Carefish report - welfare assessment in Purse seine fisheries

CARE FISH catch

Promoting better fishing standards

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Carefish/catch project - promoting better fishing standarts
Carefish/catch report – welfare assessment in Purse Seine fisheries,December 2023

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BRINGING WELFARE TO THE FISHERIES SECTOR

Animal welfare is an emerging issue in aquaculture and fisheries, relating to ethics, animal health and product quality. A growing number of researchers, decision makers and advocacy groups have been pushing for fish welfare to be thoroughly researched and integrated in the conversation about the future of seafood standards. Following these lines, the Carefish/catch project aims to promote better fishing standards, by assessing animal welfare impacts in fisheries and promoting better fishing standards.

One important objective of the project is to identify key points of welfare hazards and suggest improvements to reduce suffering of individuals in specific fishing methods. This would enable the establishment of welfare standards into the fisheries sector, through a series of recommendations and guidelines to be implemented into the fisheries certification program Friend of the Sea.

Purse Seine Fisheries

Seine and surrounding nets are fishing gears used in small-scale and industrial fisheries around the world. A common type of seine is the purse seine, which alone is responsible for close to twenty percent of global catches, being the second most common method after trawling. Certain target species varying from small to large pelagics can bring in significant revenue for the sector (e.g., Tuna), as reported by the Food and Agriculture Organization (FAO).

A purse seine is a fishing net that hangs vertically in the water with its bottom edge held down by weights and its top edge buoyed by floats. In general, seine nets can be deployed from the shore as a beach seine, or from a boat. It is deployed around an entire area or school of fish, so it is a non-selective fishing method that may capture everything that it surrounds. The capture process involves encircling the fish on the sides and below, preventing them from escaping through the bottom of the net, even when operated in deep water. Often the siege is carried out with the aid of light sources to attract schools or aggregated by artificial means, such as floating object (Fish Aggregating Devices, FADs). In purse seining, echosounder, sonar or even helicopter scanning are used to locate schools of pelagic fish many times associated with bird and mammals' aggregations as well. Once a school is located, a skiff encircles the school with the net or hangs the net while the vessel encircles the school. The lead line is then pulled in, "pursing" the net closed on the bottom, preventing fish from escaping by swimming downward and in a single event, tens of thousands of fish can be harvested. A purse seine winch is used for the pursing by hauling both sides of the purse line and catch is then brailed with nets mounted on cranes or sucked by large water pumps into containers onboard the main vessel. Nets are made up of panels of netting stitched to make a rectangular shape, can be from 10 up to 2000 meters long and up to 250 meters depth. Net size varies according to the vessel, mesh size, and target species and can be operated in marine coastal and high-sea waters, up to 300 m deep. Commonly the catch operation is divided in an initial search stage, the pursing, the hauling, and the fish transfer or pumping stage.

As an active gear, purse seine nets are designed to chase and capture target species, and compared to other fishing gears like trawling, most purse seine nets are not considered to be harmful to natural resources or environment. In certain cases, the potential negative impact produced by a purse seine may result from its catching performance, in terms of species and/or fish sizes. On one end the gear is highly selective when targeting small pelagic fish assemblages with limited species and size diversity, but on the other, there may be important bycatch of non-targeted species, small fish or fish in excess that is discarded or slipped afterwards. Regarding PET (Protected, Endangered and Threatened) species and specifically for purse seine, there are considerable risks to sea turtles and marine mammals to be encircled by nets, and even the quick retrieval during hauling might not avoid internal or external injuries or stress trauma from being entangled in nets for long periods of the operation. The implementation of mitigation methods comprises e.g., the reduction of use of fish aggregating devices (FADs) in fisheries targeting tunas, or the use of acoustic deterrent devices in fisheries targeting small pelagics to reduce the capture of dolphins.

