

GHOST

TECHNIQUES TO REDUCE THE IMPACT OF GHOST FISHING GEARS
AND TO IMPROVE BIODIVERSITY IN NORTH ADRIATIC COASTAL AREAS



Life-Ghost Report

Techniques to reduce the impacts of ghost fishing gears and to improve biodiversity in North Adriatic coastal areas

www.life-ghost.eu

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The project



Partnership



National Research Council – Institute
of Marine Sciences



Department of Design and Planning
in Complex Environments



Laguna Project snc

The Life-Ghost project (2013-2016) aims at assessing the impacts caused by "ghost" nets and other lost or abandoned fishing gears in a marine area covering about 50.000 ha off the Veneto coast. In so doing, the project has contributed to providing the first sound scientific data on the presence and impacts of lost or abandoned fishing gears in the Upper Adriatic Sea. Such gears are commonly known as ALDFG (Abandoned Lost or Discarded Fishing Gear) and consist of fishing nets and many other types of artefacts related to fishing activities at sea.

The main project objectives can be summarised as follows:

- to assess the presence and impact of ALDFG on the biodiversity of *tegnùe* (sub-tidal rocky outcrops located along the Veneto coast)
- to promote recovery and conservation measures for these habitats by drafting appropriate management strategies
- to assess the economic value of ecosystem benefits connected to biodiversity increase resulting from ALDFG removal
- to assess the impact of ghost nets on fish and zoobenthic communities living in the rocky outcrops and neighbouring areas, and to improve ecosystem biodiversity by using mapping and recovery procedures for ghost nets
- to put forward economically sustainable proposals for the correct landfilling and disposal of recovered and/or disused nets through their recycling in new production chains.

Background

*Nearly 100.000 mammals and 1.000.000 seabirds die every year because of ghost fishing.
The loss of commercial fish species and shellfish can reach up to 10% of catches*



The growing accumulation of waste at sea resulting from human activities is widely acknowledged as a global problem. According to a recent report by the UN Environment Programme, 6.4 million tons of waste are discharged into the sea every year, and 10% of them (640.000 t) are connected to fishing activities. They mainly consist of fishing gears such as nets, ropes, traps, floaters and leads which are accidentally lost or discarded into the sea and continue catching fish or other vagile organisms indiscriminately for different periods of time depending on habitats and species, thus contributing to what is known as “ghost” fishing that - by definition - is totally out of control.

Significant damage may be caused not only to fish stocks but also to all organisms that can be trapped by them. ALDFG can have an impact on the physical environment (with subsequent alterations of marine habitats), navigation, tourism, sports and professional fishing and diving activities. In particular, nets can move for long distances dragged by marine currents thus contributing to the transport of potential alien species, which are one of the major threats to biodiversity and ecosystem functions.

Ghost nets can break due to the mechanical effects of boats, waves, storms and strong winds. The lightest fragments made of plastic float on the surface and can strand on the coast or undergo photochemical decomposition leading to the formation of micro-plastics. Micro-plastics are less than 5 mm long and can be ingested by marine organisms or accumulated, especially by filter-feeding invertebrates, thus entering the trophic chain. Finally, plastic waste in sea water can release polluting substances such as phthalates, i.e. chemical compounds affecting the reproduction capacity of many marine organisms.

Environmental context

*The seabeds off the Veneto coast are characterised by the presence of many underwater rocky or organic-detrital formations. They are scattered throughout the Upper Adriatic basin and are locally known as *tegnùe**



The so-called *tegnùe* are rocky outcrops located in the stretch of sea between Trieste and Chioggia. They are scattered formations ranging in size from few to several thousand square meters. These rocky substrates crop out from the seabed to heights ranging from a few decimeters to a few meters (Mizzan, 1995; Stefanon, 1966). In flat and homogeneous sandy-muddy seabeds, they serve as natural reserves for the reproduction and settlement of species which could not otherwise be present in the same distribution areas (Polixeni, 1975).



