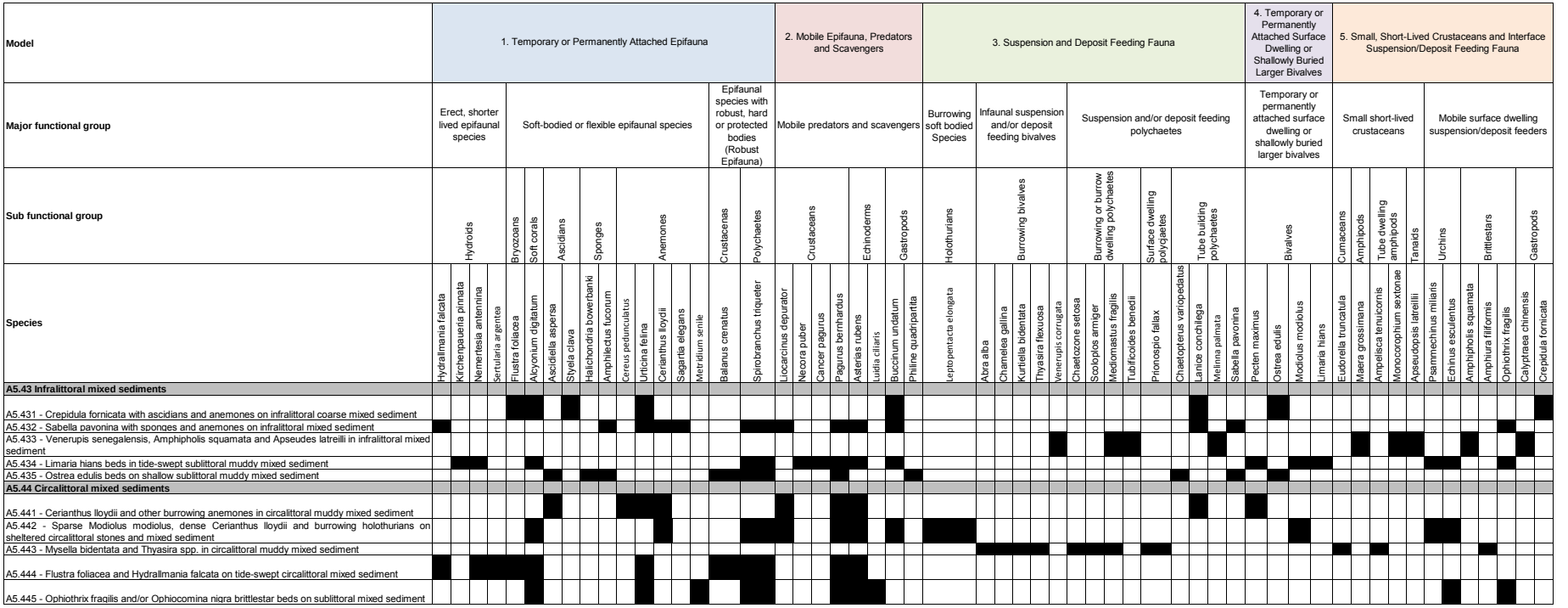
Appendix 3. Species-Biotope-Model Matrix



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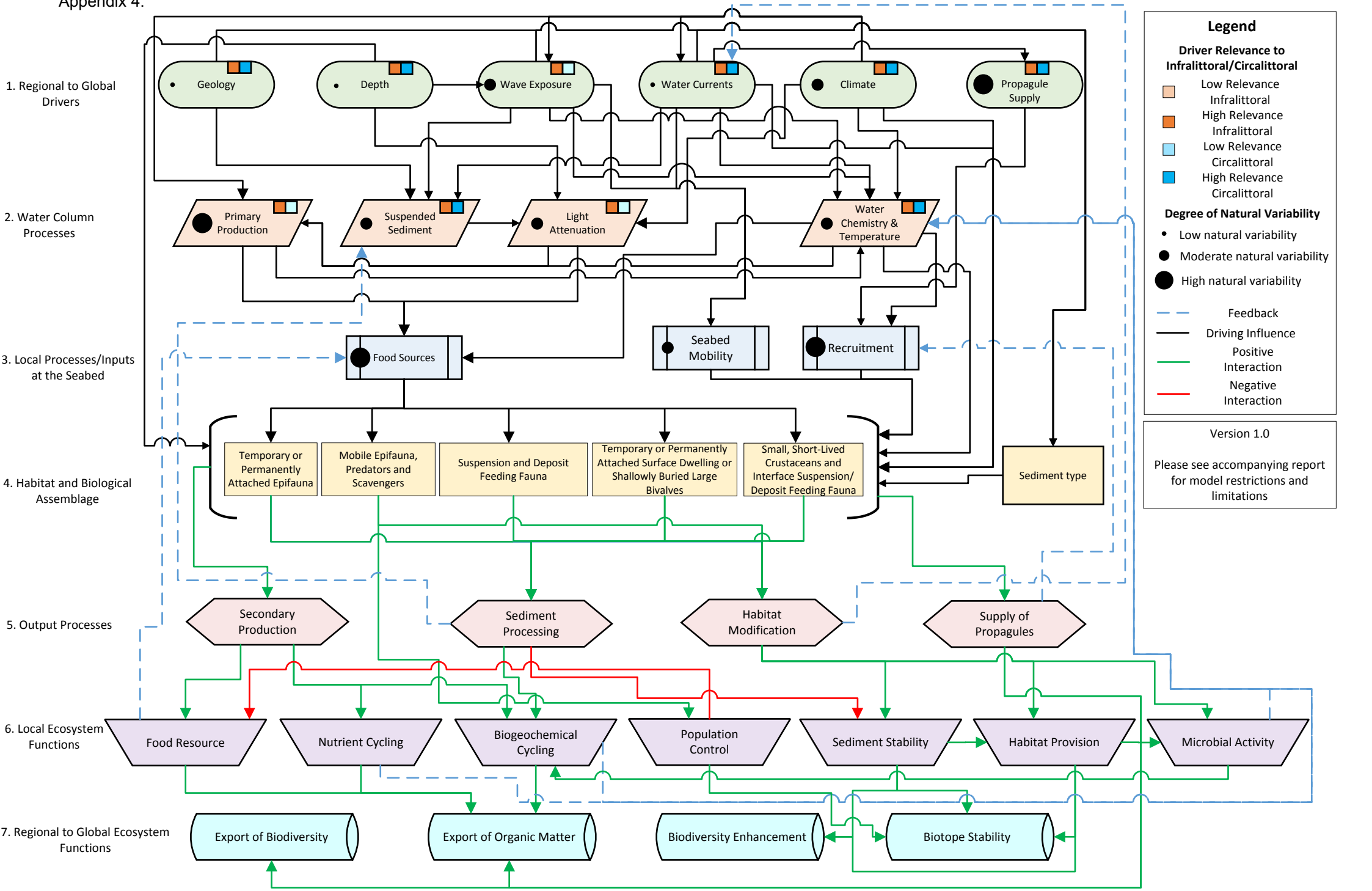
Appendix 4.

