Fishing for advantages with on-board electronic monitoring and digital image analysis techniques

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The relevance of electronic monitoring (EM) in turning data-poor into data-rich situations and cutting costs will become more and more important as a tool for sustainable fisheries management under an ecosystem approach. In this study we evaluate the utility of using cameras to a) identify beam-trawled rays passing on a sorting conveyor and b) digitally analyze the extent of bleeding on the undersides of beam-trawled flatfish. For a), video footage was collected onboard a commercial Belgian beam trawler; and for b), photographs were taken from 66 fish of six species sourced from the R/V Simon Stevin while beam-trawling in the Belgian coastal zone of the Southern North Sea. A trained reviewer was able to correctly identify thornback, undulate and spotted rays, among others, when comparing review record counts with on-board observations. For the second part of this study, injuries of interest were visible multifocal cutaneous petechiae (termed 'point bleeding'), and suffusion or haemorrhaging (termed 'bruising'). A series of algorithms was developed by students of the University of Ghent to 1) separate the fish from the background, 2) align each image and identify the species by raytracing; 3) segment the fish into fin, body and head regions (e.g. based on K-means clustering, frequency domain, Gabor filter and superpixel techniques); and 4) quantify the surface area of bleeding injury of each region by using species-specific thresholding techniques (i.e. hsv hue). For validation, results from the algorithmically obtained surface area % were compared to three rater's average % estimates. By accurately recording catches on-board and recording the coverage of externally visible bleeding injury, a device could be developed to combine and automate both camera-based techniques to sort any commercial catch and at the same time measure quality of whole fish or fillets. Such technological advancements will facilitate the transition towards a more sustainable fishery and the implementation of the European landing obligation.

Keywords: CCTV camera monitoring; commercial fisheries catches, digital image analysis