經濟部水利署
國立成功大學水工試驗所

Tainan Hydraulics Laboratory
National Cheng Kung University/
Water Resources Agency, Ministry of Economic Affairs
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A preliminary study on early stage of oyster larvae source and dispersal: a field and numerical study nearby Zhoushei river estuary, Taiwan

Ting-Chieh Lin[1,2], Yin Chang[1], Jiing-Yih Liou[1], Shih-Chun Hsiao[2]

[1]Tainan Hydraulics Laboratory, National Cheng Kung University

[2]Department of Hydraulic and Ocean Engineering, National Cheng Kung University

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(1) Research motivation and field survey experiment

Oyster (*Crassostrea angulata*) has long been an importance 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 Zhoushei river have already changed. By assuming that OL movment 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 Yunlin coast has been decreased since 2012

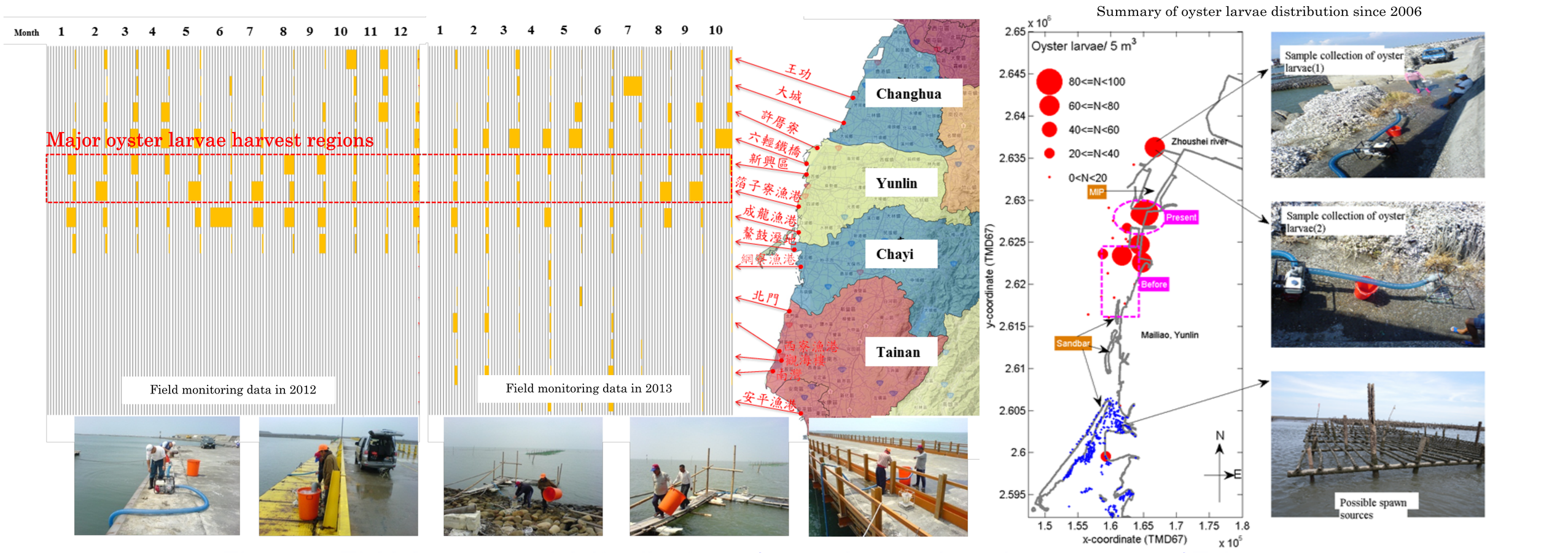


Figure. 1 Field data on spatial distributions of oyster larvae along the west coast of Taiwan