Shallow Sublittoral Mixed Sediment



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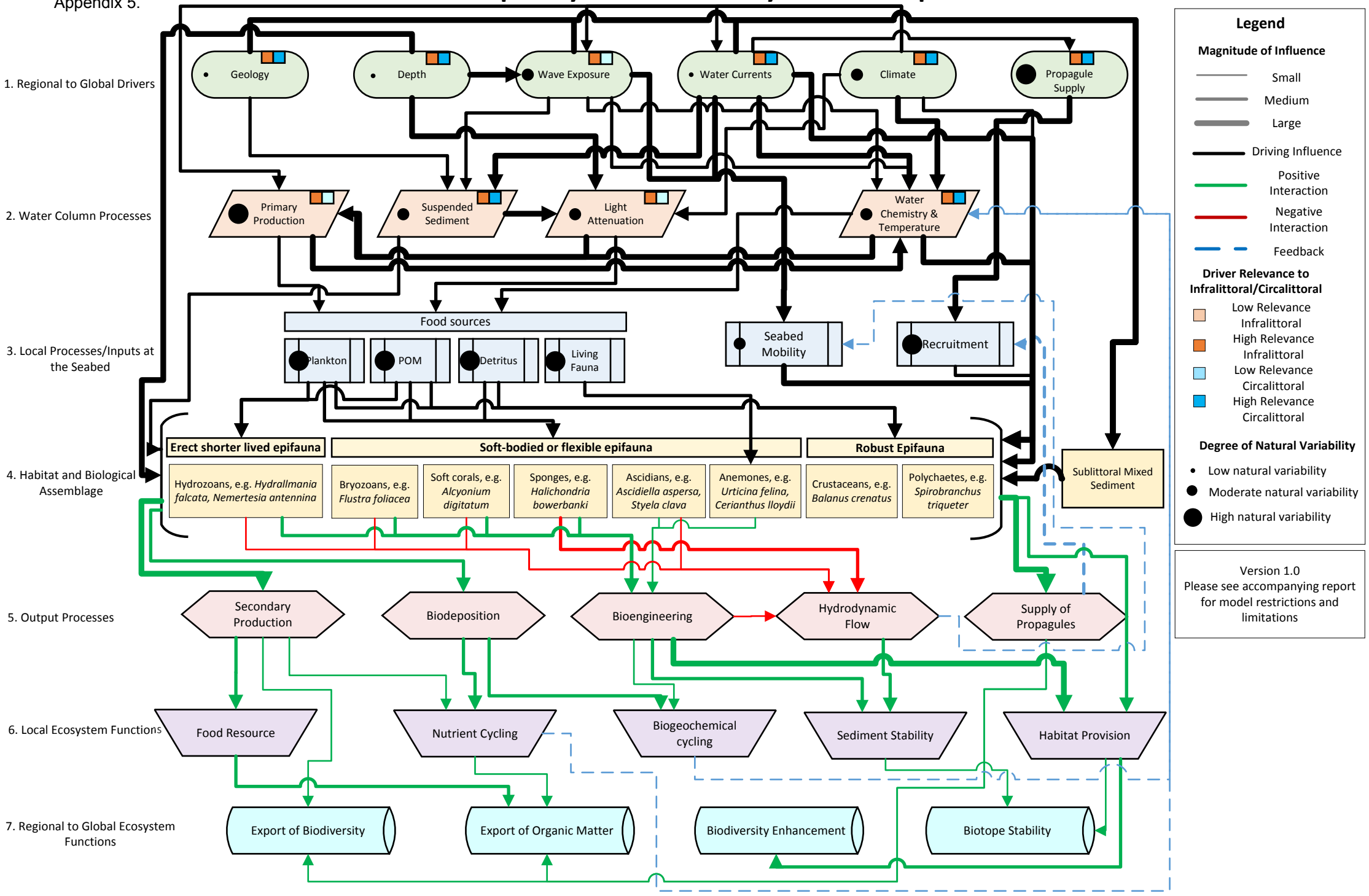
Appendix 5.

Sub-model 1. Temporary or Permanently Attached Epifauna



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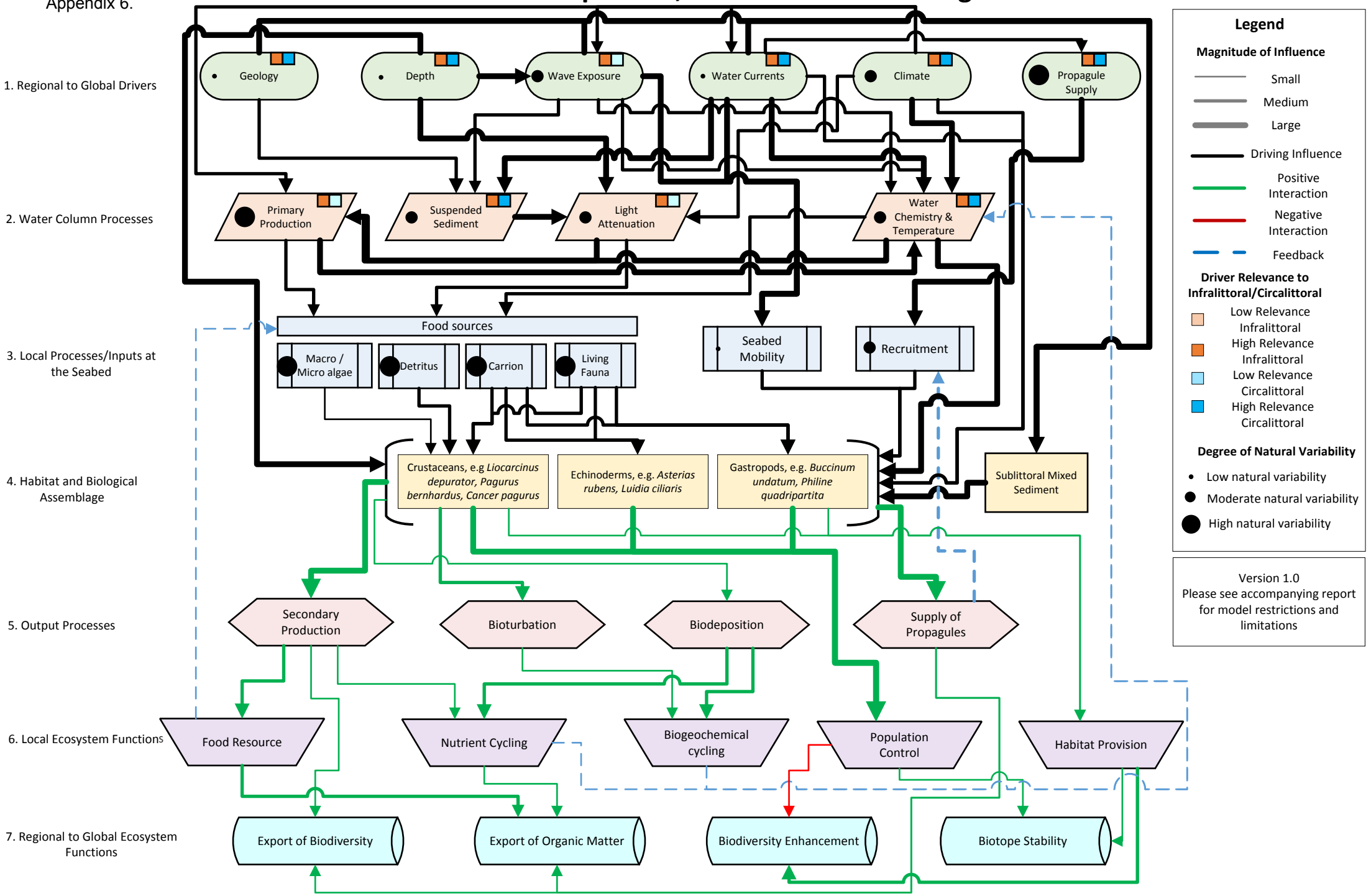
Appendix 6.