The species of community interest spotted in the surveyed area are pelagic species passing by or stopping only for grazing. They include *Caretta caretta* (marine turtle), *Chelonia mydas* (green turtle) and the marine mammal *Tursiops truncatus* (common bottlenose dolphin). These habitats also host a reasonable abundance of several other species worth protecting including the bivalve mollusc *Pinna nobilis*, listed in the list of species of community interest under strict protection (annex IV of Directive 92/43/EEC).



The attractive effect of rocky outcrops combined to the strong productivity of the Upper Adriatic basin leads to a very significant inflow of fish species, which are often of commercial interest. Therefore, it is no surprise that the richness in species of these areas attracts a large number of professional and recreational fishermen, as well as divers who are particularly interested in the rich local biodiversity.

Project actions



Action in figure

- 50 sites surveyed
- 740 animal species detected (including 38.0% molluscs, 16.4% shellfish and 12.2% annelids)
- 12 species included in protection lists
- 97 species of commercial interest

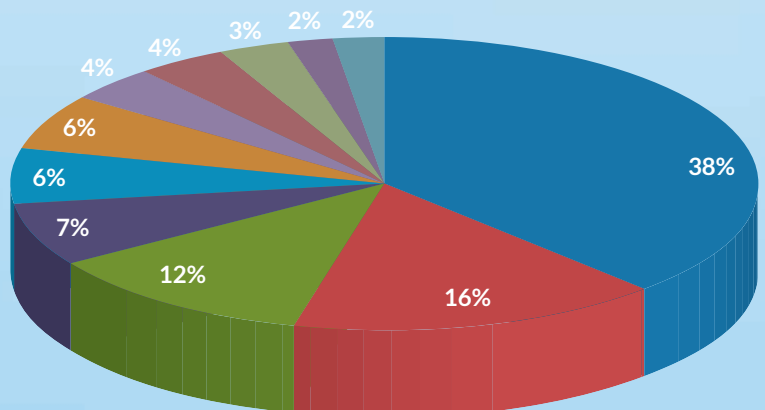
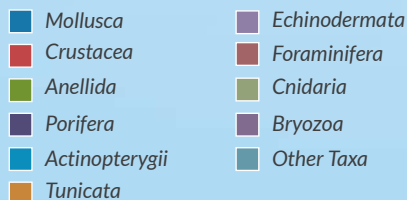
Setup of a database on rocky outcrops biodiversity

This action focused on the collection, critical assessment and organisation of data available from scientific publications and technical reports produced in the framework of local projects on rocky outcrops biodiversity, with a view to setting up an updated database on fish and macrozoobenthic populations detected in the rocky outcrops of the Veneto coast.

The main aims were the update and organisation of existing information to contribute to the ecological analysis of habitats to be safeguarded because of their biodiversity richness, such as *tegnùe*.

This information also provided a knowledge base for another project action estimating the socio-economic value of this ecosystem. Collected data were also used to assess the current situation before the ghost nets removal and used to assess the effectiveness of these actions.

PERCENTAGE OF TAXA IN NORTHERN ADRIATIC ROCKY HABITATS (TEGNUE)



Assessment of the presence of ghost nets, mapping and removal

This action was motivated by the need to quantify the presence of ghost nets in the stretch of sea off the coasts of the Veneto region.

A survey made on fishing cooperatives and a detailed analysis of the busiest routes for fishing boats operating in the area identified the top 15 potentially endangered rocky outcrop areas, which are more likely to suffer from the impact of ghost nets. Further acoustic and underwater surveys were performed in these sample areas to design high-resolution GIS maps of the main outcrops. That resulted in the acoustic and underwater mapping of all the nets and fishing waste located on the seabeds under monitoring.

