the fight of Paolo, the fisher, in Tuscany, Italy. https://www.mundusmaris.org/index.php/en/projects/2021/2529-casa-en
29. La Casa dei pesci, n.d. The underwater museum. https://casadeipesci.it/en/underwater-museum/ (consulted 22 August 2024)
30. De Bernardis, I. and Santarelli, M., 2021. La casa dei pesci. Storia di Paolo il pescatore. Palombi Editori, 162 p. ISBN-13:978-88-6060-926-7
31. Whitmarsh, D., Neves Santos, M., Ramos, J. and Monteiro, C.C., 2008. Marine habitat modification through artificial reefs off the Algarve (southern Portugal): An economic analysis of the fisheries and the prospects for management. *Ocean and Coastal Management*, 51(6):463-468. https://doi.org/10.1016/j.ocecoaman.2008.04.004
32. Vivier, B., Dauvin, J.C., Navon, M. et al., 2021. Marine artificial reefs, a meta-analysis of their design, objectives and effectiveness. *Global Ecology and Conservation*, 27, e01538. https://doi.org/10.1016/j.gecco.2021.e01538
33. Amorgos. Wikipedia. https://en.wikipedia.org/wiki/Amorgos (consulted 25 August 2024).
34. Mutlu, E., De Meo, I., & Miglietta, C., 2021. Spatio-temporal distribution of pufferfish (Tetraodontidae) along the Turkish coast of the Mediterranean Sea. *Mediterranean Marine Science*, *22*(1):1–19. https://doi.org/10.12681/mms.23481

 doi:10.20944/preprints202409.1512.v

35. Ulman, A., Zengin, M., Demirel, N. and Pauly, D., 2020. Corrigendum: The Lost Fish of Turkey: A Recent History of Disappeared Species and Commercial Fishery Extinctions for the Turkish Marmara and Black Seas. *Front. Mar. Sci.* 7:600242. doi: 10.3389/fmars.2020.600242
36. Iglésias, S. and Frotté, L., 2015. Alien marine fishes in Cyprus: update and new records. *Aquatic Invasions*, 10(4):425-438. ff10.3391/ai.2015.10.4.06ff. Ffhal-01273162
37. Amorgorama. https://amorgorama.com/ (last consulted 26 August 2024)
38. Our Ocean, Athens, 15-17 April 2024. https://www.ourocean2024.gov.gr (consulted 28 August 2024)
39. Nauen, C.E., 1984. The artisanal fisheries in Schlei Fjord, eastern Schleswig-Holstein, Federal Republic of Germany. / La pêche artisanale dans le fjord de Schley (Schleswig-Holstein oriental), République Fédérale d'Allemagne. *GFCM Studies Reviews*, 61:403-427.
40. Holm (Schleswig). https://de.wikipedia.org/wiki/Holm_(Schleswig) (consulted 10 September 2024)
41. Collet, S., 1999. Management of fishery resources: tragedies, private appropriation or reinvention of the art of cooperation in governing resources. *Social Science Information*, 38(1):87-112.
42. Nauen, C.E., 2023. Bridging the Implementation Gap in International Agreements on Marine Protection and Sustainable Use. *Examines Mar Biol Oceanogr*. 6(3). EIMBO. 000636. 2023. DOI: 10.31031/EIMBO.2023.06.000636
43. Williams, S.B., Hochet-Kibongui, A.-M., and Nauen, C.E. (eds.), 2005. Gender, fisheries and aquaculture: Social capital and knowledge for the transition towards sustainable use of aquatic ecosystems. / Genre, pêche et aquaculture: Capital social et connaissances pour la transition vers l'utilisation durable des écosystèmes aquatiques. / Género, pesca y acuicultura: Capital social y conocimientos para la transición hacia el desarrollo sostenible. / Género, pesca e aquacultura: Capital social e conhecimento para a transição para um uso sustentável dos ecosistemas aquáticos. Brussels, Bruxuelles, Bruselas, Bruxelas, *ACP-EU Fish.Res.Rep*., (16):128 p. ISSN 1025-3971 / EUR 20432
44. Harper, S., Adshade, M., Lam, V.W.Y., Pauly, D., Sumaila, U.R., 2020. Valuing invisible catches: Estimating the global contribution by women to small-scale marine capture fisheries production. *PLoS ONE*, 15(3): e0228912. https://doi.org/ 10.1371/journal.pone.0228912
45. Collet, S., 1992. De la fonction symbolique des femmes dans les économies halieutiques. *Anthropologie Maritime*, 4:181-194.
46. Frangoudes, K., Gerrard, S. & Kleiber, D., 2019. Situated transformations of women and gender relations in small-scale fisheries and communities in a globalized world. *Maritime Studies* **18:**241–248. https://doi.org/10.1007/s40152-019-00159-w