Supplement of

Stable isotopes track the ecological and biogeochemical legacy of mass mangrove forest dieback in the Gulf of Carpentaria, Australia

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Table S1. Mangrove seedling and sampling densities (ind. per m$^2$).

| Year | Unimpacted (Mean, SE) | Impacted (Mean, SE) | n     | n     |
|------|-----------------------|---------------------|-------|-------|
| 2016 | 6.2, 0.7              | 0.2, 0.1            | 124   | 143   |
| 2017 | 5.5, 0.5              | 4.2, 0.4            | 161   | 175   |
| 2018 | 13.8, 1.6             | 7.1, 0.5            | 80    | 117   |
Table S2. Leaf CNS isotope values across intertidal zones.

| Forest                  | Sampling plot             | Mean   | SE     | n  |
|-------------------------|---------------------------|--------|--------|----|
| Unimpacted              | forest edge, land         | 5.3    | -28.6  | 20.0 | 0.5 | 0.5 | 1.5 | 3  |
| Unimpacted              | high                      | 4.1    | -27.7  | 12.0 | 0.1 | 1.4 | 2.7 | 3  |
| Unimpacted              | mid                       | 4.4    | -28.9  | 8.9  | 0.4 | 1.0 | 2.6 | 3  |
| Unimpacted              | low                       | 3.9    | -29.4  | 7.1  | 0.3 | 0.6 | 1.1 | 3  |
| Unimpacted              | forest edge, ocean        | 4.2    | -27.6  | 14.9 | 0.6 | 0.4 | 1.5 | 3  |
| Impacted                | forest edge, land         | 5.1    | -25.3  | 19.8 | 0.1 | 0.4 | 1.8 | 3  |
| Impacted                | high                      | 5.3    | -25.6  | 16.6 | 0.7 | 0.5 | 2.6 | 3  |
| Impacted                | mid                       | 5.2    | -26.2  | 13.4 | 0.3 | 0.5 | 2.9 | 3  |
| Impacted                | low                       | 4.9    | -26.7  | 9.8  | 0.1 | 0.5 | 1.2 | 3  |
| Impacted                | forest edge, ocean        | 1.0    | -25.4  | 7.9  | 1.1 | 0.7 | 1.1 | 3  |
Table S3. Surface (<0.5cm) sediment C isotope values across intertidal zones.

| Forest                  | Sampling plot          | Mean    | SE     | n  |
|-------------------------|------------------------|---------|--------|----|
|                         |                        | %C      | d13CVPDB |     |
| Unimpacted              | forest edge, land      | 2.76    | -25.1  | 1.0 | 3  |
| Unimpacted              | high                   | 1.54    | -23.6  | 0.35| 0.2| 3  |
| Unimpacted              | mid                    | 1.62    | -24.3  | 0.24| 0.5| 3  |
| Unimpacted              | low                    | 1.84    | -24.7  | 0.46| 0.3| 3  |
| Unimpacted              | forest edge, ocean     | 2.33    | -23.6  | 0.91| 1.1| 3  |
| Unimpacted              | mud flat               | 1.02    | -21.8  | 0.05| 0.5| 3  |
| Impacted                | forest edge, land      | 1.02    | -22.4  | 0.22| 0.8| 3  |
| Impacted                | high                   | 1.01    | -22.2  | 0.18| 0.3| 3  |
| Impacted                | mid                    | 1.32    | -22.1  | 0.30| 0.1| 3  |
| Impacted                | low                    | 1.24    | -21.0  | 0.12| 0.6| 3  |
| Impacted                | forest edge, ocean     | 0.71    | -21.0  | 0.10| 0.6| 3  |
| Impacted                | mud flat               | 0.58    | -21.2  | 0.11| 0.5| 3  |
Table S4. Stable C, N and S isotopic compositions of animals