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

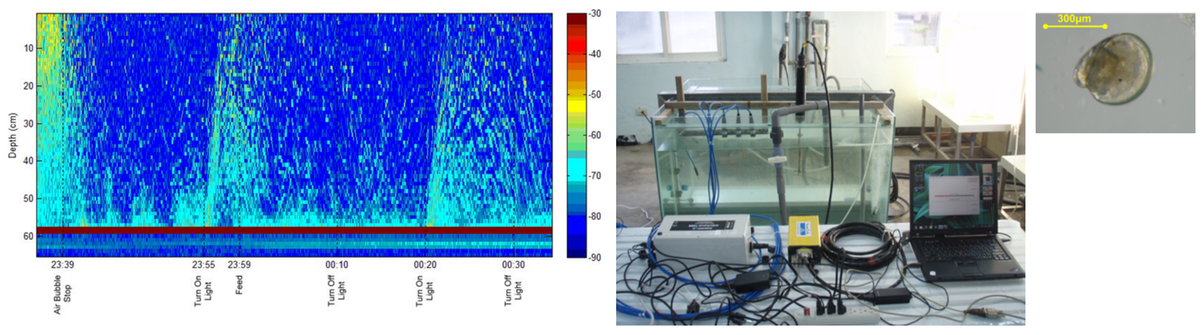


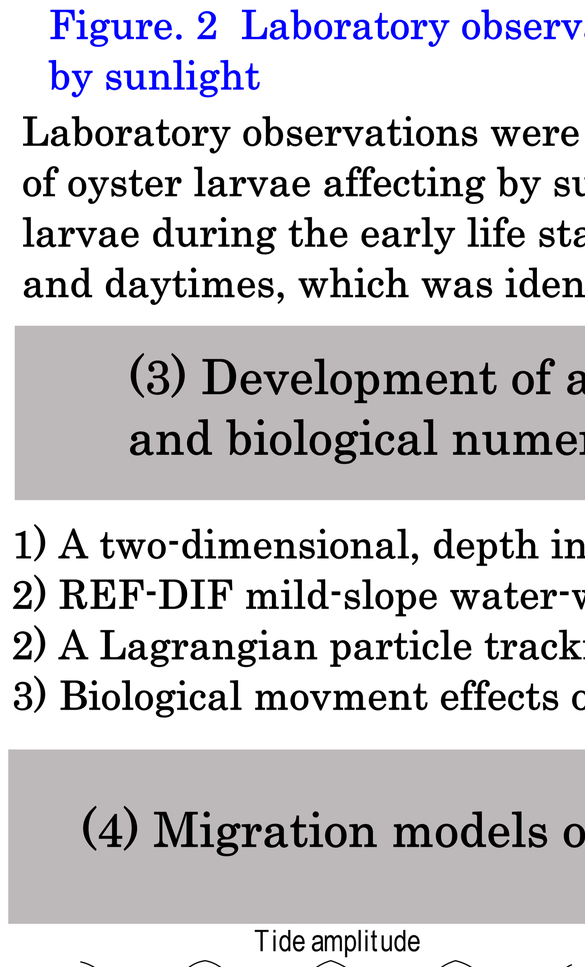
Figure. 2 Laboratory observations on oyster larvae affecting by sunlight

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

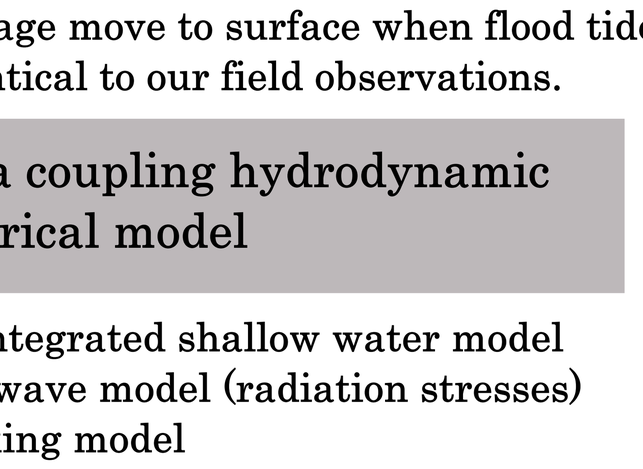
(3) Development of a coupling hydrodynamic and biological numerical model

1) A two-dimensional, depth integrated shallow water model
2) REF-DIF mild-slope water-wave model (radiation stresses)
2) A Lagrangian particle tracking model
3) Biological movment 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



Oyster farming nearby coast of Yunlin County, Taiwan. The settlement behaviors are modeled when oyster larvae touches the oyster crack boundaries.