Sub-model 2. Mobile Epifauna, Predators and Scavengers



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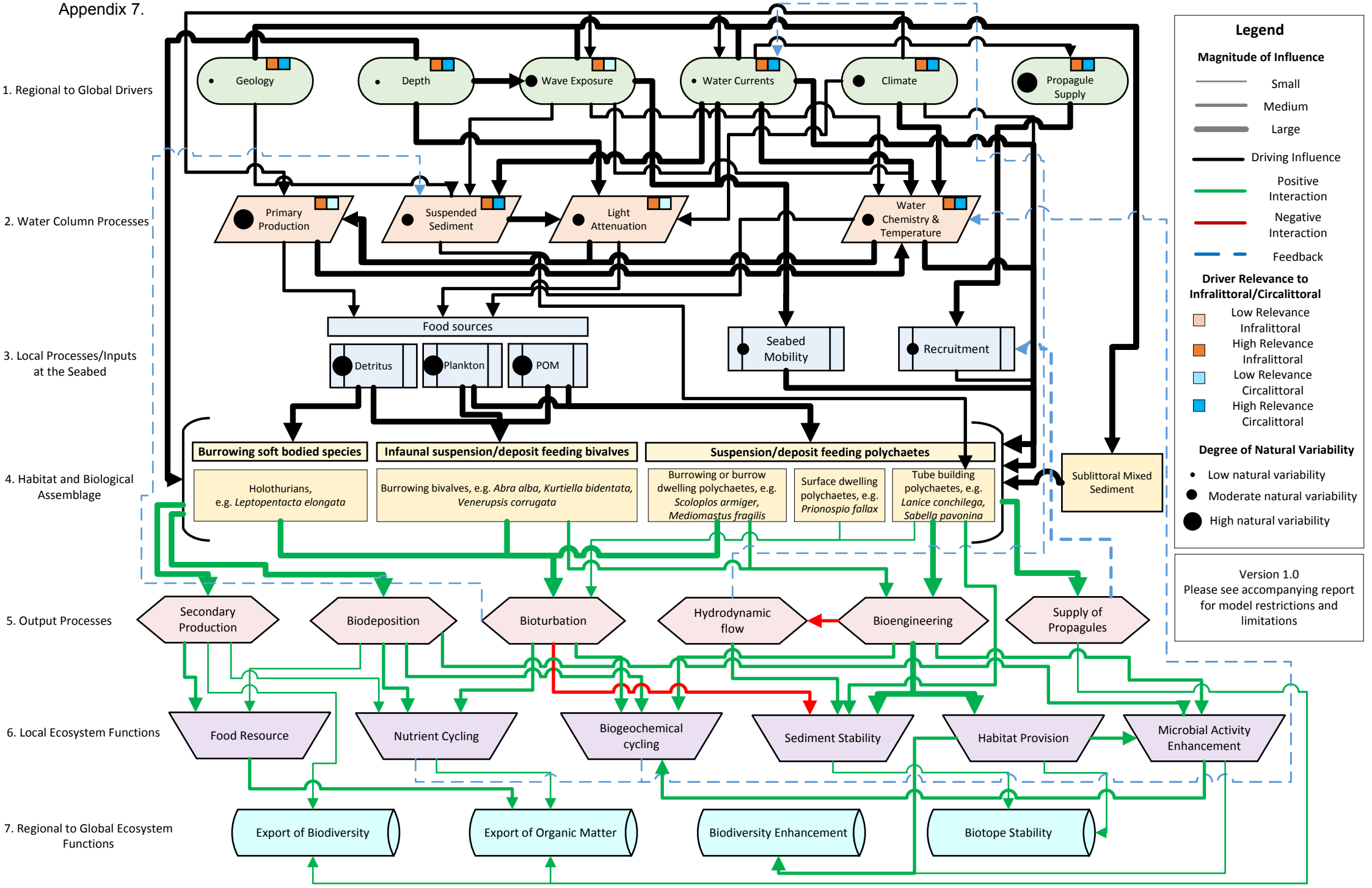
Appendix 7.