| Forest     | Year | Group          | Taxa                  | δ13C | SE  | δ15N | SE  | δ34S | SE  | n  |
|------------|------|----------------|-----------------------|------|-----|------|-----|------|-----|----|
| Unimpacted | 2016 | algae feeder   | *Tubuca signata*     | -17.4| 0.3 | 6.7  | 0.3 | 14.3 | 1.0 | 3  |
| Unimpacted | 2017 | algae feeder   | *Tubuca signata*     | -17.1| 0.8 | 6.0  | 0.2 | 14.2 | 0.2 | 3  |
| Unimpacted | 2018 | algae feeder   | *Tubuca signata*     | -16.5| 0.4 | 6.9  | 0.2 | 14.7 | 0.2 | 5  |
| Unimpacted | 2017 | filter feeder  | *Saccostrea* sp.     | -19.3| 0.2 | 7.8  | 0.1 | 13.5 | 0.4 | 3  |
| Unimpacted | 2018 | filter feeder  | *Saccostrea* sp.     | -20.2| 0.1 | 6.9  | 0.2 | 14.0 | 0.3 | 3  |
| Unimpacted | 2016 | grazer         | *Telescopium*        | -20.3| 0.1 | 7.1  | 0.0 | 10.9 | 1.0 | 2  |
| Unimpacted | 2017 | grazer         | *Telescopium*        | -18.2| 1.1 | 6.4  | 0.1 | 12.0 | 1.1 | 3  |
| Unimpacted | 2018 | grazer         | *Telescopium*        | -18.4| 0.8 | 7.3  | 0.2 | 11.3 | 0.9 | 6  |
| Unimpacted | 2016 | leaf feeder    | *Parasesarma* or *Episesarma* | -21.0| 0.3 | 7.7  | 0.3 | 11.5 | 1.0 | 3  |
| Unimpacted | 2017 | leaf feeder    | *Parasesarma* or *Episesarma* | -21.1| 0.8 | 8.1  | 0.4 | 12.9 | 2.0 | 4  |
| Unimpacted | 2018 | leaf feeder    | *Parasesarma* or *Episesarma* | -22.0| 0.5 | 7.9  | 0.4 | 15.0 | 0.7 | 4  |
| Impacted   | 2016 | algae feeder   | *Tubuca signata*     | -15.7| 0.7 | 7.5  | 0.2 | 17.0 | 0.2 | 3  |
| Impacted   | 2017 | algae feeder   | *Tubuca signata*     | -15.4| 0.8 | 8.4  | 0.4 | 15.5 | 0.3 | 3  |
| Impacted   | 2018 | algae feeder   | *Tubuca signata*     | -15.1| 0.2 | 7.3  | 0.4 | 16.7 | 0.2 | 6  |
| Impacted   | 2017 | filter feeder  | *Saccostrea* sp.     | -19.0| 0.5 | 7.9  | 0.1 | 14.5 | 0.4 | 3  |
| Impacted   | 2018 | filter feeder  | *Saccostrea* sp.     | -20.0| 0.0 | 7.5  | 0.1 | 15.2 | 0.2 | 3  |
| Impacted   | 2016 | grazer         | *Telescopium*        | -16.2| 0.1 | 7.5  | 0.0 | 14.1 | 0.7 | 2  |
| Impacted   | 2017 | grazer         | *Telescopium*        | -16.7| 0.8 | 7.2  | 0.1 | 14.7 | 0.4 | 3  |
| Impacted   | 2018 | grazer         | *Telescopium*        | -16.0| 0.5 | 7.8  | 0.2 | 14.5 | 0.2 | 6  |
| Impacted   | 2016 | leaf feeder    | *Parasesarma* or *Episesarma* | -18.6| 0.0 | 9.0  | 0.4 | 15.7 | 0.1 | 2  |
| Impacted   | 2017 | leaf feeder    | *Parasesarma* or *Episesarma* | -18.3| 0.1 | 9.0  | 0.3 | 16.0 | 0.5 | 3  |
| Impacted   | 2018 | leaf feeder    | *Parasesarma* or *Episesarma* | -18.0| 0.7 | 7.7  | 0.9 | 19.4 | 1.2 | 3  |
Table S5. C isotopic compositions in essential amino acids (EAAs)

| Forest      | Common name   | Taxa               | n   | EAA (mean, SD) | mean of five EAAs |
|-------------|---------------|--------------------|-----|----------------|-------------------|
|             |               |                    |     | Lys | Ile | Val | Leu | Phe |                |
| Unimpacted  | Algae feeder  | Tubuca signata     | 3   | -15.3, 2.1    | -18.8, 1.3        | -23.5, 1.1        | -24.4, 1.5      | -27.5, 1.5      | -21.9           |
| Unimpacted  | Leaf feeder   | Sesarmidae         | 3   | -19.7, 1.7    | -22.7, 1.9        | -26.8, 2.0        | -27.6, 1.9      | -29.7, 1.0      | -25.3           |
| Unimpacted  | Grazer        | Telescopium        | 3   | -18.1, 1.5    | -21.3, 1.6        | -25.9, 2.0        | -26.3, 1.9      | -28.3, 2.2      | -24.0           |
| Unimpacted  | Filter feeder | Crassostrea (oyster) | 2  | -16.8, 0.6   | -18.6, 0.2        | -24.7, 0.3        | -26.0, 0.3      | -27.6, 0.2      | -22.8           |
| Unimpacted  | Mangrove      | Avicennia marina   | 2   | -22.8, 0.4    | -25.0, 0.7        | -32.5, 0.5        | -34.8, 0.4      | -28.8, 0.9      | -28.8           |
| Unimpacted  | MPB           |                     | 1   | -23.4, 2.2    | -25.2, 1.4        | -30.3, 1.5        | -30.5, 1.7      | -27.8, 2.2      | -27.4           |
| Impacted    | Algal feeder  | Tubuca signata     | 3   | -13.9, 0.3    | -17.3, 1.4        | -22.4, 1.5        | -23.2, 1.7      | -26.0, 2.2      | -20.5           |
| Impacted    | Leaf feeder   | Sesarmidae         | 2   | -17.8, 1.2    | -21.4, 0.4        | -25.0, 0.2        | -26.0, 0.1      | -29.2, 0.1      | -23.9           |
| Impacted    | Grazer        | Telescopium        | 3   | -17.1, 1.2    | -19.2, 1.1        | -23.9, 1.1        | -24.5, 1.1      | -26.5, 1.2      | -22.2           |
| Impacted    | Filter feeder | Crassostrea (oyster) | 2  | -17.5, 0.0   | -18.5, 0.4        | -24.7, 0.4        | -25.7, 0.3      | -28.1, 0.3      | -22.9           |
| Impacted    | Mangrove      | Avicennia marina   | 2   | -21.8, 1.1    | -23.6, 0.2        | -30.4, 0.9        | -33.0, 0.0      | -26.4, 0.6      | -27.0           |
| Impacted    | MPB           |                     | 1   | -15.5, 1.1    | -18.6, 0.2        | -23.4, 0.9        | -22.9, 0.6      | -23.2, 0.6      | -20.7           |
Figure S1. Normalized δ^{13}C_{EAA} fingerprint patterns of four mangrove consumer groups and resources including mangrove leaves and MPB from the unimpacted and impacted mangrove sites during 2017 (20 months after the dieback). The values were normalized to the mean δ^{13}C value of five EAA in the sample as per Larsen (2009). Error bars show ± SD. The normalized δ^{13}C_{EAA} fingerprint patterns did not differ between the forests for all the samples (PERMANOVA p > 0.05, Table 3).