*The following supplement accompanies the article*

# Ecosystem effects of contemporary life-history changes are comparable to those of fishing

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**Supplement 1.** Details of the Atlantis ecosystem model and fisheries selectivity curve parameters.

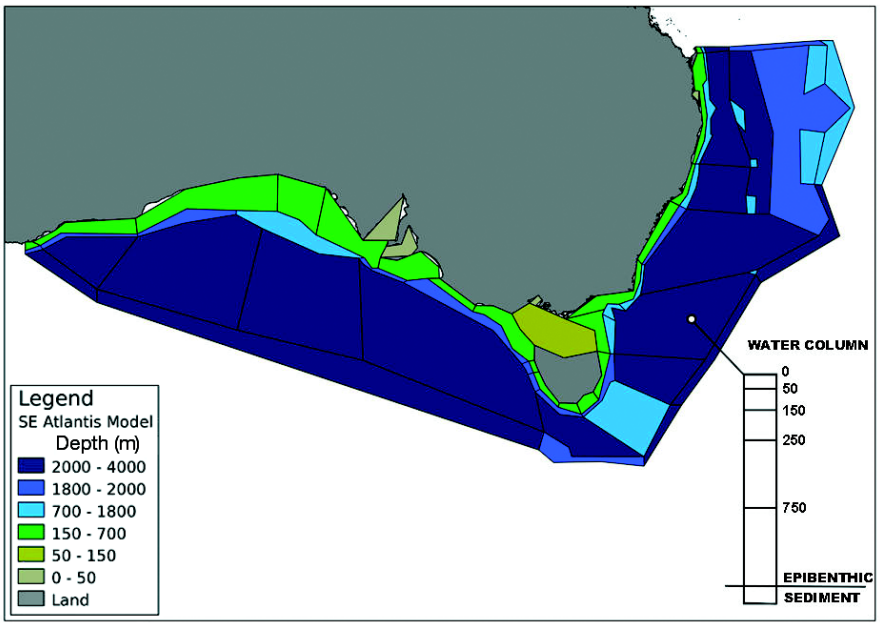


Fig. S1. Map of the Atlantis-SE model domain. The polygons indicate individual geographic boxes, each with its own vertical structure (one example column is provided for reference). Detailed descriptions of the processes are given in Fulton et al. (2004; operational equations given in Supplements for that article) and Fulton et al. (2007) chapters 2.1 to 2.3

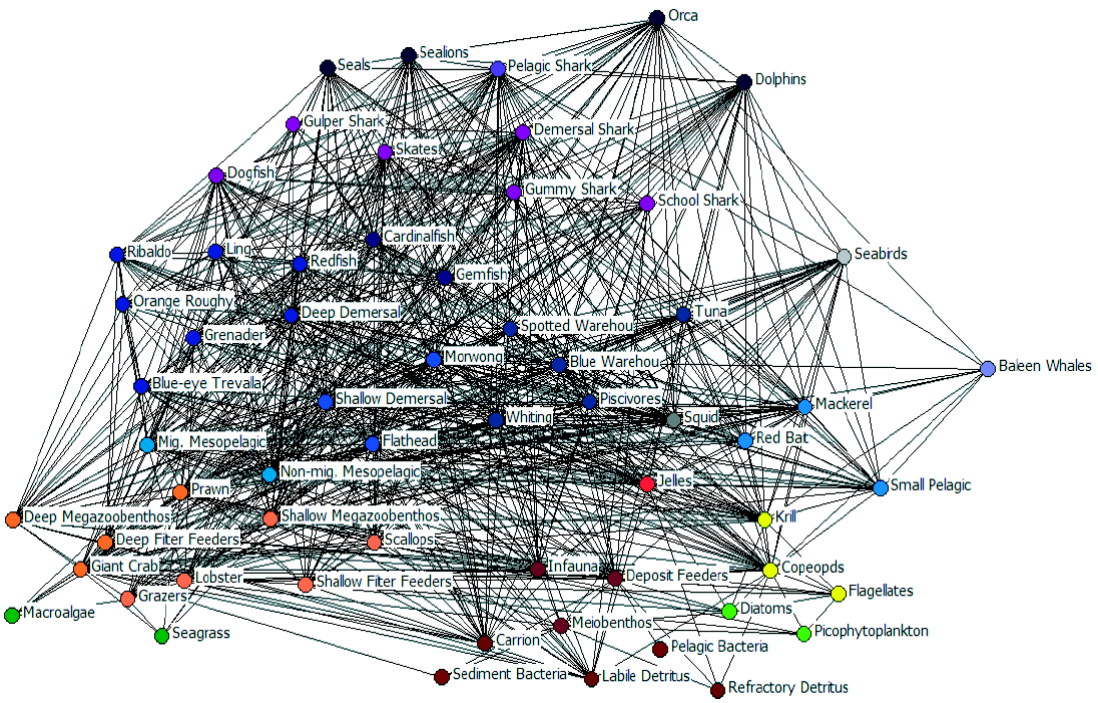


Fig. S2. Food-web diagram indicating links among the functional groups in the Atlantis model