Sub-model 3. Suspension and Deposit Feeding Fauna



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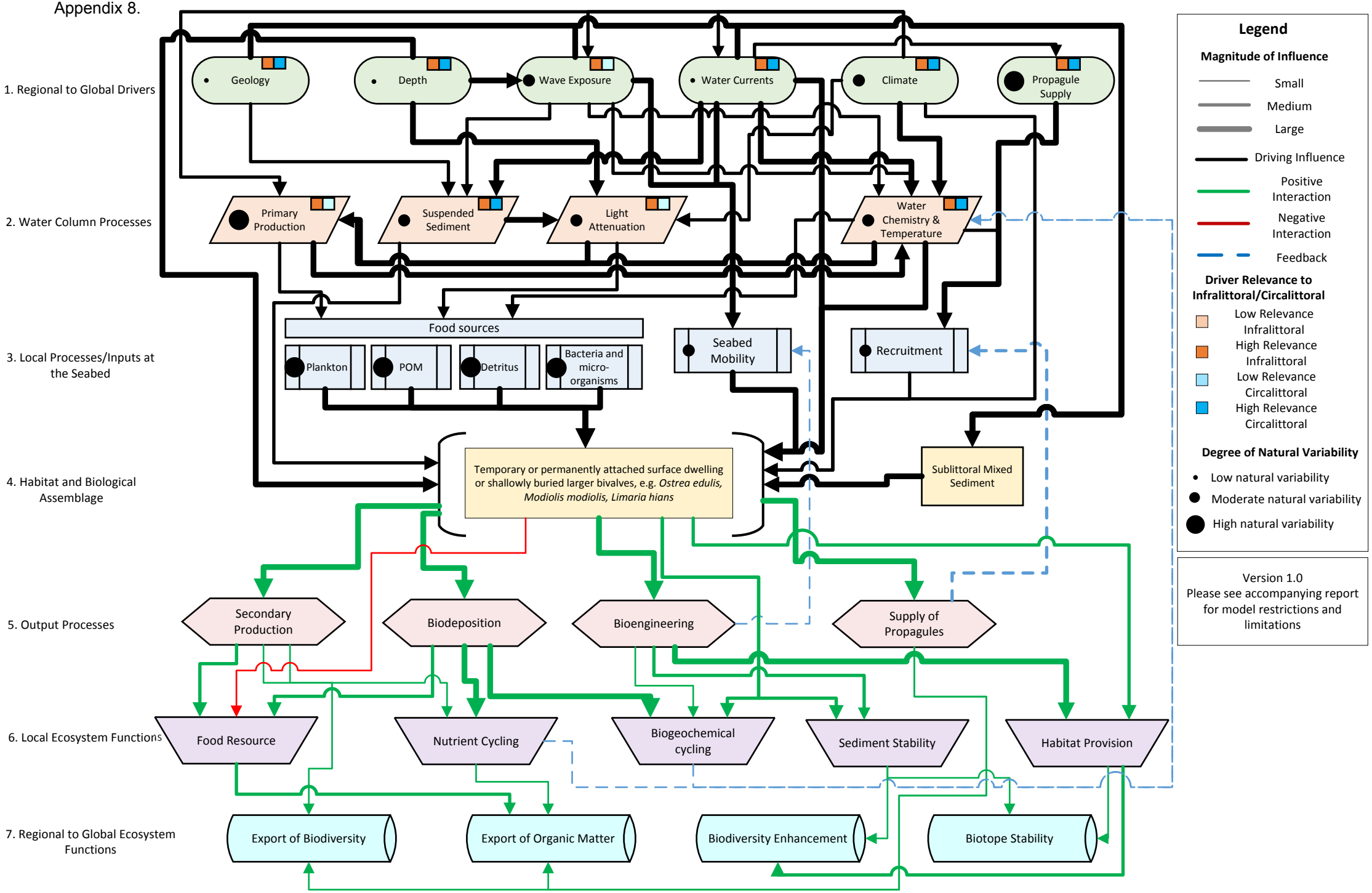
Appendix 8.

Sub-model 4. Attached Surface Dwelling or Shallowly Buried Bivalves



Sub-model 5. Small, Short-Lived Crustaceans and Interface Suspension/Deposit Feeding Fauna

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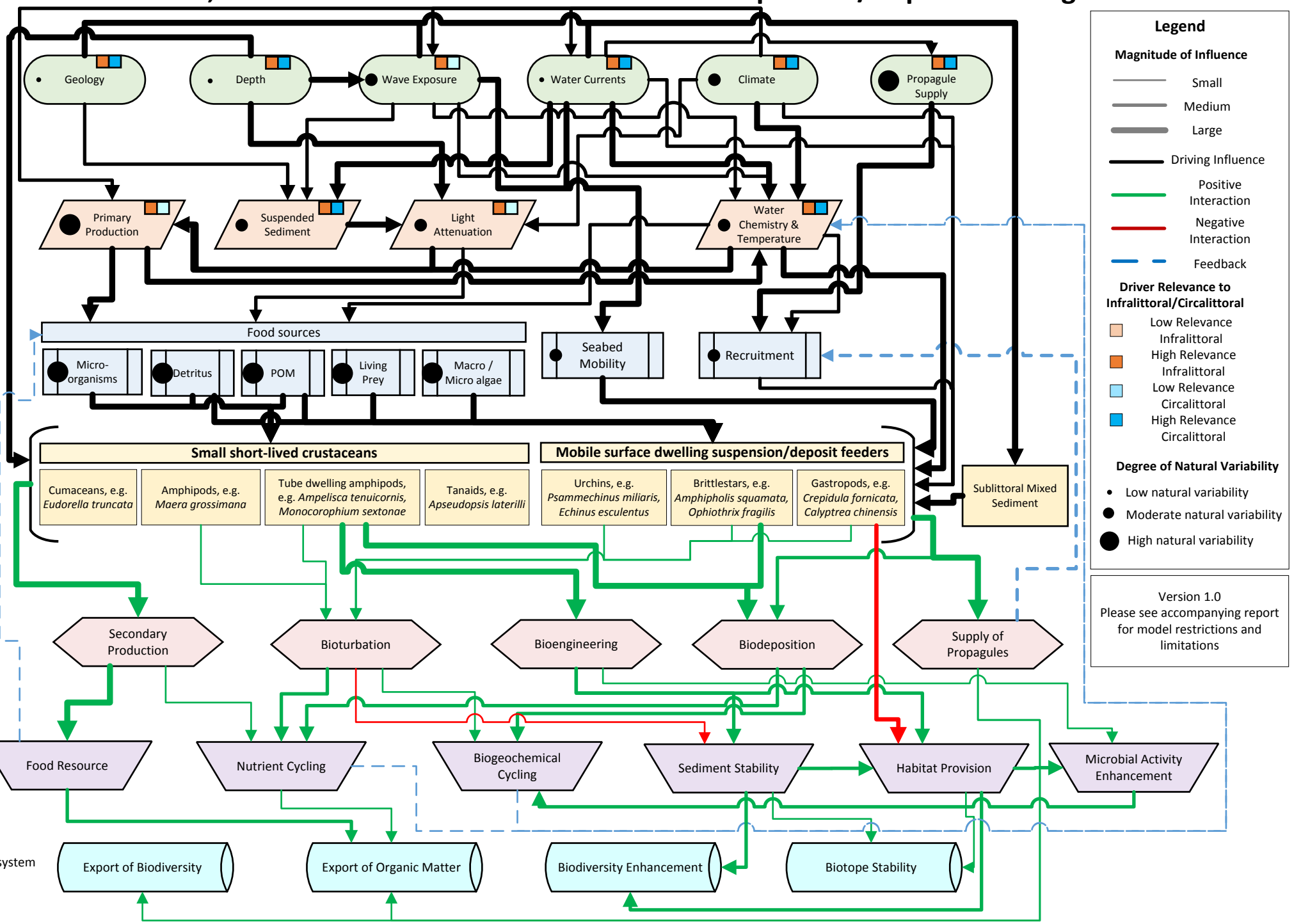
1. Regional to Global Drivers
2. Water Column Processes
3. Local Processes/Inputs at the Seabed
4. Habitat and Biological Assemblage
5. Output Processes
6. Local Ecosystem Functions
7. Regional to Global Ecosystem Functions



