

FINAL REPORT OF THE MAVA DEPREDATION PROJECT

INTRODUCTION AND OBJECTIVES

Depredation caused by cetaceans (mainly bottlenose dolphins) in fisheries is a growing matter of concern for several fisheries in the Mediterranean region. Socio-economic impacts caused by the damages to the fishing gears and the loss of catches create situation of conflicts between fishers and dolphins, weakening the conservation and sustainability efforts promoted by regional organizations such as ACCOBAMS, the General Fisheries Commission for the Mediterranean (GFCM) and the Regional Activity Centre for Specially Protected Areas of the UN Environment/Mediterranean Action Plan (UNEP-MAP/SPA-RAC).

During a first phase from 2018 to 2020 (Phase 1), the depredation issue was addressed through the MAVA-Funded project *“Towards solutions to interactions between fisheries and cetaceans in Moroccan and Tunisian waters”* aiming at reducing depredation by bottlenose dolphins (*Tursiops truncatus*) in small pelagic purse seine fisheries in Morocco and Tunisia. The overall coordination of the project was ensured by ACCOBAMS and GFCM Secretariats, in collaboration with UNEP-MAP/SPA-RAC. Activities were implemented in areas identified by the scientific national partners, building upon pilot actions carried out on cetacean depredation through a former 2015-2018 project¹.

In parallel, another MAVA-funded project *“Mainstreaming Small-scale Fisheries in the Mediterranean”* (2019-2020)¹ led by the Low Impact Fishers of Europe (LIFE) covered small scale fishing gears in South Spain, Sicily and Malta. It included data collection through questionnaires to fishers from various ports aimed at gathering information on the characteristics of the fishing fleet and gear, and on the state of cetacean depredation and expenses incurred.

Based on the knowledge and experience acquired through both projects, efforts were then oriented to assess potential mitigation measures (technical or management solutions) in different fisheries under controlled circumstances during a second phase. This project *“Mitigating dolphin depredation in Mediterranean fisheries – Joining efforts to strengthen cetacean conservation and sustainable fisheries”* (2020-2022), also funded by MAVA, has been coordinated by ACCOBAMS Secretariat, GFCM Secretariat, UNEP/MAP - SPA/RAC and LIFE.

The objective of Phase 2 was to exchange and capitalize on the knowledge acquired in Phase 1 by all involved organisations, and to pursue the activities related to the assessment of depredation caused by cetaceans in purse seine fisheries in Morocco and Tunisia, in small-scale fisheries in Andalucía (Spain), in Sicily (Italy) and Malta, in a harmonised way, and to test different mitigation measures - respectively, strengthened fishing gears, the efficiency of different acoustic devices like pingers or other innovative potential measures, such as lights, alarm systems, umbrella devices, etc. - with the technical support of skilled experts in fishing gear technologies, in acoustics and in cetacean population monitoring, and the close engagement of the fishing sector.

¹ The MAVA1 project *“Mitigating the negative interactions between threatened marine species and fishing activities”*

GOVERNANCE AND PARTNERS

The overall coordination of all MAVA funded depredation projects (MAVA1 project, Phase 1 and Phase 2) was ensured by **ACCOBAMS Secretariat** and **GFCM Secretariat**, in collaboration with **UNEP/MAP - SPA/RAC**. **LIFE** was also involved in the coordination of Phase 2. At the national level, the following **indirect partners** were responsible for the implementation of field activities related to depredation monitoring and mitigation trials within five specific locations. They collaborated with local fishing communities and local fishery authorities, keeping them informed on the project objectives and activities:

- **The National Agronomic Institute (INAT)** and the **National Institute of Marine Sciences and Technologies (INSTM)** of Tunisia
- **Marecamp ONLUS Association** in Italy, Sicily
- **Asociación Herpetológica Española**, Spain (Andalucia)
- **the National Institute for Fisheries Research (INRH)** of Morocco
- **the Department of Fisheries and Aquaculture**, Ministry for Agriculture, Fisheries, Food and Animal Rights and **Malta College of Arts, Science and Technology, Malta**

