**Executive summary of the stereoscopic cameras pilot project, objective 1: test the use of stereoscopic cameras during first transfer (Universitat Politècnica de València - UPV)**

Tests for the use of stereoscopic cameras during the first transfers from purse seine vessels to towing cages in order to be able to estimate at this stage the weight of the captured bluefin tuna (BFT) were conducted during the fishing campaigns of 2024 in the Mediterranean and the Adriatic.

In the Mediterranean, four first transfers were recorded in collaboration with Balfegó Tuna after a 13-day extended stay on board a patrol vessel, simulating the typical setup used during caging transfers from transport cages to farm cages — fish recorded laterally with a monocamera for counting and a stereocamera for length estimation. Fish length estimations were carried out by using custom software and stereocamera recordings, based on marking snout and fork-tail points of at least 20% of the number of fish being caged. In first transfers, 32%, 21%, 45%, and 73% of fish recorded by the stereocamera were manually measured, corresponding to 23%, 20%, 37%, and 59% of the fish recorded by the monocamera. Note that the percentage of samples depends on whether the counting is based on the monocamera or the stereocamera recordings, due to the fish missing due to the stereocamera's narrower field of view. The time invested for fish counting varied between 1.5 and 4 hours per transfer, depending on the number of fish, amounting to a total of 10.5 hours across all the first transfers, whereas the time invested for fish length estimation varied between 1.3 and 9.5 hours per transfer, amounting to a total of 16.3 hours across all first transfers.

In two transfers, there were no additional transfers after the first, so the results could be compared with those obtained by fishing authorities from caging transfer videos. Average lengths were 201.9 and 210.5 cm in the first transfers, compared to 192.6 (-4.6%) and 207.4 cm (-1.5%) in the caging transfers. This disparity could stem from differences in sampling, operator variability, and software (with caging transfer measurements provided by fishing authorities using AM100 software), but this needs further investigation. Average weights could be derived by applying the corresponding length-weight relationship. Fish counts differed by 5%, likely due to operator differences and the difficulty of counting schools in video footage. Studying the feasibility of using acoustic echosounders for counting – capable of detecting occluded fish and potentially automatable – may be beneficial.

In conclusion, estimating the weight of captured bluefin tuna during first transfers from purse seine vessels to towing cages proved technically feasible in the Mediterranean, using a procedure similar to that employed in caging transfers. This approach involves a monocamera for fish counting and a stereocamera for fish length estimation, as outlined in Annexes 8 and 9 of *Recommendation by ICCAT amending the Recommendation 21-08 establishing a multi-annual management plan for bluefin tuna in the eastern Atlantic and the Mediterranean* (Rec. 22-08). However, we have concerns about the logistical demands required to implement quota control during first transfers. These include increased needs for resources such as inspection personnel, stereocameras, and patrol vessels, as well as potential delays in the fishing campaign if transfers need to be repeated to obtain valid sample sizes due to fish occlusion.

Two alternative recording setups were proposed for the Adriatic: 1) Use a 7x6 meter gate and record with one stereocamera for small catches, up to 500 fish averaging 8-10 kg. 2) Use the common 14x6 meters gate and record with two stereocameras, positioned on either side of the gate, to accommodate larger catches. These setups were intended to allow for comparisons and recommendations. Unfortunately, after a 17-day extended stay in Croatia, only one transfer was recorded using a setup with two stereocameras and 10x6 meter gate. The lack of additional recordings was due to a scarcity of catches during our stay, primarily caused by unfavorable weather and sea conditions. Additionally, the tests were conducted late in the season, by which time most of the quota had already been captured as per the operators' request. A comparison of fish counting and sizing between first transfers and caging could not be performed, as fish from four other first transfers were placed into the transport cage.

Fish length estimation covered 65% of fish counted with the stereocamera, which corresponds to 54% of fish counted with the monocamera. The rest could not be measured due to occlusion. Fish counts using the monocamera and the stereocamera differed by 16.7%. Given that all fish were within the field of view of both cameras, the discrepancy is likely due to occlusions and the different perspective and wider field of

view of the monocamera. The comparison between first transfers and caging transfers could not be made as fish from other four first transfers were placed in the transport cage prior to caging, although average lengths (80.6 and 79.1 cm) and average distances (6.4 and 5.4 meters) are similar.

In conclusion, estimating the weight of captured bluefin tuna during the first transfers from purse seine vessels to towing cages was technically feasible in the Adriatic. The transferred fish could be counted with one monocamera and measured with one stereocamera using a gate size of 10x6 meters, as the fish passed at a distance between 4 and 9 meters from the camera (most between 5 and 8 meters). However, since only one experiment was conducted, further experiments are likely needed to properly determine the optimal gate size and number of stereocameras required. With the current 14x6 meter gate, two stereocameras should be used to adequately sample the transferred fish. If the transfer gate size could be reduced to 7x6 meters, one stereocamera would be sufficient. Additionally, the possibility of implementing the optimal setup used for stereocamera sizing at caging – where smaller gates of approximately 4x3.5 meters are employed together with a frame attached to the transfer gate to hold the cameras – should also be explored. However, the logistical demands noted for the Mediterranean apply similarly in the Adriatic.

Spreadsheets containing detailed results for all transfers are available for download via the following link [1]

to provide transparency for the report's findings.

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[1] https://upvedues-my.sharepoint.com/:f:/g/personal/pamuobe_upv_edu_es/EmBbujDyRMVAumwubK3X7KEB_zxNufx-wtOoqgMIeKA1bg?e=aIDPRG