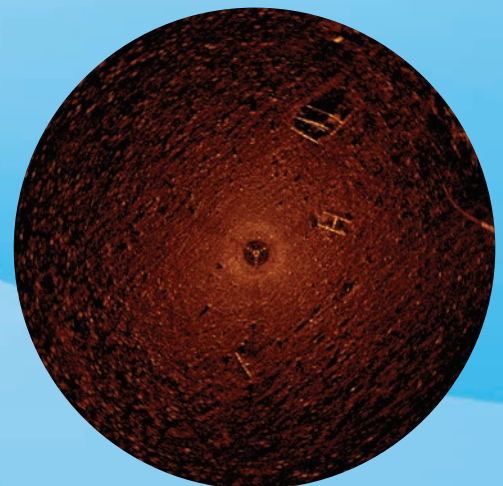
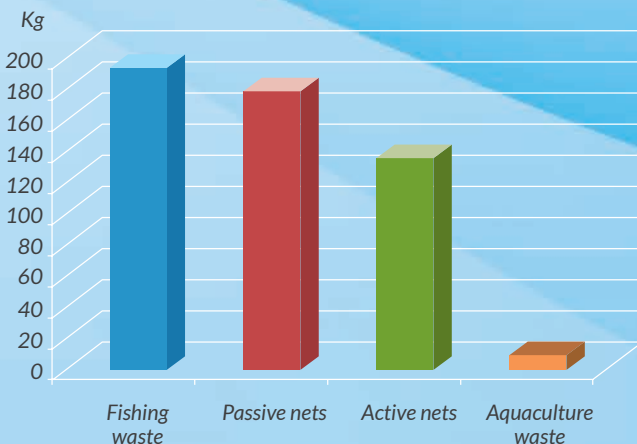
Removal was carried out based on an operational protocol designed in the framework of the project. According to the steps envisaged by the protocol, an assessment was made on the feasibility and environmental sustainability of removing every single fishing gear from the seabed based on its type, presence/absence of encrusting organisms under protection, the level of encrustation and cohesion with the seabed and the possibility to work cheaply and safely.



Action in figure

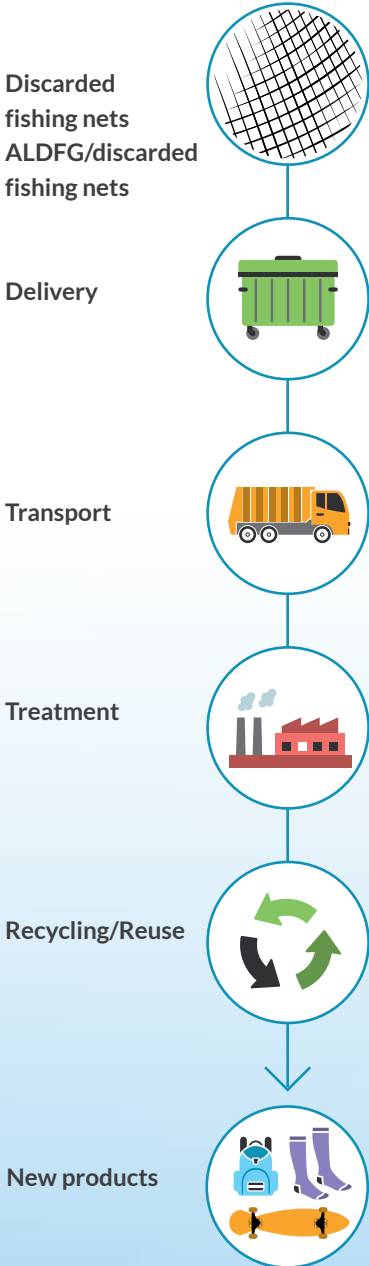
- 20** km² of rocky areas surveyed, out of which 50% were marked by the presence of ALDFG
- 347** fishing gears mapped on the seabeds
- 514** kg of fishing gears and fishing/aquaculture waste recovered, i.e. fishing waste (ropes, sheets, stays, mooring posts, sheaths, metallic frames, etc.) (38%), passive fishing gears (34%), active fishing gears (26%), mussel socks (2%)

QUANTITIES OF RECOVERED ALDFG



Metal frames identified on the seabed through the use of Sonar HRSS - MS1000

Fishing net waste chain



Development of a disposal/recycling strategy for ALDFG

Preliminary analyses were performed on recovered ghost nets to identify their chemical-physical composition in order to select the most suitable options to separate potentially recyclable components. The possibility to clean recovered materials that can be recycled after preliminary washing was also considered.