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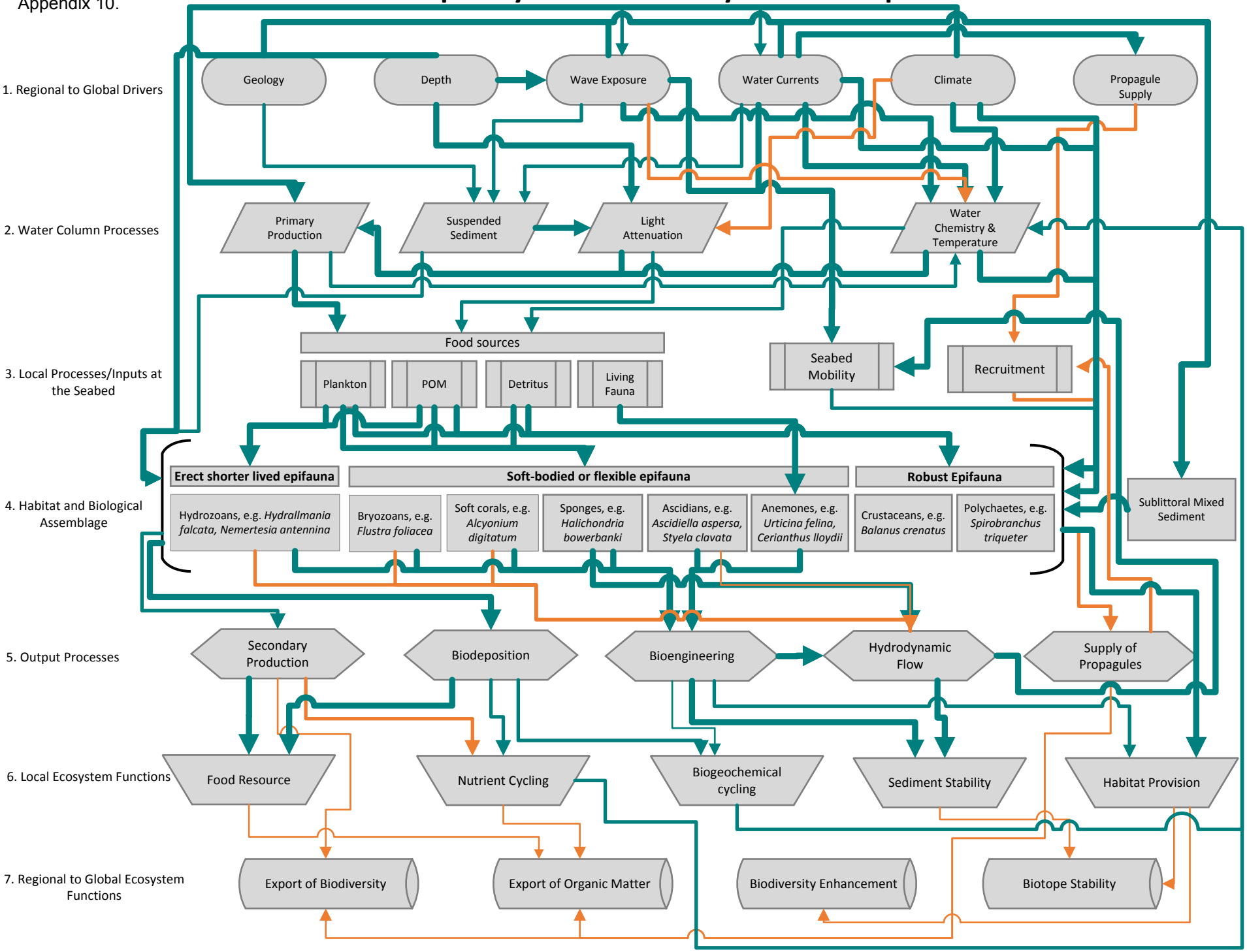
Appendix 10.

Sub-model 1. Temporary or Permanently Attached Epifauna - CONFIDENCE



Legend

- Low confidence
- Medium confidence
- High confidence
- Link informed by Literature Review
- Link informed by Expert Opinion *

* Links informed by Expert Opinion do not exceed the Medium Confidence level.

Version 1.0

Please see accompanying report for model restrictions and limitations

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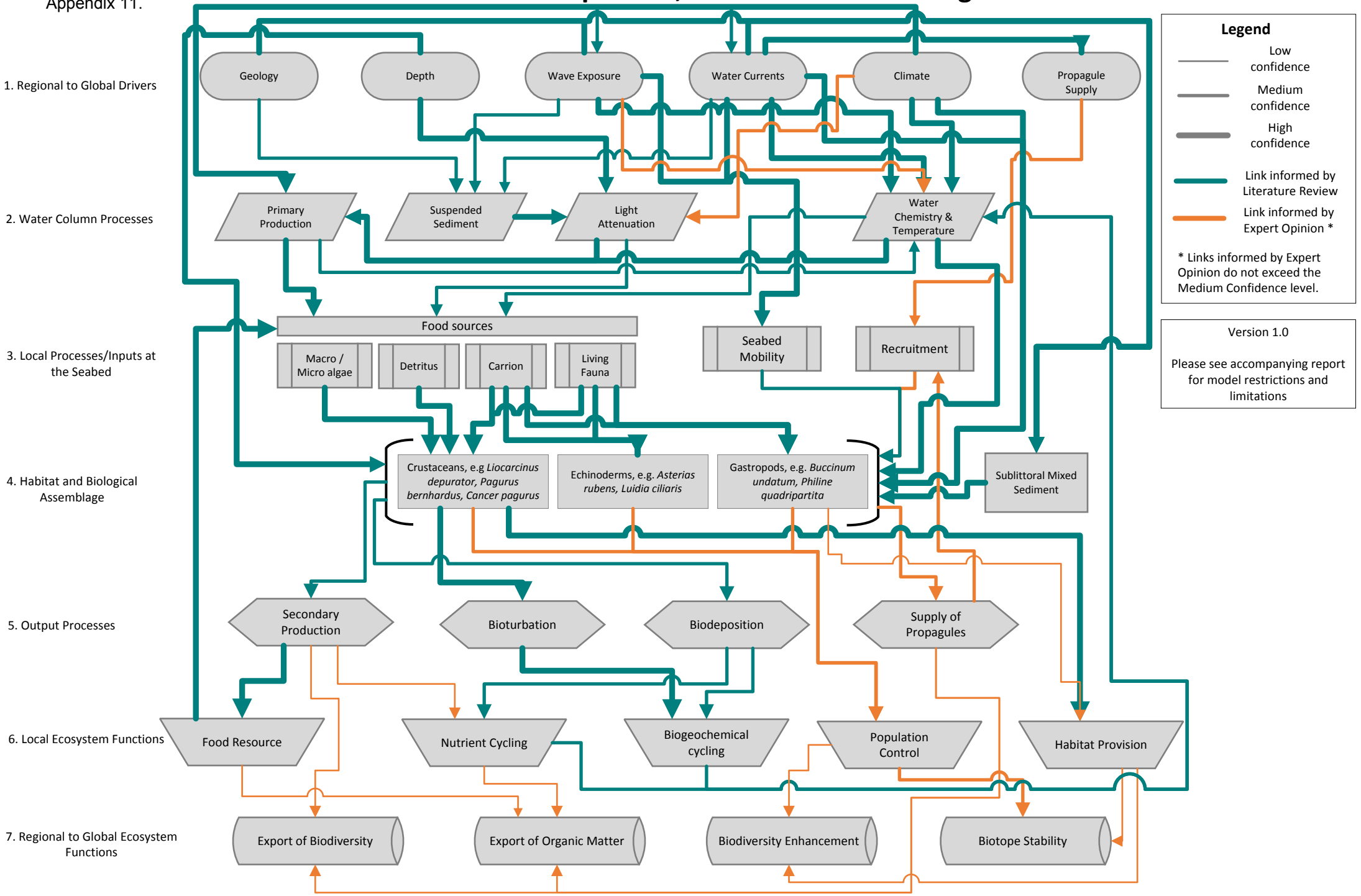
Appendix 11.

