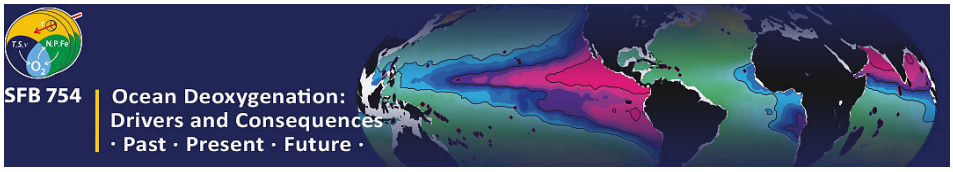

Contribution ID : **233** Type : **Oral**

Hypoxia in mangroves: occurrence and impact on nursery fish habitats

Tuesday, 4 September 2018 17:00 (15)

Mangroves naturally experience short-term dissolved oxygen (DO) fluctuations, making them susceptible to diel hypoxia. Hypoxia has adverse effects on aerobic organisms such as fish as it leads to physiological and behavioural altering community dynamics of marine animals.
DO is a fundamental parameter of water quality, but few studies have examined short-term changes of DO and the associated impacts on mangrove fish assemblages. This study examined diel DO fluctuations associated with tidal variations in mangroves in Australia and New Caledonia using high-frequency loggers. Meantime, underwater video cameras (UVCs) were deployed to link variations in fish assemblages to DO. Results highly suggested that DO could be one of the main factors influencing fish assemblages. However, as DO concurrently fluctuates with numerous factors (temperature, pH, depth, salinity), it was hazardous to confidently identify DO as a driver of fish assemblages without more investigations. Therefore, field results were used to conduct physiological experiments using respirometry to determine hypoxia thresholds of species exhibiting different mangrove utilisation patterns potentially influenced by DO. This understanding was then used to investigate how low DO influences fish assemblages and their mangrove utilisation.
Hypoxia (≤50% saturation) was commonly reported in mangroves of New Caledonia and Australia, especially during ebbing night tide, neap tide, and low tide. Severely hypoxic events (<10% saturation) were occasionally observed in these relatively undisturbed systems. Continuous monitoring of fish assemblages using UVCs provided invaluable information on how fish use mangroves, and allowed us to determine how DO influences fish present in mangrove forests. Indeed, some species would be systematically observed once DO reached unharmful levels (between 70 and 80% saturation), while other species were constantly observed even if DO was low. Physiological experiments corroborated these results, supporting our hypothesis that DO plays a crucial role in determining the value of mangroves for fish. These results demonstrated that in some mangrove systems, DO naturally reaches levels that can lead to physiological stress for fish, potentially making these habitats temporally unsuitable.
Mangroves are often used to dump nutrient-rich effluents from anthropogenic activities. These effluents contribute to eutrophication which alters the natural DO cycle and exacerbate the occurrence and severity of potentially natural diel hypoxic events. In a rapidly changing world, these nursery habitats are threatened as aquatic organisms utilising them are already coping with extreme environmental conditions that if further degraded may disadvantage species or even exclude some, leading to potential loss of high value nursery grounds.

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Session Classification : 02 Ecosystem Impacts

Track Classification : 02 Ecosystem Impacts