The project team worked in close collaboration with some companies specialised in waste recycling that were interested in this topic, and was able to put forward some recycling and/or disposal solutions after checking their technical-economic sustainability. In this context, project activities aimed at identifying the best recycling technologies available at a local level for materials recycling. It is important to recall that waste transformation into new products to be placed on the market is one of the European Commission's strictest recommendations, as highlighted in the Circular Economy Package of December 2nd, 2015.

Finally, the project tried to fill in specific local gaps identified during project implementation by also focusing on fishing materials that are usually totally or partially discarded. Not only did it adapt recycling solutions to them, but it also suggested possible short-term solutions for their landfilling.

DEFINITION OF FISHING GEARS MANAGEMENT STRATEGY

| ORIGIN OF FISHING GEARS | CHARACTERISTICS OF MATERIALS | DEGRADATION STATUS |
|---|--|---|
| Abandoned Discarded Confiscated | Synthetic fibres, iron, steel, lead, inert materials | Presence of encrusting organisms, level of physical degradation |
| FEASIBILITY STUDY <i>Type of treatment, performance, environmental sustainability</i> | | |

Monitoring and assessment of the impact of ghost net removal on biological communities

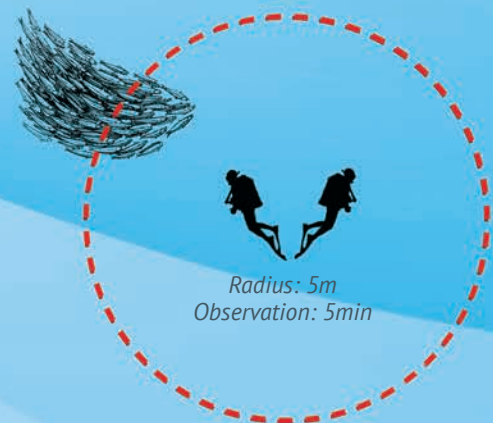
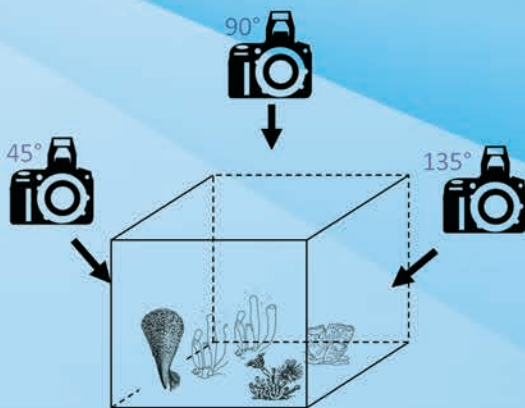
Changes to the rocky habitat ecosystem resulting from the removal of ghost nets were monitored for 18 months. The reaction of macrobenthic and fish communities in 5 cleared areas was assessed by comparing them with habitat areas that suffered no impact from fishing waste and were therefore the most suitable benchmark.

Innovative and non-destructive analysis techniques (i.e. 3D photographic technique and Underwater Visual Census) were used for monitoring. They showed a statistically significant increase in the biodiversity indexes (Richness, Shannon, Margalef) of the communities considered. In particular, the survey of the macrobenthic community was performed onsite using a special steel frame to acquire high-definition images of a stretch of seabed covering 2.500 cm² (50X50) from three different angles (45°, 90° and 135°). The images were acquired every 4 months as from ghost net removal, were processed and provided evidence of a biodiversity increase with the recovery and development of some populations.



Action in figure

- 5 areas monitored
- 5 monitoring campaigns performed over 18 months
- 57 hours of immersion
- 1200 photographs taken





Development of a regulation proposal for ghost net management

The project issued some recommendations to the regional administration in the document "Operational recommendations for ALDFG effective management".

The text outlines the most effective prevention, mitigation and response measures to reduce the negative effects of this type of waste; in particular, the need for implementing a management plan for both recovered and discarded fishing gears is highlighted. Its importance was acknowledged by the Veneto Region with motion No. 173 of the Regional Council.