STRATEGIES AND ACTIVITIES

Description of the strategy	Main activities per strategy
<p>Partnership Ensure the good governance of the project; coordinate between project partners and with other MAVA funded projects; coordinate activities implemented in each target country; strengthen collaboration between all partners working on depredation</p>	<ul style="list-style-type: none"> • Project management, including monitoring and reporting • Coordination with direct partners and national partners • MAVA OAP meetings and coordination with other MAVA Partners
<p>Ensuring technical solutions/mitigation measures to limit by-catch and conflict This strategy will focus on continued collection of depredation data and trials of mitigation measures with collaborative fishers. The strategy will be implemented in all of the target countries</p>	<ul style="list-style-type: none"> • Assessing depredation and monitoring cetacean populations involved in depredation • Testing mitigation measures (management solutions or technical solutions such as strengthened nets, acoustic devices and other innovative potential measures, such as lights, alarm systems, umbrella devices, etc.) • Exchange of experience between the different national teams and target groups (fishers) • Training of fishers
<p>Replication and scaling-up at Mediterranean level Activities for promoting the project approach, encouraging uptake across the Mediterranean and for disseminating the results and lessons-learned</p>	<ul style="list-style-type: none"> • Establishing state of knowledge on depredation and harmonising baseline of information available at Mediterranean level on the issue • Developing a standardized monitoring methodology, including an assessment of the feasibility/need to develop a single and unified register/portal of registered depredation cases across Mediterranean countries • Promoting exchanges between national partners and target groups (fishers) • Capitalizing on the results and lessons learnt related to the mitigation measures • Developing best practice materials/recommendations

MAIN RESULTS

❖ Ensuring technical solutions/mitigation measures to limit by-catch and conflict

Research activities were conducted in 5 pilot sites with the objectives to monitor cetacean populations present in the targeted fisheries areas, to analysis the interaction between cetaceans and targeted fisheries and to test Mitigation technologies. **The full reports of the results of those pilot studies** are compiled in the document ACCOBAMS-MOP8/2022/Inf39. There are also summarized in a dedicated brochure for dissemination purpose (see below) .

○ *Italy: “An Acoustic Alert System to mitigate the effects of the Feeding in Net behaviour by the Bottlenose dolphin”*

Marecamp has led an experimentation made to develop an Acoustic Alert System (AAS) to mitigate the effects of the “feeding in net” behaviour applied by the bottlenose dolphin on artisanal gillnets and trammel nets. This approach has shown to be effective in allowing fishers to haul up their fishing gear when the danger of depredation is near, helping to limit the suffered damage. Moreover, field investigations required for its development permitted to collect a vast repertoire of dolphin vocalizations, as well as to characterize the soundscape of the Gulf. Thus, every well-defined sound has been classified and included in a catalogue which could be the starting point for setting a future prototype of AAS.

Preliminary results promise a decrease in depredation events when the AAS is applied, with a consequent increase in catches for the fishers and a decrease in the risk of by-catch for the dolphins that usually feed on the nets.

○ *Malta: “Towards solutions to interactions between fisheries and cetaceans – The Malta case » - Malta College of Arts, Science and Technology (MCAST) & the Department of Fisheries and Aquaculture (DFA), Ministry for Agriculture, Fisheries, Food and Animal Rights*

DFA and MCAST Maltese scientists teamed up with foreign researchers to understand the status of cetacean occurrence, depredation, and their interaction with fisheries. Focus was deployed on small-scale fisheries which represent 93% of the national fleet so to collate knowledge from fishers, and integrate it with scientific data to closely understand how increasing cetacean populations are interacting with Mediterranean fisheries, quantify their socio-economic impacts, and invest in innovative technologies to curb damaging interactions to safeguard the fishing sector and the cetaceans.

During the second phase of this research, trammel nets were provided to fishers which were chosen at random on a rotational basis, along with pingers. Onboard observers joined fishers on a regular basis in order to determine the frequency, type and location of the dolphin interactions. Subsequently, pingers were tested on the trammel nets with the aim of reducing the damaging depredation interactions on fishing activities. Results show that cetacean depredation is a commonly occurring phenomenon in Maltese waters, and even though the results achieved can be considered to be preliminary, it appears that the tested pingers are proving to be effective mitigation measures, at least in the short term.

○ *Morocco « Bottlenose dolphin interactions with purse seine fishery in the Moroccan Mediterranean Sea »*

In the Moroccan Mediterranean Sea, dolphin depredation is adding additional hardship to the region's struggling small-scale fisheries sector. The INRH has been studying bottlenose dolphin depredation on purse seiner fishery in the South Alboran Sea, mainly in two areas M'diq Region and Al Hoceima region, which host the most depredations dolphin on purse seine fishery in the Moroccan Mediterranean coast.

Spatial distribution of depredation shows that this phenomenon is mainly encountered in a places of high encounter probability of bottlenose dolphins. Observations of bottlenose dolphin behaviours have also shown some very initial interesting results. Monitoring should continue for several years to investigate changes in behaviour or preference (which may require new mitigation measures) and to support marine conservation work in the region

Regarding mitigation measures, the pilot results show that the reinforced seine is a reliable solution. Generally, the prototypes suffered fewer tears than the regular purse seine. Furthermore, the average catch per fishing day for the large and medium-sized reinforced seine was almost twice that of the regular seine. This seine was more resistant to depredation, and its repair cost was lower than the regular seine used by fishers in both regions.