Table S1. List of biological groups in Atlantis-SE and whether they are represented as biomass pools, age structured biomass pool (i.e. biomass pools for juveniles separate to adults) or full age-structured populations (where the size and numbers per age class are followed). Species that were fished and decreasing in body size are highlighted in **bold**

| Group | Composition | Type |
|---|---|---|
| *Pelagic groups* | | |
| Large phytoplankton | Diatoms | Biomass pool |
| Small phytoplankton | Picophytoplankton | Biomass pool |
| Small zooplankton | Heterotrophic flagellates | Biomass pool |
| Mesozooplankton | Copepods | Biomass pool |
| Large zooplankton | Krill and chaetognaths | Biomass pool |
| Gelatinous zooplankton | Salps (pryosomes), coelenterates | Biomass pool |
| Pelagic bacteria | Pelagic attached and free-living bacteria | Biomass pool |
| Cephalopods | *Sepioteuthis australis*, *Notodarus gouldi* | Age structured biomass pool |
| *Benthic groups* | | |
| Sediment bacteria | Aerobic and anaerobic bacteria | Biomass pool |
| Carnivorous infauna | Polychaetes | Biomass pool |
| Deposit feeders | Holothurians, echinoderms, burrowing bivalves | Biomass pool |
| Deep water filter feeders | Sponges, corals, crinoids, bivalves | Biomass pool |
| Other filter feeders | Mussels, oysters, sponges, corals | Biomass pool |
| Scallops | *Pecten fumatus* | Biomass pool |
| Herbivorous grazers | Urchins, *Haliotis laevigata*, *Haliotis rubra*, gastropods | Biomass pool |
| Deep water megazoobenthos | Crustacea, asteroids, molluscs | Biomass pool |
| Shallow water megazoobenthos | Stomatopods, octopus, seastar, gastropod, and non-commercial crustaceans | Biomass pool |
| Rock lobster | *Jasus edwardsii*, *Jasus verreauxi* | Biomass pool |
| Meiobenthos | Meiobenthos | Biomass pool |
| Macroalgae | Kelp | Biomass pool |
| Seagrass | Seagrass | Biomass pool |
| Prawns | *Haliporoides sibogae* | Age structured biomass pool |
| *Fin-fish* | | |
| Small pelagics | *Engraulis*, *Sardinops*, sprat | Age structured |
| Red bait | Emmelichthyidae (*Emmelichthys nitidus*) | Age structured |
| Mackerel | *Trachurus declivis*, *Scomber australisicus* | Age structured |

| Group | Composition | Type |
|---|---|---|
| Migratory mesopelagics | Myctophids | Age structured |
| Non-migratory mesopelagics | Sternophychids, cyclothene (lightfish) | Age structured |
| School whiting | *Sillago* | Age structured |
| Shallow water piscivores | Barracouta, *Arripis*, , *Seriola*, leatherjackets | Age structured |
| Blue warehou | *Seriolella brama* | Age structured |
| **Silver warehou** | ***Seriolella punctata*** | **Age structured** |
| Tuna and billfish | *Thunnus*, *Makaira*, *Tetrapturus*, *Xiphias* | Age structured |
| Gemfish | *Rexea solandri* | Age structured |
| Shallow water demersal fish | Flounder, *Pagrus auratus*, Labridae, *Chelidonichthys kumu*, *Pterygotrigla*, *Sillaginoides punctata*, *Zeus faber* | Age structured |
| **Flathead** | ***Neoplatycephalus richardsoni*, *Platycephalus*** | **Age structured** |
| Redfish | *Centroberyx* | Age structured |
| **Morwong** | ***Nemadactylus*** | **Age structured** |
| **Ling** | ***Genypterus blacodes*** | **Age structured** |
| | | |
| **Blue grenadier** | ***Macruronus novaezelandiae*** | **Age structured** |
| Blue-eye trevalla | *Hyperoglyphe Antarctica* | Age structured |
| Ribaldo | *Mora moro* | Age structured |
| Orange roughy | *Hoplostethus atlanticus* | Age structured |
| Dories and oreos | Oreosomatidae, Macrouridae, *Zenopsis* | Age structured |
| Cardinalfish | Cardinalfish | Age structured |
| | | |
| *Sharks and Seabirds* | | |
| Gummy shark | *Mustelus antarcticus* | Age structured |
| School shark | *Galeorhinus galeus* | Age structured |
| Demersal sharks | *Heterodontus portusjacksoni*, Scyliorhinidae, Orectolobidae | Age structured |
| Pelagic sharks | *Prionace glauca*, *Isurus oxyrunchus*, *Carcharodon carcharias*, *Carcharhinus* | Age structured |
| Dogfish | Squalidae | Age structured |
| Gulper sharks | *Centrophorus* | Age structured |
| Skates and rays | Rajidae, Dasyatidae | Age structured |
| Seabirds | Albatross, shearwater, gulls, terns, gannets, penguins | Age structured |
| | | |
| *Mammals* | | |
| Seals | *Arctocephalus pusillus doriferus*, *Arctocephalus forsteri* | Age structured |
| Sea lion | *Neophoca cinerea* | Age structured |
| Dolphins | Delphinidae | Age structured |
| Orcas | *Orcinus orca* | Age structured |
| Baleen whales | *Megaptera novaeangliae*, *Balaenoptera*, *Eubalaena australis* | Age structured |

**Selectivity curve and parameters**

Fishing was done using logistic selectivity curve, where retention probability at length L is
$1/\{1 + \exp[-\mathbf{b}\times(L-\mathbf{a})]\}$

Here **a** is the inflection point (or 50% selectivity) and **b** is the shape parameter. The parameter values for the 5 harvested species are:

| | **a** | **b** |
|---|---|---|
| Morwong | 28.0 | 0.5 |
| Warehou | 21.0 | 0.25 |
| Blue grenadier | 50.0 | 0.35 |
| Flathead | 33.2 | 0.5 |
| Ling | 50.0 | 0.35 |

## LITERATURE CITED

Fulton EA, Fuller M, Smith ADM, Punt A (2004) Australian Fisheries Management Authority Report R99/1546. CSIRO, Hobart

Fulton EA, Smith ADM, Smith DC (2007) Alternative management strategies for southeast Australian Commonwealth fisheries: Stage 2: quantitative management strategy evaluation. Australian Fisheries Management Authority, Fisheries Research and Development Corporation. http://atlantis.cmar.csiro.au