The project also drew up a Code of good practices to limit the loss and abandonment of fishing gears at sea, and promoted its adoption by fishing operators. The Code describes a series of behaviours and operational suggestions that can prevent the involuntary loss of fishing gears at sea. The document was shared with many regional fishing operators during targeted meetings held in the main fishing ports of Chioggia, Caorle and Porto Tolle.



Action in figures

- 3 technical meetings with fishing operators to discuss about the code of conduct
- 2 meetings with key stakeholders to approve draft regulation
- 100 copies of the Code of Conduct distributed to fishing and aquaculture operators



Economic valuation of ecosystem services, implementation of contingent valuation and costs/benefits resulting from ghost net removal

The project estimated the economic value of ecosystem benefits connected to the removal of fishing waste from seabeds in areas of great ecological value, such as rocky outcrop habitats. For the first time in Italy, Life-Ghost focused on the economic valuation of benefits resulting from marine biodiversity improvement in valuable areas. This original and targeted survey was developed by adopting an uncommon method known as *Contingent Valuation*.

Hypothetical scenarios were used to design four different fishing waste removal measures that were necessary to restore habitat biodiversity. Through questionnaires, the respondents assessed the different measures for improving rocky outcrop biodiversity and stated if they were willing to pay a certain sum of money for their implementation. In order to fully understand the respondents' position, the opinions and the level of acceptability of the local population for projects and policies on environmental protection and marine biodiversity improvement were also considered.



Action in figures

13 Focus Groups in 4 Italian cities with 170 participants

4000 questionnaires filled in at a national level

What is the value of preserving all this?





Dissemination, Communication and Networking

Life-Ghost has made a website in Italian and English on the project (www.life-ghost.eu) connected to the Facebook page (www.facebook.com/progettoghost) and YouTube (www.youtube.com/progettoghost).

The project team has participated in several national and international events to present the activities made, the methodologies used and the results achieved. It has also organised many events aimed at informing and raising awareness on ALDFG impacts among both fishermen and citizens. These meeting and dissemination opportunities have targeted key stakeholders such as fishermen, divers, harbour masters, as well as students and teachers of secondary school. They have been useful in increasing knowledge on the topic of marine litter, which also includes ghost nets.

Networking actions with other LIFE and European projects dealing with similar issues have been launched with a twofold aim, i.e. to promote the dissemination of project activities and the transfer of applied methodologies and the know-how achieved.

Action in figures

- 37 events organised by the project
- 38 participations to external events
- 3 editions of the project brochure
- 5 e-newsletters
- 6 roll-up
- 1 communication plan
- 1 press review
- 2 fact sheets
- 11 posters
- 5 articles
- various gadgets (pens, usb, umbrellas, folders)
- 1 web site
- 1 Facebook page
- 1 YouTube channel
- 2 videoclips
- 1 project video



Achieved results

- Compilation of a database including all the information available on the biological communities of the rocky outcrops (tegnùe) located in the coastal areas of the Veneto region.
- Total removal of ghost nets and fishing waste materials from 9 impacted coastal areas. Overall, 12 km² of seabed have been monitored and 514 Kg of materials removed
- Biodiversity enhancement in cleared areas through the functional recovery of the relevant habitats.
- Gradual biodiversity increase monitored over 18 months in 5 areas cleared of ALDFG. Their diversity indexes were assessed at the end of the survey and resulted to be improved and comparable with those in unaffected reference site
- Analysis of the economic value of biodiversity improvement in marine environments (rocky outcrops in particular) and definition of policy guidelines to identify, quantify and calculate the economic value of the major impacts resulting from the removal of this type of waste.
- Cost-benefit analysis to assess the feasibility and cost-effectiveness of waste removal and disposal from seabeds by using alternative management options
- Drafting of a Code of conduct for the adoption of responsible behavior and fishing practices, shared with the fishermen operating in the project area, illustrating best practices to limit loss and abandonment of fishing nets and other fishing equipment at sea.
- Issue of operational recommendations for ALDFG effective management.
- Drafting of a technical protocol for ALDFG management in marine and coastal areas containing the definition of tools, procedures and instructions for collection as well as recovery guidelines for the different materials they are made of.
- Awareness-raising among stakeholders, concerned entities and all citizens on the wide issue of marine litter and ghost nets in particular, by means of training and information activities on this topic and ALDFG-related environmental impacts.



