Development of a CPFD model-based technique to optimize feed pellet transfer in fish farms

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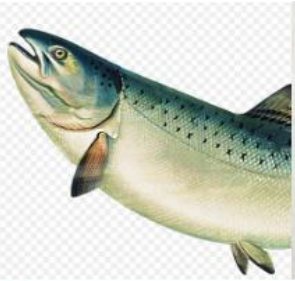
Introduction and background:

The act of seafood farming also referred to as aquaculture is no doubt the most looked into food alternative for humans. Fish farming happens to be the most prominent in the aquaculture industry. The fish needs to be fed some nutrients to enable healthy growth and these nutrients traditionally come in the form of granules or pellets. The pellets are transported over long distances to the fish cage through pipes, with different bends along the pipeline. However, erosion impact and pellet breakage predictions due to high velocities during the pneumatic transport of feed pellets has become a cause of concern in the fish farming industry, as it poses a threat to the pipe integrity and environment.

Problem description and objective:

Fish farmers in a bid to prevent pipe blockage during pellet transfer have adopted the use of very high transport air velocities. However, this has left a negative trail of environmental and economic consequences. These challenges include the cost associated with frequent pipe maintenance and damage due to increased wear on pipes, microplastic emissions into the sea, pellet breakage, local pollution, and loss of valuable yet expensive feed with high energy consumption in the process. In recent years, solutions to some of these problems have been provided through physical experiments carried out on different pilot platforms but this comes at a heavy cost. Therefore the objective of this study was to build a preliminary CPFD model using Barracuda VR® to describe the flow of fish feed through a HDPE pipe. The hydrodynamics of the transport process was investigated and optimization of the feed pellet transfer system was carried out. The CPFD model was validated against experimental data collated from a pilot rig test by using the results from simulations.



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