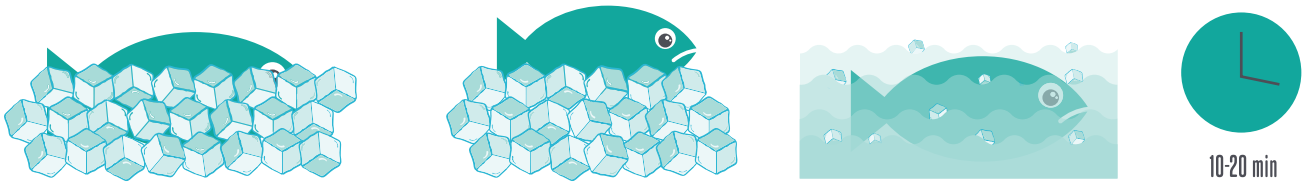
This report adresses the purse seine fishery that operates in southern Portugal targeting small pelagic fish, which is representative of purse seine fisheries operating in southern European Atlantic and most western and central Mediterranean countries.

Carefish/catch experimental approach on Fisheries welfare

For this study, our focus has been to better understand the impact of purse seine fisheries in welfare of the main target species. Collaborating with commercial fishing vessels we conducted experimental trials to enable the i) the identification of key points of animal welfare when arriving and handled onboard, and ii) the proposal of innovative and alternative methods or recommend other best practices and improve product quality.

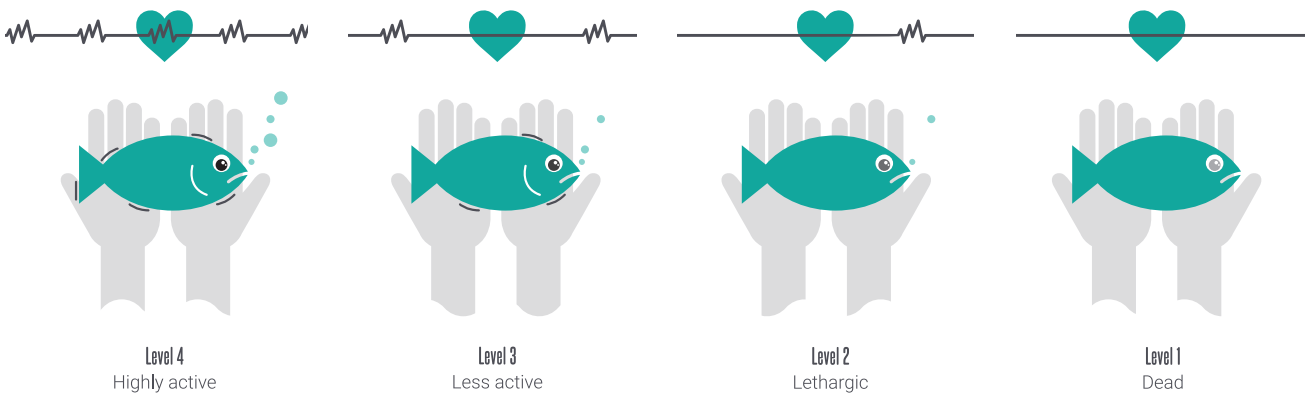
Sampling conditions:

The sampling was linked to distinct stress sources / moments of fishing operation in three target species - European sardine *(Sardina pilchardus)*, Atlantic chub mackerel *(Scomber colias)*, and Atlantic horse mackerel *(Trachurus trachurus)*. Fish conditions were appraised at different moments during the catching and storing procedures in a normal commercial operation. We scored and sampled the first fish to arrive on deck before being stored (first brail hauled onboard) and followed this group through different treatments for 10 and 20 minutes: 1. stored on ice; 2. stored under ice and 3. immersed in ice slurry. We also observed those collected from the center of a storage container with little or no ice at 10-20 min after hauled and those collected from the last brail carried onboard, approximately 20 min from the beginning of the brailing operation.



Vitality assessment:

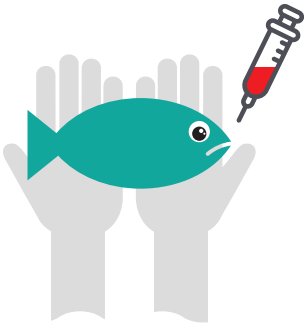
Vitality of the purse seine target species was assessed upon arrival on deck using a decreasing scale with four levels (e.g., from level 4 indicating free movement to level 1 indicating death/unresponsive state). In parallel to this score, we followed and documented the process and possible impacts to the animals from the moment they are collected the water until they are stored for transport.

