A preliminary study on early stage of oyster larvae source and dispersal: a field and numerical study nearby Zoushe river estuary, Taiwan

Ting-Chieh Lin, Yin Chang, Jiing-Yih Liou, Shih-Chun Hsiao

Department of Hydraulic and Ocean Engineering, National Cheng Kung University

(1) Research motivation and field survey experiment

Oyster (Crassostrea angulata) has long been an important species for economic aquaculture in the west coast of Taiwan. It is found that tradition regions where oyster larvae (OL) were collected in the South part of Zoushe river have already changed. By assuming that OL movement is neutrally passive, we would like to investigate (1)where oyster larvae came from (2)which dispersal process of OL may behavior (3)hydrodynamic effects of tidal currents and nearshore water waves on OL dispersal processes. Both field survey and numerical model are applied. Figure 1 gives annual field distributions of OL, showing that (a)OL is able to spawn throughout the years, (b) spatial distribution of OL density Yulin coast has been decreased since 2012.

![Field data on spatial distributions of oyster larvae along the west coast of Taiwan](image)

Figure 1. Field data on spatial distributions of oyster larvae along the west coast of Taiwan

(2) Laboratory observations on oyster larvae movement and swimming velocities

![Laboratory observations on oyster larvae affecting by sunlight](image)

Figure 2. Laboratory observations on oyster larvae affecting by sunlight

Laboratory observations were performed to measure “behaviors” of oyster larvae affecting by sunlight. It was found that oyster larvae during the early life stage move to surface when flood tide and daytime, which is identical to our field observations.

(3) Development of a coupling hydrodynamic and biological numerical model

1) A two-dimensional, depth integrated shallow water model
2) RPF-DEP mild-slope water-wave model (radiation stresses)
3) A Lagrangian particle tracking model
4) Biological movement effects of oyster larvae

(4) Migration models of oyster larvae movement

1) Constant migration near surface
2) Constant migration near bottom
3) Sinusoidal-type migration
4) Step function-type migration

![Modeling strategy of oyster larvae movement](image)

Figure 3. Modeling strategy of oyster larvae movement

(5) Preliminary numerical simulation results

![Model calibration of tidal velocity & simulating oyster larvae dispersal processes using particle tracking approach](image)

Figure 4. Model calibration of tidal velocity & simulating oyster larvae dispersal processes using particle tracking approach

(6) Conclusion

1) Field survey data on oyster larvae distributions evidently indicates that current migration northward is urgent to be studied
2) Laboratory experiments suggest that oyster larvae would move to surface when flood tide and daytime.
3) A coupled hydrodynamic (tidal wave & water-wave) and oyster larvae movement model is tested and developed (future works).
4) A preliminary test indicates that oyster larvae came from the south coast near Chayci county. The dispersal processes are proved to be that from south to north.
5) Future efforts would be made to realize which hydrodynamic effects are predominant, especially the effects of nearshore breaking waves.
6) A possible mechanics on “rip current” driving larva to dispersal seaward has been investigated. Field experiments will be performed.

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