Figure. 3 Modeling strategy of oyster larvae movment

(5) Preliminary numerical simulation results

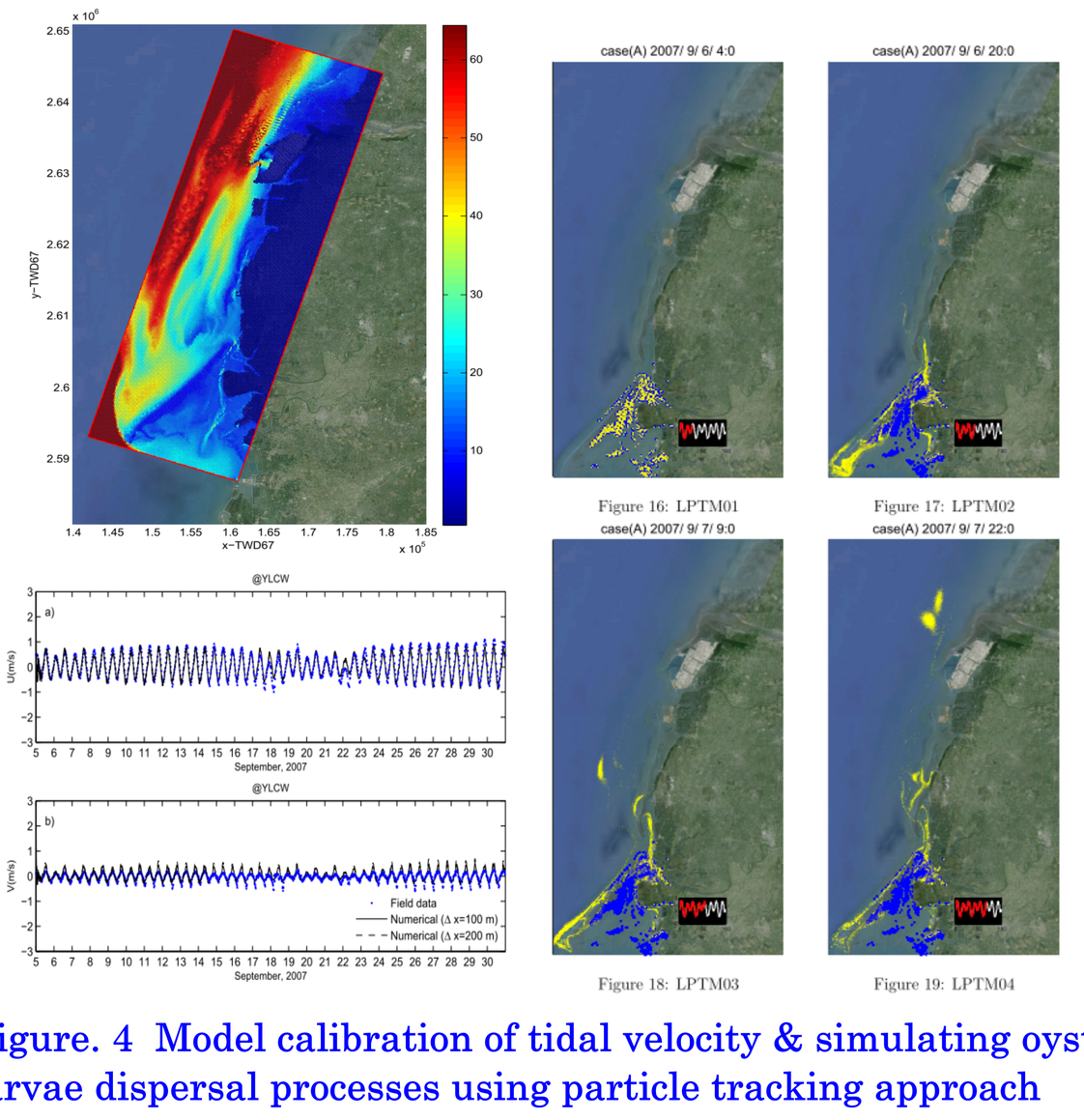


Figure. 4 Model calibration of tidal velocity & simulating oyster larvae dispersal processes using particle tracking approach

(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 movment model is tested and developed (future works).
4) A preliminary test indicates that oyster larvae came from the south coast nearby Chayi 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 larvae to dispersal seaward has been investigated. Field experiments will be performed.

Acknowledgement

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