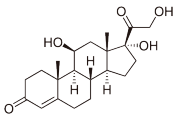


Physiological assessment:

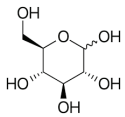
We took blood samples at each stage mentioned above and evaluated the production and accumulation in time of stress indicators (e.g., cortisol, glucose, lactate, osmolality) to estimate the level of impact caused by the onboard storing treatment.

The approach derives from established behavioral and physiological methods to assess pain, stress/distress and negative affective states in fish overall, including our previous experience in aquaculture species and in pelagic fish from purse seine fishing.

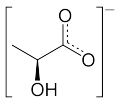




Cortisol



Glucose



Lactate

Osmolality

Welfare impact of Purse Seine Fishing

Results exposed relevant differences in resilience associated with the three species. Although no significant differences in vitality were observed between fish initially retrieved from the water and the last sampled fish, on board chub mackerel presented a slower loss of vitality than the other, whereas the sardine exhibited the quickest (Figure 1). Simulation of the storage process using ice in different ice conditions showed all species' decrease in vitality was accelerated by use of ice, albeit for chub mackerel in particular many individuals remained responsive for several minutes after being placed in such conditions.

Physiological data (Figure 1) indicates that for chub mackerel storage on ice or under ice appears to halt or reduce the release of metabolites as vitality drops, being slightly more effective than placing the fish in a storage container with no ice, especially in relation to cortisol and lactate. Sardine under ice show higher levels of metabolites than those on ice despite the faster drop in vitality. Storage in a container without ice results leads in a continued increase in lactate for both species.

The time the fish spend in crowding conditions in the closed seine before being hauled on-board has also relevant impacts on physiology and vitality. Chub mackerels do not seem to lose vitality within a 20-minute period of intense crowding, but show large increases in blood cortisol and lactate, while the sardine collected in the first brail already show elevated values of cortisol, with a drop in vitality even in free swimming fish. It is important to note that the value measured at time zero (first brail to be hauled) reflects the circulating levels in fish that were already enclosed and increasingly crowded for at least 30 minutes before the sample was taken (Figure 1).