○ *Spain: « Interactions between air breathing marine vertebrates, particularly cetaceans, and artisanal fisheries in northern Alboran Sea (CETAFISHBE) »*

The CETAFISHBE project studies the interaction between cetaceans and small-scale fisheries in southern Spain. The main aims of this study were to show the existence of dolphin-fisheries interaction in the northern margin, and particularly to monitoring cetacean interactions in the fishing areas of Caleta de Velez and Fuengirola and to implement and test different low-cost mitigation methods to reduce bottlenose interactions in SSF in northern Alboran Sea.

As well as repeated interactions with dolphins, fishers increasingly report encounters with the invasive seaweed *Rugulopteryx okamurae*. The results of the analysis conducted with the project indicate that approximately 30% of the monitored sets suffered a net damage due to unwanted interaction with non-target wildlife species (alien seaweeds or dolphins). As part of the approach to the problem, fishermen were surveyed about the economic impact dolphins have on their economic activity. The economic value of the repair time of a net on each interaction is between €50 and €60 per net plus the equivalent value of the fish not caught by that area of net with a hole in it and the losses by depredation. The economic situation of the fishermen is in a critical state due to the need to reinvest the few profits in repairing the nets.

Depredation mitigation trials efforts were focused in trying to find and apply a low-cost solution/mitigation to dolphin depredation through the design of two over four proposed low-cost mitigation devices: Mitigation based on recycled glass bottles used as acoustic deterrents and mitigation based on Compact Disks (CDs) based on acoustic and light reflection device. Pingers were also tested as high-technology devices for dolphin mitigation as alternative solution but without positive results. Although these low-cost mitigation devices did not show any noticeable reduction in dolphin depredation, more experiments are needed to draw statistical conclusions.

○ *Tunisia: « Towards solutions to interactions between fishing communities and *Tursiops truncatus* in Tunisian waters »*

In order to attenuate depredation induced by *Tursiops truncatus* to sardine fishery in the region of Kélibia, depredation events were monitored and three types of repellents were tested. The depredation rate was equal to 36%. The depredation events occurred mainly during encirclement and concentration of fish under the lights. The experimentation of the acoustic devices showed a significant decrease of depredation rate, where boats equipped with device showed the lowest frequency. Comparing the averages of the depredation rate by type of repellent used, it appears that purse seines equipped with interacting acoustic device (DiD-01 and Licado) had the lowest depredation rate.

Among the three tested repellents, only DDD-03-H gave discouraging results. A clear decrease in efficacy was observed in the short term. This may be probably related to bottlenose dolphin habituation to this kind of repellent especially as it is immediately activated by water contact. It could possibly have developed a "Dinner Bell" effect in this species, which may explain the attractiveness of bottlenose dolphins to purse seiners once deployed.

This study should be sustained to assess the habituation period to the selected devices. Research leaders from INAT and INRH also strongly recommend the initiation of reinforced seine monitoring and bioacoustics monitoring both on the farm and around sardines. It is also suggested to experiment other acoustic repellents and to take account of the depredation phenomenon in the Regional Dolphin Conservation Plan.

❖ Replication and scaling-up at Mediterranean level

Two reports were developed by ACCOBAMS and GFCM, in order to get a review on the State of depredation in the Mediterranean fisheries and a standardized monitoring methodology of depredation events. Both following reports were endorsed and are published by FAO/GFCM:

- Carpentieri, P. & Gonzalvo, J. 2022. Dolphin depredation in Mediterranean and Black Sea fisheries: methodology for data collection. FAO Fisheries and Aquaculture Technical Paper No. 688. Rome, FAO. (ACCOBAMS-MOP8/2022/Inf41);
- Gonzalvo, J. & Carpentieri, P. Dolphin depredation in Mediterranean and Black Sea fisheries - Methodology for data collection (*in dev*) (ACCOBAMS-MOP8/2022/Inf40).

In order to raise awareness on the issue of depredation, the following **communication products** were developed:

- an 8 minutes GFCM-ACCOBAMS Movie on the depredation issue;
- a short video deriving from the movie for social media use;
- a series of Comics stripes.

In order to return and capitalize on project results, a **brochure summarizing the results, lessons learnt and recommendations** from activities conducted in the 5 pilot sites was developed for dissemination purposes.

2 workshops “Mitigating dolphin depredation in Mediterranean fisheries joining efforts for strengthening cetacean conservation and sustainable fisheries” were organized in order to promote exchange of information and lessons learnt across the region between national teams involved in the project, and also with other experts/organizations working on depredation assessment/mitigation in the Mediterranean and beyond:

- A first exchange workshop organized online in November 2020;
- A second exchange workshop in Catania, Sicily, 8-10 June 2022.

These workshops have produced a **series of recommendations** related to the scope of the depredation issue, Cetaceans' populations and behaviour, and to mitigation techniques and management measures aimed at reducing negative effects.

Tunisian researchers from INAT and INSMT presented their research work and results during the 24th Biennial Conference on the Biology of Marine Mammals of the Society of Marine Mammalogy.