Sub-model 2. Mobile Epifauna, Predators and Scavengers



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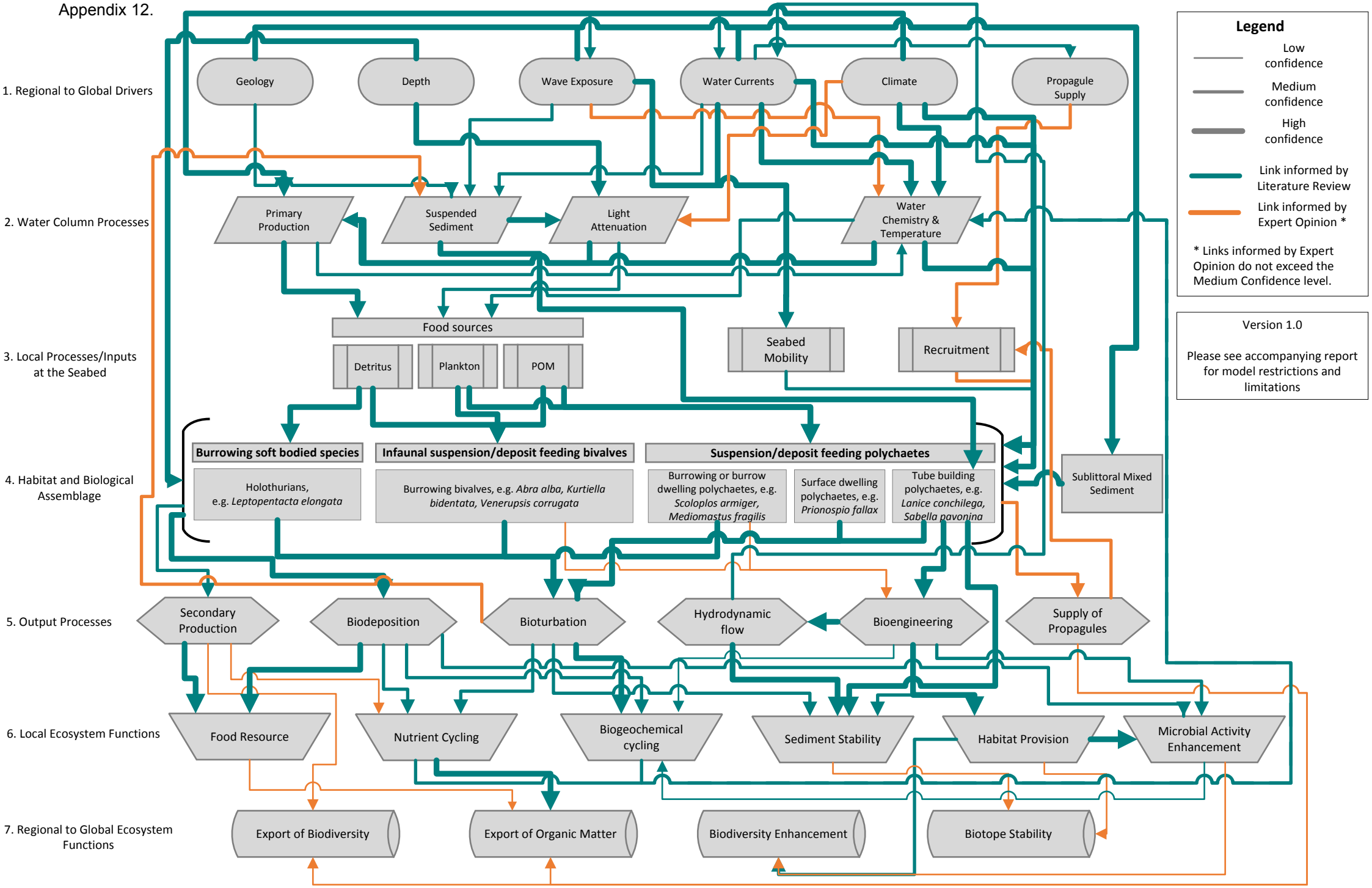
Appendix 12.