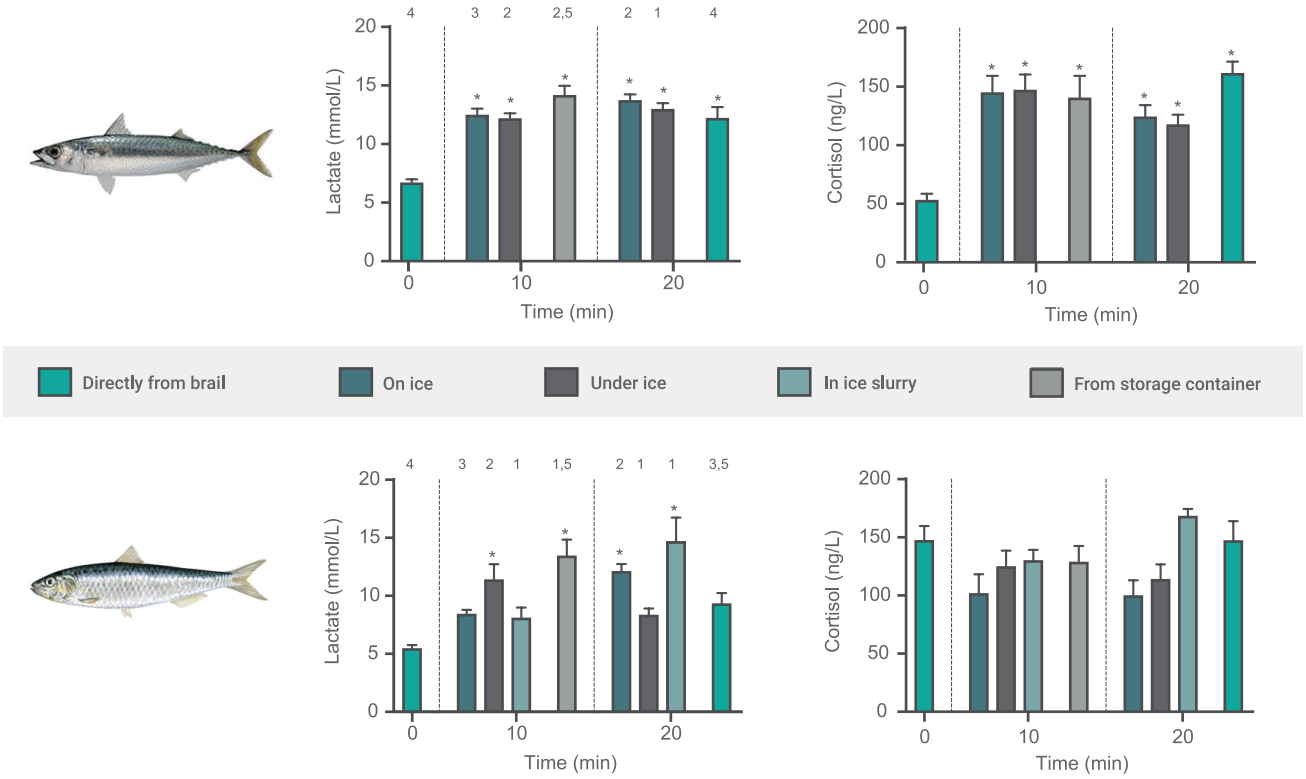


Figure 1. Analysis of plasma lactate (left) and cortisol (right) in chub mackerel *S. colias* (top) and European sardine S. pilchardus (bottom). A One-way ANOVA was used to compare differences between groups with a cut-off of p=0.05. Asterisk – significantly different from 0i (directly from brail at 0 min). Numbers on top denote the average vitality level at each stage.

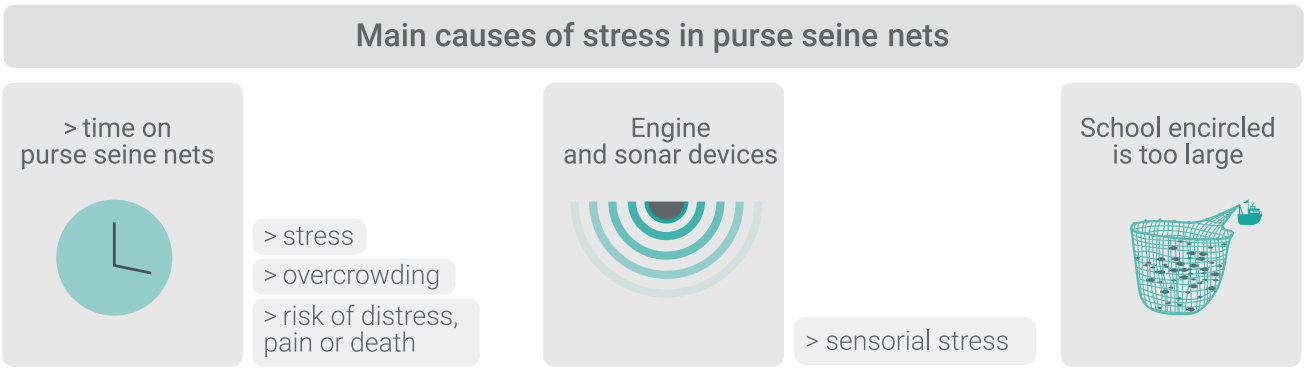
Key points with Impact on Animal Welfare

i.Capture

There are diverse factors interfering in fish welfare during harvest associated to what happens to fish below the water column after the interaction with fishing gear until it reaches the vessel deck.

The full duration of the purse seine operation might take between one and a couple of hours and depends on gear dimensions associated to factors such as target species or fishing area. The longer this period is, the higher is the impact of restraining stress during net encircling and overcrowding, increasing the risk of distress, pain or even death by depredation, suffocation, hypoxia, exhaustion, physical injuries (e.g., scale loss, cuts, bleeding wounds) or psychological.

Engine and sonar devices are a potential cause for sensorial stress during long periods of time and only the reduction to a minimal usage of such devices, or the use of alternative and less intrusive devices (e.g., electrical engines), could help to reduce such stress source. Also, although the sonar is used to localize and track the schools it cannot always effectively determine the species or fish size, and frequently schools of fish are composed of more than one species (mixed schools), and consequently a small percentage of non-target species is regularly captured. Despite being reasonably selective, bycatch will always be associated with this fishery as for now it is not possible to evaluate and detail the composition of the encircled school until the purse is closed and tighten. The release of non-target species or bycatch in mixed schools is a complex procedure that can only be done after the purse seine is fully hauled back, with all the potential impacts on fish welfare referreed above.



