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Study of Fish Spawn Drift in the Elbe Estuary

Client: E.ON Kraftwerke GmbH (E.ON), DOW Deutschland Anlagengesellschaft mbH (DOW)

Location: Lower Elbe

Scope of Work: Construction of a operational Elbe model, simulation of the fish spawn drift

Method: Bearing and measurements of currents (ADCP) in a synoptic intake, 2D particle model

INTRODUCTION

DOW and E.ON are planning two power plants at the lower Elbe Estuary near Stade. It was supposed that fish spawn is extracted by the cooling system.

Therefore we were asked to study the drift of fish spawn from different spawn areas (in three points each with different cross sections of the Elbe) and spawning events (onset of flow resp. onset of ebb) to the outtake.

METHODOLOGY

A 2D hydrodynamic model of the Elbe Estuary was between Geesthacht and Scharhörn (Figure 1). The bathymetry was derived from multibeam echo soundings and official data from BSH. The model was calibrated for tidal water levels and by reference to current measurements (ADCP) (Figure 2).

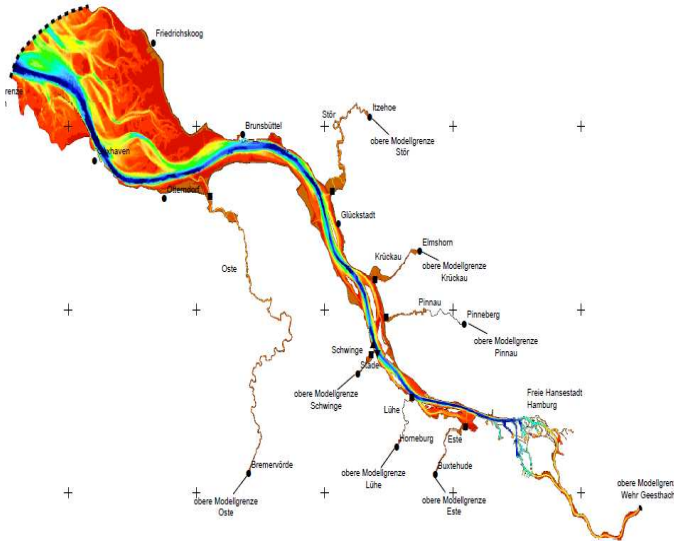

Figure 1: Operational model of the Elbe Estuary between Scharhörn and Geesthacht

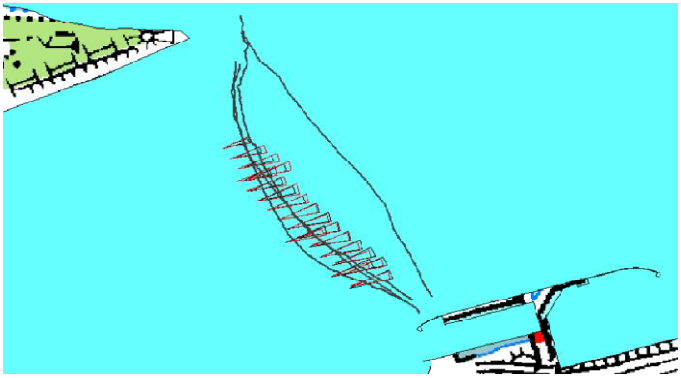

Figure 2: Comparison of model results with current measurements in front of the port of Stade-Bützfleth

In a second step, a particle model was setup on top of the hydodynamic model, which considers also turbulent mixing effects. One million fish eggs were suspended in a circle of 50 m for every spawn event.

The intake and outtake were considered appropriate to their real location and dimension in the geometry of the model.

The simulation was made for a period of 40 days. For this purpose an average spring-nipp cycle was chosen. At the weir in Geesthacht a mean discharge was used, which is appropriate for the period may - june. At the downstream boundaries of all other affluences a mean discharges were inserted.

RESULTS

The results show the transport paths of fish spawn over the tidal cycle in the farfield and near the outtakes resp. in Northsea direction and the local spreading near jetties and outtakes (Figure 3).

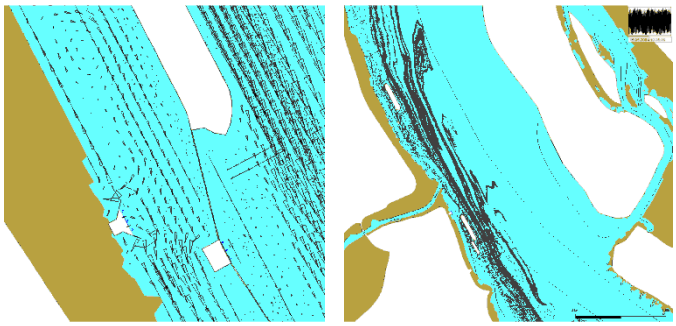

Figure 3: Spreading of fish spawn at the outtake of DOW and near the Mouth of the River Schwinge

It is visible, that the main outtake of fish spawn happen for spawning events at the left riverside. The majority of fish spawn is alreadyremoved after 5 days. There is a rapid spread across the river. Fish spawn from spawning events at or downstream of Rhinplate does not reach the outtakes.