The LIFE+ programme

The LIFE programme is the EU's funding instrument for the environment. The general objective of LIFE is to contribute to the implementation, updating and development of EU environmental policy and legislation by co-financing pilot or demonstration projects with European added value.

LIFE began in 1992 and to date there have been four complete phases of the programme (LIFE I: 1992-1995, LIFE II: 1996-1999, LIFE III: 2000-2006, LIFE+: 2007-2013 and LIFE+ 2014- 2020). During this period, LIFE has co-financed some 4.171 projects across the EU, contributing approximately €3.4 billion to the protection of the environment. All the projects funded under this Community instrument have a common aim, i.e. to help achieve *sustainable growth through investment in a resource-efficient economy so as to help Member States and local authorities to implement plans and strategies in key policy areas like nature, waste, air and water*. The LIFE programme is managed by the European Commission through two Directorates-General (DG Environment and DG Climate Action) and is usually organised under thematic sub-programmes. In particular, the 2014-2020 programming period focuses on the implementation of two sub-programmes, Environment and Climate Action. Eligible measures must fall within the specific sectors listed below:

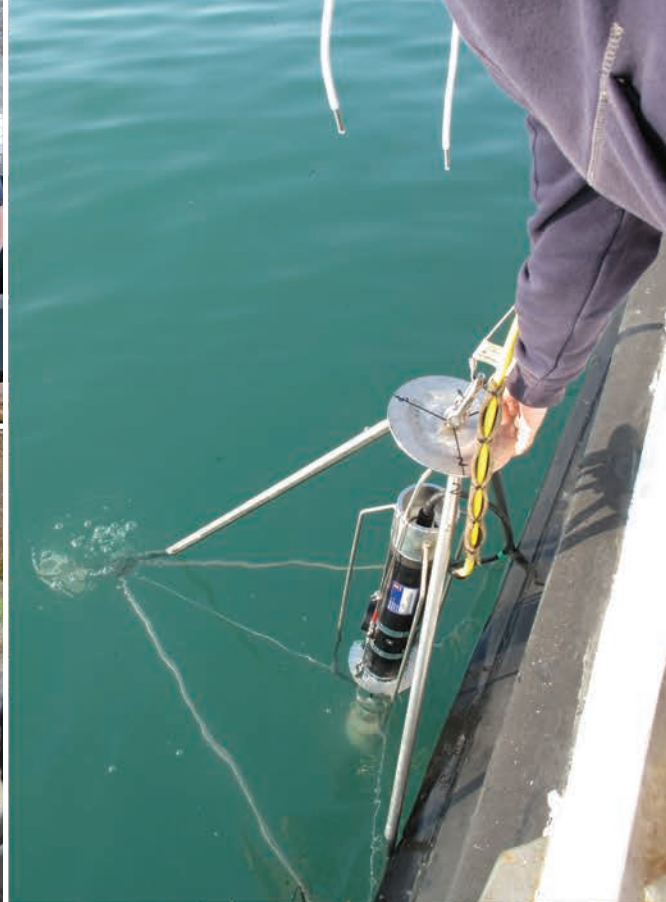
Environment

Environment and Resource Efficiency;
Nature and Biodiversity;
Environmental Governance and Information.

Climate actions

Climate Change Mitigation;
Climate Change Adaptation;
Climate Governance and information.

The Life-Ghost project has been co-financed by the LIFE-Environment sub-programme in the 2007-2013 programming period.



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- Comando Generale delle Capitanerie di Porto
- Rari Nantes Venezia
- Club Sommozzatori Mestre
- Società Cooperativa San Marco - Pescatori di Burano
- Coopesca - Organizzazione Produttori e Lavoratori della Pesca S.r.l. Chioggia