A similar situation occurs when the size of the school encircled is too large for the vessel capacity or allowed quota, or when most of the fish is under minimum size, and thus some or all fish from the target species must be released. Quicker and not too severe hauling and drying of the net procedures are recommended to minimize crowding stress, compression trauma and injuries, physiological and sensorial stress, and even asphyxia during this process. Also, to improve the likelihood of survival of released bycatch and discards, the use of modified enhanced slipping techniques is highly recommended. Finally, the catch collecting process by using both, scooping net or pumps lead to internal and external injuries in fish. It is recommended to proceed with higher swiftness even if it takes to reduce load volumes on landing nets or adjustment of intensity and flow in pumps.

Some possible recommendations would be to improve gear selectivity, improve fishing areas mapping namely by identifying biodiversity "hotspots" or even to develop technology allowing a more accurate identification of the species in schools. Such tools would eventually help to minimize bycatch, avoid juvenile catch, or even minimize catch size in general.

ii. Onboard handling

Welfare of captured fish handled alive onboard is impaired by two main factors; i) the handling time itself, related to the removal of fish from its natural environment and its prolonged air exposure; and ii) the sorting activity, which adds extra time on this procedure and sums up to the possible impact in fish welfare. Focusing on the period since when fish is hauled, handled by fishers onboard and it is killed or dies, there are additional mental, physiological, and physical disturbances to the previously identified: gill membrane collapse and asphyxia due to air exposure, injury, pain, and scale loss from direct impacts with materials and from being in contact with other fish through overcrowding and crushing, thermal shock, decompression and exhaustion. In purse seining, containers are usually only lightly covered with chipped ice and the stacked fish will die by asphyxia and compression, so, an important recommendation is to develop and expedite onboard slaughter methods to avoid such suffering.

Our preliminary test on-board with different types of ice-storaging show a rapid drop of vitality when fish are placed on and under ice, or in an ice-slurry with a reduction in the release and accumulation of stress metabolites. Whether this reflects simply a reduction in metabolism in these ectothermic animals or may be related to a decrease in perception and distress needs to be addressed. Ice seems to be relevant to maintain product quality, and fish in these conditions are less likely to jump and sustain shock-related injuries, but ice may also be a cause for skin burns and other abrasion injuries.

The Carefish/catch Project is currently targeting these two periods, here identified as key points in Purse Seine fisheries; i) Capture and ii) Onboard handling, aiming to assess individual fish physiological status and vitality capacity as proxy for fish welfare for this specific fishing method. Additionally, other research trials (e.g., comparative analysis of pumps and landing nets effect in fish condition and vitality), are foreseen in the scope of this project.

iii. Stunning and Slaughter

No dedicated stunning and slaughter methods are used in this fishery. Currently, death by asphyxia and compression on deck containers after hauling or during storing process are commonly reported for most of the known seine and surrounding fisheries. General recommendations to decrease pain or suffering are to **stun and slaughter animals as soon as possible when they arrive on board**. Immediate storage on ice cannot be seen or recommended as a stunning method, but it may provide a quicker demise, avoiding more prolonged suffering while maintaining better organoleptic and nutritional features. Ice is already used for some high value commercial species, and if deemed beneficial in reducing suffering, may be more acceptable and easier to adopt by fishers in the short term while alternatives are tested.

Stunning methods for seine fisheries could include electricity by providing an electrical shock either in water or in contact with two electrodes while emerged, rendering the fish unconscious. Slaughter following electrical stunning should be performed as soon as possible even before sorting procedures, by immersion in ice water (hypothermia) or storage on ice (asphyxia + hypothermia) while stunned, avoiding, or reducing the rate of tissue acidification due to buildup of lactate, allowing to maintain the best quality of fish meat possible.

Although electrical stunning mechanisms can be adapted to some vessels, this requires additional and trained manpower and mostly the installation of large equipment onboard. There are also current doubts about the species-related efficiency of electrical stunners, which also highlights the need to continue research in more effective, efficient, and practical stunning /slaughter methods, that can be suitable to install in fishing vessels and easy and safe to operate by fishers.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