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| <b>STUDENT:</b>    | Cecile Rousseaux                               | <b>DATE:</b> | 09/12/2009 |
| <b>SUPERVISOR:</b> | Anya M. Waite, Ryan Lowe,<br>Peter A. Thompson |              |            |

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| <b>PROJECT TITLE:</b>  | Production and transport of particulate matter in a regional current system adjacent to a fringing reef |
| <b>NODE LEADER:</b>    | Node 1 and 3 (John Keesing and Chris Simpson)   |
| <b>PROJECT NUMBER:</b> | Project 3.9.4   |

| <b>REPORTING REQUIREMENTS</b> |   |
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| 1                             | <p>PROGRESS REPORT FROM SUPERVISOR [TO INCLUDE]</p> <p style="text-align: center;">Overall aims of research [to be used on the WAMSI website]<br/>Cecile's work aims to assess the availability of oceanographically derived nutrients and primary productivity in waters immediately adjacent to Ningaloo Reef.</p> <p style="text-align: center;">Progress made on the project [ to be communicated to the WAMSI Board]<br/>Having completed her field work, Cecile has proceeded to investigate satellite oceanographic analysis of the regional context for her work, and to pursue and understanding of the key factors governing regional production via Bluelink. She has also drafted two thesis chapters, presented her work internationally (gaining a student award in Nice, France) and locally.</p> <p style="text-align: center;">Any major risk issues [that the WAMSI CEO should be made aware of]<br/>Cecile is currently making excellent progress and we have every belief that she will complete her degree in a timely manner.</p>   |
| 2                             | <p>PROGRESS REPORT FROM STUDENT TO [INCLUDE]</p> <p style="text-align: center;">Summary of progress [to be used on the WAMSI website]</p> <ol style="list-style-type: none"> <li>1) Based on a large-scale oceanographic study from Northwest Cape to Capes Naturaliste and Leeuwin off WA (May-June 2007), I have quantified the gradients in relative production rates focusing on microzooplankton grazing.</li> <li>2) Focusing on several transects off Ningaloo Reef from the same cruise I executed a detailed analysis of the oceanographic linkages between the LC</li> <li>3) In a more detailed study of the shelf and reef front immediately adjacent to the reef, we executed a transect with 7 stations where physical data (Conductivity Temperature Depth) and biological data (fluorescence, extracted chlorophyll, picoplankton biomass, nutrient concentration and nutrient uptake rates) were sampled in May and November 08. Primary production was also measured at several stations in November 08.</li> <li>4) I used satellite images to extrapolate our field observations to a larger spatial and temporal scale. The data for the period from 1997 until 2008 to</li> </ol> |

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|                               | <p>allow an analysis of the impact of climate-driven process such as El Nino and La Nina on the chlorophyll <i>a</i> concentration in the Ningaloo Region. Bluelink was also used to analyse the temporal and spatial variation of the mixed layer depth in this region.</p>  |
|                               | <p>Summary of major findings to-date [to be used on the WAMSI website]</p> <p>Satellite images of ocean colour commonly reflect the annual development of a phytoplankton bloom during June – July on the western coast of Australia in the chlorophyll wavebands. In studies conducted in the South Western Australia a range of investigators observed this increase in phytoplankton concentration, and attributed it to various mechanisms including 1) high eddy kinetic energy, 2) shallowing of the thermocline, horizontal advection and breakdown of stratification (Koslow et al. 2008). In this study we investigate the different mechanisms that could lead to the input of nutrients into the euphotic zone supporting the relatively high production observed during winter off North Western Australia using field data, satellite-derived ocean colour and Bluelink output. We hypothesise that the temporal and spatial variation of the mixed layer depth (MLD) is the key mechanism allowing nutrient to increase in the surface layer in the Ningaloo Region in autumn/winter. Results show that the MLD increases to 160 m during early winter (June-July), which corresponds to the development of the phytoplankton bloom. I suggest that the MLD deepening could be the phenomenon triggering the development of the annual winter bloom off Western Australia, via increased nutrient supply.</p> <p>Field data (calibrated fluorescence and extracted chlorophyll <i>a</i> samples) reveal the existence of deep (~ 75 m) chlorophyll maximum during summer that remains undetected by satellite sensors. The existence of this DCM is likely to be related to the stratification of the water column, where phytoplankton growth is supported by diffusion of deep nutrients into the euphotic zone. Sporadic “cryptic” upwelling events (Twomey et al. 2007) could also contribute to the input of nutrients in the surface layers.</p> <p>Field observations bring additional information about the nature, productivity and cross-shelf transport of this particulate matter. These results show that the bloom observed during autumn 2008 was mainly represented by diatoms and that these were mainly taking up nitrate rather than ammonium. The dominance of downwelling favourable conditions and the analysis of nitrate profiles allow us to reinforce our hypothesis that the deepening of the MLD is the mechanism replenishing the surface layer with nitrate that in turns allow the phytoplankton bloom to develop during winter.</p> |
|                               | <p>Presentations made at workshops &amp; conferences</p> <ul style="list-style-type: none"> <li>• American Society of Limnology and Oceanography, Nice (January 2009) - Poster</li> <li>• Ningaloo Research day for students (February 2009) - Oral presentation</li> <li>• WAMSI Node 1 (July 2009) - Oral presentation</li> <li>• SESE seminar (August 2009) - Oral presentation</li> <li>• Annual UNESCO IOC Perth / IMarEST Western Australian Marine Science Awards (October 2009) - Oral presentation</li> <li>• Australian national network in marine science (December 2009), Tasmania – Oral presentation</li> </ul>   |
|                               | <p>Final report [approximately 10 pages if the project has concluded]</p> <p>The project will be finished in August 2010</p>  |
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| <b>REPORTING REQUIREMENTS</b> |   |
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| 3                             | OTHER REQUIREMENTS  |
|                               | Major findings to be reported immediately [ to be used for media, website, increased funding opportunity]<br>N/A                                      |
|                               | Supervisor & student present at a minimum of one WAMSI organised event<br>WAMSI Node 1 (July 2009) - Oral presentation                                |
|                               | Node Leader, supervisor and student to meet at a minimum of 2 times yearly [preferably more]<br>We have met at the various WAMSI conference this year |
|                               | Final report to be placed on WAMSI website  |