

Supplementary Table 6. Contribution of the ammonia oxidation to carbon fixation and bacterioplankton production in Antarctic coastal waters

| Water Mass | Water mass persistence (months) | Water mass thickness (m) | Mean measured AO rate ^a (nmol L ⁻¹ d ⁻¹) | Integrated AO rate (mmol m ⁻² d ⁻¹) | Annual integrated AO rate ^b (mol yr ⁻¹) | Annual integrated AO rate (Tg yr ⁻¹) | Ammonia oxidizer C fixation ^c (mole C m ⁻² yr ⁻¹) | Production of ammonia oxidizer biomass ^d (gC m ⁻² yr ⁻¹) |
|--|---------------------------------|--------------------------|--|--|--|--|---|--|
| AASW - Fall, Winter and Spring | 8 | 100 | 62 | 6.2 | 4.47E+12 | 63 | 0.15 | 0.67 |
| WW Summer | 4 | 50 | 14 | 0.7 | 2.52E+11 | 4 | 0.01 | 0.04 |
| SSW* - Summer | 4 | 50 | 1.4 | 0.1 | 2.52E+10 | 0 | 0.001 | 0.004 |
| CDW - Fall, Winter and Spring | 8 | 375 | 21 | 7.9 | 5.68E+12 | 79 | 0.19 | 0.85 |
| CDW Summer | 4 | 375 | 25 | 9.4 | 3.38E+12 | 47 | 0.11 | 0.51 |
| Continental Shelf Total 0-475 m | | | | | | 193 | 0.5 | 2.1 |

a) From this study, SSW AO rate not measured, assumed to be 10% of WW

b) Integrated over the entire Antarctic continental shelf (area from Supplemental Table 5a).

c) Assumes 1 mole C fixed per 10 moles ammonia oxidized from Berg et al. (2015)

d) Assumes 1 mole of biomass C produced per 27 moles of ammonia oxidized (from Konneke et al 2005, Martens-Habben et al. 2009, Ward 2011, Berg et al 2015)

| Month | Days | Photoautotrophic C Fixation Rate ^a (gC m ⁻² d ⁻¹) | Photoautotrophic C Fixation (mole C m ⁻² month ⁻¹) |
|---|------|---|---|
| November | 30 | 0.72 | 1.8 |
| December | 31 | 1.52 | 3.9 |
| January | 31 | 1.48 | 3.8 |
| February | 28 | 1.02 | 2.4 |
| March | 31 | 0.72 | 1.9 |
| April | 30 | 0.61 | 1.5 |
| Annual Continental Shelf Photoautotrophic C Fixation, mole C m⁻² yr⁻¹ | | | 15 |
| Annual Continental Shelf Chemoautotrophic C Fixation supported by ammonia oxidation^b, mole C m⁻² yr⁻¹ | | | 0.5 |
| Ratio of Chemoautotrophy to Photoautotrophy, % | | | 3.0% |

a) from Table 2 in Arrigo et al. 1998, assumes rate = 0 in months other than those listed

b) From Supplementary Table 6a above

| Date ^a | Annual Vertically Integrated Photoautotrophic C Fixation (mole C m ⁻² yr ⁻¹) |
|---|---|
| 1997-1998 | 8.8 |
| 1999-2000 | 11.6 |
| 2000-2001 | 6.0 |
| 2001-2002 | 9.7 |
| 2002-2003 | 0.4 |
| 2003-2004 | 6.5 |
| 2004-2005 | 5.6 |
| 2005-2006 | 16.3 |
| Average | 8.1 |
| Annual Continental Shelf Chemoautotrophic C Fixation supported by ammonia oxidation^b, mole C m⁻² | 0.5 |
| Ratio of Chemoautotrophy to Photoautotrophy, % | 5.7 |

a) From Table 4, Ducklow et al. (2008) for the period Dec-Feb, assumes rate = 0 in other months

b) From Supplementary Table 6a above

| Depth Range of Integration | gC m ⁻² d ⁻¹ |
|--|------------------------------------|
| 0-150 m | 25.2 |
| 150-475 m ^a | 45.8 |
| Bacterioplankton Production Fall, Winter and Spring (gC m⁻²) | 17.3 |
| Production by Ammonia Oxidizers Fall, Winter and Spring^b (gC m⁻²) | 1.5 |
| Contribution of Ammonia Oxidizers to Winter Bacterioplankton Production (%) | 8.8 |

a) From Table 1 in Manganelli et al. (2009); value given (84.5) adjusted for differences in depths of integration (750 vs 475 m)

b) Derived from information in Supplementary Table 6a above

| Depth Range | Bacterioplankton production, mmolC m ⁻² d ⁻¹ | | | |
|--|--|--------------------------|-------------------|--------------------------|
| | Early Spring 96 (Oct-Nov) | Late summer 97 (Jan-Feb) | Autumn 97 (April) | Late Spring 97 (Nov-Dec) |
| 0-50 | 0.1 | 6.6 | 0.2 | 0.4 |
| 50-150 | 0.2 | 5.0 | 0.5 | 0.3 |
| 150-300 | 0.2 | 2.4 | 0.7 | 0.2 |
| 300-475 ^a | 0.3 | 2.8 | 0.8 | 0.2 |
| Water Column Total | 0.8 | 16.9 | 2.2 | 1.1 |
| Time Period (months of the year) | Oct-Dec ^b | Jan-Mar | Apr-Jun | Jul-Sept ^b |
| Vertically Integrated Rate (mmol C m ⁻² d ⁻¹) | 87 | 1539 | 205 | 87 |
| Annual Integrated Bacterioplankton Production Rate, 0-475 m (gC m⁻² yr⁻¹) | 23.0 | | | |
| Production by Ammonia Oxidizers | 2.1 | | | |
| Contribution of Ammonia Oxidizers to Bacterioplankton Production | 9.0 | | | |

a) 150-300 m rate assumed, adjusted for water column thickness

b) Average of Early Spring and Late Spring rates used in calculation