Sub-model 3. Suspension and Deposit Feeding Fauna



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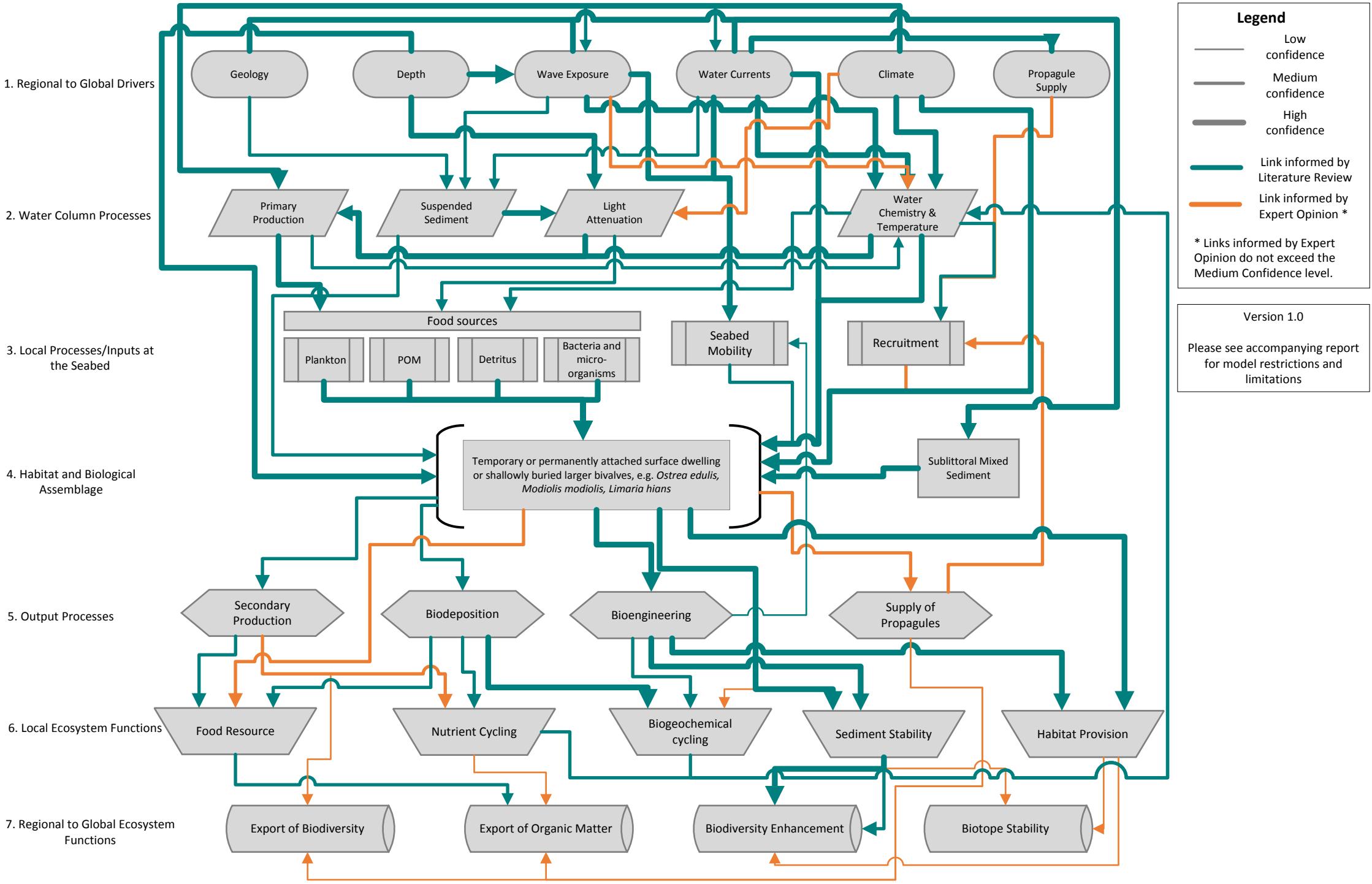
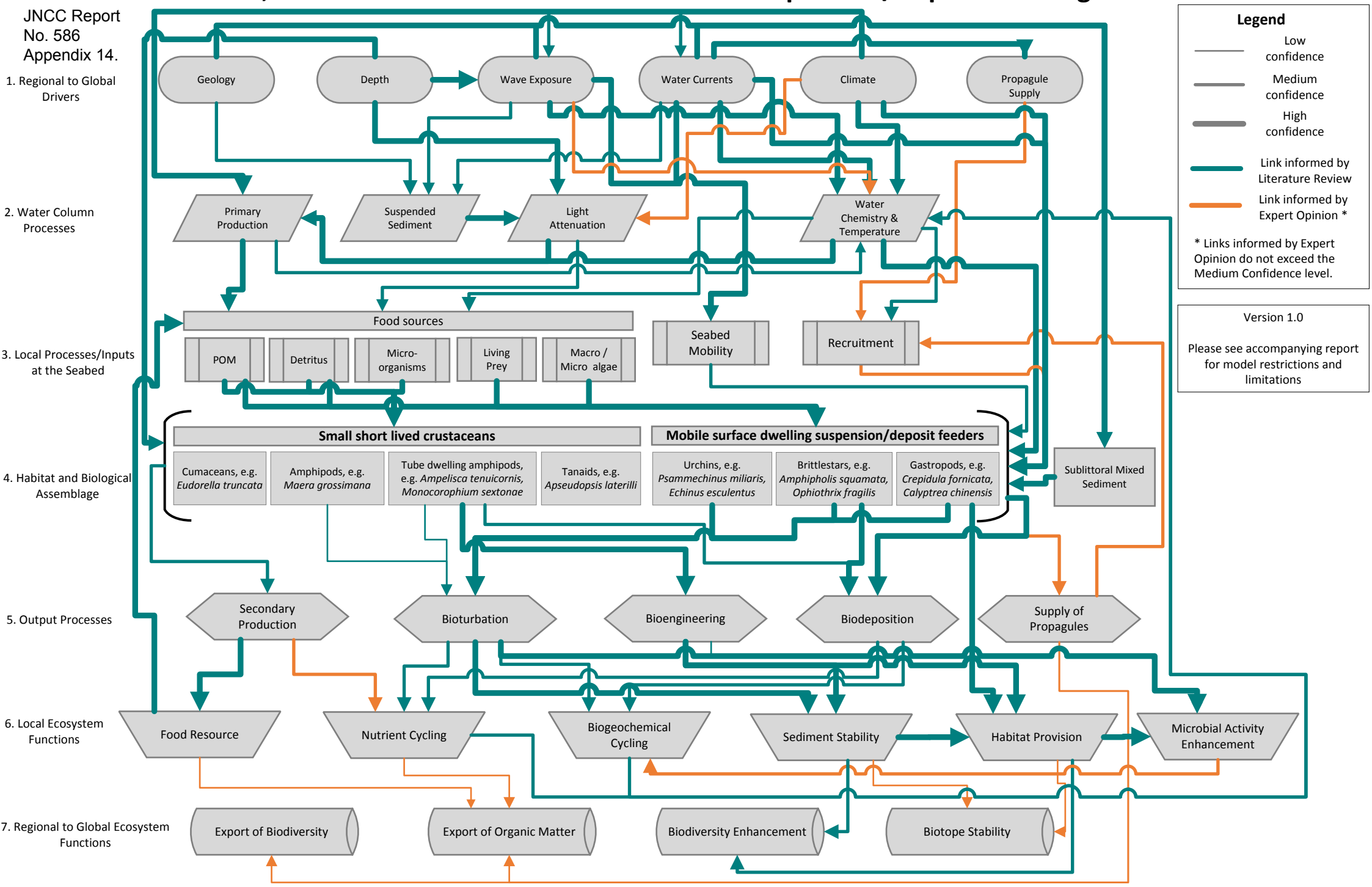
Appendix 13.

Sub-model 4. Attached Surface Dwelling or Shallowly Buried Bivalves - CONFIDENCE



Sub-model 5. Small, Short-Lived Crustaceans and Interface Suspension/Deposit Feeding Fauna - CONFIDENCE

JNCC Report No. 586 Appendix 14.



Appendix 15 – Pressure descriptions

List of anthropogenic pressures relevant to shallow sublittoral mixed sediment habitats. Pressures and descriptions are taken from the Intercessional Correspondence Group on Cumulative Effects (ICG-C).

