Appendix 2. Tools and concepts
Examples of the tools and concepts used by the cases when engaging with different aspects of complexity.

1. Tools and concepts for identifying external drivers and cross-scale interactions
External drivers and cross-scale interactions were identified during different types of exercises, for example, when developing historical timelines, systems diagrams, state-and-transition models, when defining system boundaries, or in specific scoping exercises. Approaches used in scoping exercises were e.g. SWOT-analysis, which identifies strengths, weaknesses, opportunities, and threats, and V-STEEP, which captures factors of systems or contexts across six dimensions: values, social, technological, ecological, economic, and political (Biggs and Rogers 2003, Pollard et al. 2014). Scales above and below the focal system were sometimes included in, for example, historical timelines and systems diagrams (e.g., Eskilstuna, Shyamnagar, Limpopo).

2. Tools and concepts for mapping relations
To conceptualize people-biosphere connections, cases mapped bundles of ecosystem services within their region (e.g., Helge å), developed systems diagrams of social-ecological systems (e.g., Pacific herring, Shyamnagar) and of how different system components influence each other (e.g., Limpopo, Helge å), and used interactive workshop exercises that illustrated connections (e.g., ALH). To describe social-ecological systems, some used frameworks and heuristics, such as ecosystem services and human well-being as defined in the Millennium Ecosystem Assessment (MA 2005) (e.g., Eskilstuna) or "the 3 L's": Landscapes, Livelihoods, and Lifestyles (e.g., Ethiopia, Murray, Helge å).

To map relations between actors, cases used e.g., social network analysis (e.g., Tajikistan, Murray), and focus group discussions (Shyamnagar). Limpopo used the Cultural Historical Activity Theory (CHAT) (Engeström 2016). CHAT offers different tools to explore issues collaboratively with actors, including a heuristic of an "activity system". Limpopo used this to tease out the different roles, responsibilities and connections between actors at different levels of governance in a "non-threatening way".

3. Tools and concepts for facilitating dialogue and enhancing learning
To facilitate dialogue and enhance learning in workshops, cases used social learning processes (e.g. Limpopo, Murray) (e.g., Brown and Lambert 2013, Engeström 2016), collaborative development of causal loop diagrams (e.g., Limpopo, Helge å), interactive workshop exercises (e.g. ALH) (see e.g., Hopkins 2008:60), discussions in small groups with people with different backgrounds and perspectives, and by establishing "ground rules" of listening and respecting different perspectives (e.g., Eskilstuna) (informed by Yankelovich 2001).

The Australian organizations incorporated ideas of 'triple-loop' learning (Tosey et al. 2011), adaptive management (Walters 1986) and adaptive governance (Folke et al. 2005) into their organizations, as part of building a learning culture (Mitchell 2013, Sellberg et al. 2018).

4. Tools and concepts for assessing system dynamics
Historical timelines have been used to identify, discuss and visualize different eras, trends, drivers of change, events, transformations, and changes in resilience and adaptive capacity over

time (see Resilience Alliance 2010). In some cases, the timeline was part of describing the system, rather than assessing resilience and provided important context (e.g., Helge å, Shyamnagar). The time span was usually more than a hundred years back.

Tools and heuristics to facilitate workshops discussions of *potential thresholds*, alternate system states (current, desirable, undesirable) and what could drive system change, included: state-and-transition diagrams (Ethiopia, Murray, Kangaroo Island), the "ice-cream-diagram" (Murray) and other types of interactive workshop exercises (Eskilstuna, ALH). The ice-cream diagram is a heuristic used to discuss the current situation (bottom of the ice-cream cone) the vision or aspirations (the ice-cream), and the potential thresholds and limits of a desirable development trajectory towards the vision (the edges of the ice-cream cone). Two cases reviewed documented regime shifts in the scientific literature and the regime shifts database (http://www.regimeshifts.org) to identify potential thresholds relevant for their context (Eskilstuna, Arctic). Limpopo and Goulburn-Broken were informed by the approach of strategic adaptive management (Biggs and Rogers 2003) and used the idea of thresholds to set monitoring and management goals as ranges, rather than exact targets.

Systems diagrams include influence diagrams, causal loop diagrams and conceptual systems models. Conceptual systems models illustrate how different parts of the system are related to each other. Influence diagrams emphasize which components influence which, using boxes and arrows (Heemskerk et al. 2003). Causal loop diagrams expand on this by specifying the kind of interactions and identifying potential reinforcing and dampening feedback loops (Sterman 2000).

Different approaches to developing *scenarios* were: adaptation pathways (Wise et al. 2014) (Kangaroo Island, Ethiopia), downscaling of national scenarios (Kangaroo Island), combining two drivers in a scenario cross (Shyamnagar, Kangaroo Island), the ice-cream diagram explained above (Helge å), and "Seeds of a Good Anthropocene" (Pereira et al. 2018) (Helge å).

5. Theory-based resilience frameworks
Resilience frameworks that are based on theory make it easier to translate between cases and to compare them. The theory-based frameworks used by the cases in this paper were primarily based on social-ecological resilience theory. However, the frameworks adopted related but different aspects of this body of theory. The most common frameworks used by the cases in this study were the seven resilience principles (Biggs et al. 2015) (Pacific herring, Eskilstuna, ALH, Goulburn-Broken) and the four categories of resilience-building strategies (Berkes et al. 2003) (Arctic, Shyamnagar). Other frameworks used were: five capitals of adaptive capacity (Murray) and nine characteristics of resilient systems (Walker and Salt 2006) (Limpopo).