FLOW PATTERN ANALYSIS OF RECTANGULAR AQUACULTURE TANKS USING PARTICLE TRACKING VELOCIMETRY TECHNIQUES

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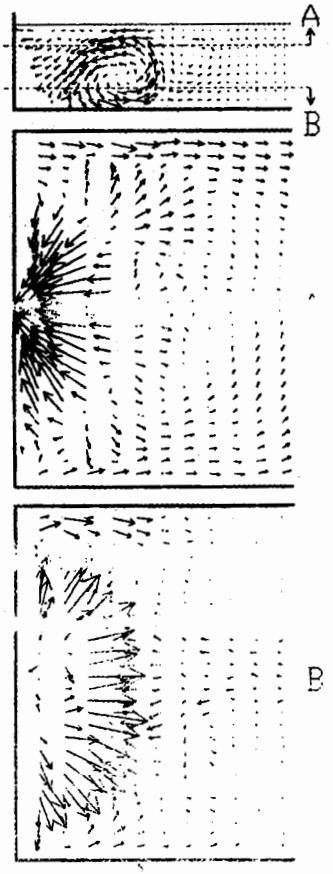
The basic design constraints of fish rearing tanks include good solids removal and uniform mixing, avoiding fluid dead volumes and bypass flows. All these factors contribute to achieve a uniform water quality, a more efficient use of feed and oxygen and to improve rearing conditions. The geometry of the tank, together with the characteristics of inlet and outlet flow structures must be defined in order to obtain a flow pattern allowing to succeed in the above mentioned purposes.

Particle Tracking Velocimetry (PTV) is a non-intrusive experimental method for investigating fluid flows. It uses tracer particles and measures a full velocity field in a two-dimensional slice of a flow by tracking individual particles in images over a time sequence. In this work, PTV has been used to describe and evaluate the flow pattern obtained in a rectangular tank with a ratio length-wide 2,5 and testing several inlet and outlet configurations and flow rates.

Configurations with an inlet consisting in an upright waterfall generate a vertical eddy near the inlet with a length around three times water depth. Secondary eddies can be generated close to the main eddy with smaller length and velocities (see figure). The submerged horizontal inlets induced a very heterogeneous velocity field.

Large horizontals eddies can be observed in configurations with a central inlet placed in the extreme of the tank. These eddies can occupy nearly the whole width of the tank, appearing fluid dead volumes in the eddy cores. The number of eddies generated will be influenced by flow rates and its emplacement is very unstable. In any case symmetrical velocity field can be observed. The influence of outlet characteristics on the flow pattern is very small.

Circular eddies can be forced in rectangular tanks through an appropriate emplacement of inlets. This kind of configurations produces a more consistent flow pattern. The emplacement of the outlets in eddies centres will facilitate the solids removal and avoid local recirculation.



Velocity field in a vertical and two horizontal sections (A and B) of a tank head with a central waterfall inlet