Pressure theme	Pressure	Description	Benchmark (Tillin et al, 2010)
Biological pressures	Removal of non-target species	By-catch associated with all fishing activities. The physical effects of fishing gear on sea bed communities are addressed by the "abrasion" pressure type so this addresses the direct removal of individuals associated with fishing/ harvesting. Ecological consequences include food web dependencies, population dynamics of fish, marine mammals, turtles and sea birds (including survival threats in extreme cases, e.g. Harbour Porpoise in Central and Eastern Baltic).	Removal of features through pursuit of a target fishery at a commercial scale
Physical damage (Reversible Change)	Changes in suspended solids (water clarity)	Changes in water clarity from sediment & organic particulate matter concentrations. It is related to activities disturbing sediment and/or organic particulate matter and mobilising it into the water column. Could be 'natural' land run-off and riverine discharges or from anthropogenic activities such as all forms of dredging, disposal at sea, cable and pipeline burial, secondary effects of construction works, e.g. breakwaters. Particle size, hydrological energy (current speed & direction) and tidal excursion are all influencing factors on the spatial extent and temporal duration. This pressure also relates to changes in turbidity from suspended solids of organic origin (as such it excludes sediments - see the "changes in suspended sediment" pressure type). Salinity, turbulence, pH and temperature may result in flocculation of suspended organic matter. Anthropogenic sources mostly short lived and over relatively small spatial extents.	A change in one rank on the WFD (Water Framework Directive) scale e.g. from clear to turbid for one year
Physical damage (Reversible Change)	Abrasion/disturbance of the substrate on the surface of the seabed	The disturbance of sediments where there is limited or no loss of substrate from the system. This pressure is associated with activities such as anchoring, taking of sediment/geological cores, cone penetration tests, cable burial (ploughing or jetting), propeller wash from vessels, certain fishing activities, e.g. scallop dredging, beam trawling. Agitation dredging, where sediments are deliberately disturbed by and by gravity & hydraulic dredging where sediments are deliberately disturbed and moved by currents could also be associated with this pressure type. Compression of sediments, e.g. from the legs of a jack-up barge could also fit into this pressure type. Abrasion relates to the damage of the sea bed surface layers (typically up to 50cm depth). Activities associated with abrasion can cover relatively large spatial areas and include: fishing with towed demersal trawls (fish & shellfish); bio-prospecting such as harvesting of biogenic features such as maerl beds where, after extraction, conditions for recolonisation remain suitable or relatively localised activities including: seaweed harvesting, recreation, potting, aquaculture. Change from gravel to silt substrate would adversely affect herring spawning grounds.	Damage to seabed surface features
Physical damage	Habitat structure	Unlike the "physical change" pressure type where there is a permanent change in sea bed type (e.g. sand to	Extraction of sediment to 30cm

(Reversible Change)	changes - removal of substratum (extraction)	gravel, sediment to a hard artificial substrate) the "habitat structure change" pressure type relates to temporary and/or reversible change, e.g. from marine mineral extraction where a proportion of seabed sands or gravels are removed but a residual layer of seabed is similar to the pre-dredge structure and as such biological communities could re-colonise; navigation dredging to maintain channels where the silts or sands removed are replaced by non-anthropogenic mechanisms so the sediment typology is not changed.	
Physical damage (Reversible Change)	Siltation rate changes, including smothering (depth of vertical sediment overburden)	When the natural rates of siltation are altered (increased or decreased). Siltation (or sedimentation) is the settling out of silt/sediments suspended in the water column. Activities associated with this pressure type include mariculture, land claim, navigation dredging, disposal at sea, marine mineral extraction, cable and pipeline laying and various construction activities. It can result in short lived sediment concentration gradients and the accumulation of sediments on the sea floor. This accumulation of sediments is synonymous with "light" smothering, which relates to the depth of vertical overburden. “Light” smothering relates to the deposition of layers of sediment on the seabed. It is associated with activities such as sea disposal of dredged materials where sediments are deliberately deposited on the sea bed. For “light” smothering most benthic biota may be able to adapt, i.e. vertically migrate through the deposited sediment. “Heavy” smothering also relates to the deposition of layers of sediment on the seabed but is associated with activities such as sea disposal of dredged materials where sediments are deliberately deposited on the sea bed. This accumulation of sediments relates to the depth of vertical overburden where the sediment type of the existing and deposited sediment has similar physical characteristics because, although most species of marine biota are unable to adapt, e.g. sessile organisms unable to make their way to the surface, a similar biota could, with time, re-establish.	up to 30cm of fine material added to the seabed in a single event
Physical loss (Permanent Change)	Physical change (to another seabed type)	The permanent change of one marine habitat type to another marine habitat type, through the change in substatum, including to artificial (e.g. concrete). This therefore involves the permanent loss of one marine habitat type but has an equal creation of a different marine habitat type. Associated activities include the installation of infrastructure (e.g. surface of platforms or wind farm foundations, marinas, coastal defences, pipelines and cables), the placement of scour protection where soft sediment habitats are replaced by hard/coarse substrate habitats, removal of coarse substrate (marine mineral extraction) in those instances where surficial finer sediments are lost, capital dredging where the residual sedimentary habitat differs structurally from the pre-dredge state, creation of artificial reefs, mariculture i.e. mussel beds. Protection of pipes and cables using rock dumping and mattressing techniques. Placement of cuttings piles from oil & gas activities could fit this pressure type, however, there may be an additional pressures, e.g. "pollution and other	Permanent loss of existing saline habitat

		chemical changes" theme. This pressure excludes navigation dredging where the depth of sediment is changes locally but the sediment typology is not changed.	
Pollution and other chemical changes	Nutrient enrichment	Increased levels of the elements nitrogen, phosphorus, silicon (and iron) in the marine environment compared to background concentrations. Nutrients can enter marine waters by natural processes (e.g. decomposition of detritus, riverine, direct and atmospheric inputs) or anthropogenic sources (e.g. waste water runoff, terrestrial/agricultural runoff, sewage discharges, aquaculture, atmospheric deposition). Nutrients can also enter marine regions from 'upstream' locations, e.g. via tidal currents to induce enrichment in the receiving area. Nutrient enrichment may lead to eutrophication (see also organic enrichment). Adverse environmental effects include deoxygenation, algal blooms, changes in community structure of benthos and macrophytes.	Compliance with WFD criteria for good status
Pollution and other chemical changes	Organic enrichment	Resulting from the degraded remains of dead biota & microbiota (land & sea); faecal matter from marine animals; flocculated colloidal organic matter and the degraded remains of: sewage material, domestic wastes, industrial wastes etc. Organic matter can enter marine waters from sewage discharges, aquaculture or terrestrial/agricultural runoff. Black carbon comes from the products of incomplete combustion (PIC) of fossil fuels and vegetation. Organic enrichment may lead to eutrophication (see also nutrient enrichment). Adverse environmental effects include deoxygenation, algal blooms, changes in community structure of benthos and macrophytes.	A deposit of 100gC/m^2/yr