NBA Marine and Coastal Component: Research priorities

Species and Genetic Research

- Taxonomic priorities should align with priority biodiversity knowledge needs as well as address key gaps reported in Section 13 – The status of marine taxonomy. Groups that are poorly known and suitably diverse are priorities for the revision of existing species and description of new species, using natural science collections and through additional surveys (systematic where possible).
  Groups that are priorities for marine biodiversity management include
  - Groups with high levels of endemism and many range restricted species;
  - Groups with high potential for invasion and introduction,
  - Harvested groups (for food, aquaculture, and trade)
  - Groups that will be useful in monitoring impacts of global change
  - Groups that are important in major ecosystem processes.
- DNA barcoding of priority groups to enable identification of traded, harvested, threatened and invasive species, and the development of mechanisms to carry out analyses of bulk ecological / monitoring samples. Note that improved co-ordination is needed in this area to ensure wise use of resources and avoid repetition of work done.
- More effort is needed in the inventory of marine species and comprehensive national species databases should be compiled and expanded, maintained and disseminated by SANBI. Resources will need to be secured if this is to be achieved. Two types of databases are needed; verified species lists (checklists / inventories that include basic information such as endemism and threat status for each species, as well as invalid names and up to date classification) and co-ordinated species databases (such as a South African version of the Encyclopaedia of Life) that link to collection and spatial information through the Global Biodiversity Information Facility or the Ocean Biogeographic Information System and the literature. More systematic surveys are needed to support improved species distribution data for South Africa.
- A national fish atlas remains a research priority as identified in the 2004 National Spatial Biodiversity Assessment. This atlas could be focused on priority species including threatened, protected and other species of concern, indicator species, key resources and species that can contribute to current research efforts.
- Endemic and species with very restricted ranges need to be identified. Many marine invertebrates are known only from the type locality. Lists of these taxa need to be produced and investigated to identify priority groups for further taxonomic and other research and possibly conservation assessment. Atlassing projects could be considered for selected groups with many such species.
- Civil society can and should contribute to improved coastal and marine biodiversity information for South Africa. New initiatives that can harness citizen science collaboration from divers, fishers and other user groups are needed.
- Scientists need to support the identification of potential invasive species and the development of appropriate lists to enable effective regulation.
- Systematic surveys and monitoring is needed to identify potential invasive species. Research effort is needed on the east and south coasts, in offshore habitats and in mariculture facilities.
- There are opportunities to use genetic tools to better understand the colonisation and invasion dynamics of non-indigenous marine species.

- Improved species data are needed for Marine Protected Areas. Such data will underpin the assessment of the effectiveness of current MPAs in meeting biodiversity protection and resource management objectives. Research to guide appropriate spacing of MPAs is required and model-based approaches should be used to determine targets for key species identified using clear criteria.
- Research priorities to support improved stock assessment and resource management include
  - Assessment of whether kingklip on the west coast and south coast are separate stocks
  - Aging studies for sole to improve stock assessment
  - Updated and more reliable information is needed for squid effort and catch data
  - Many linefish assessments need updating
  - Improved data collection and research are needed to support management in the prawn trawl fisheries (DAFF 2010)
  - Improve data to support stock assessments and management of sharks are required.
- Conservation assessments are needed to support the identification of threatened marine and coastal species. (See Section 10.2 – Threatened species).
- Genetic biodiversity requires further research attention to facilitate the incorporation of this component of biodiversity into future assessments & MPA planning. More detailed research priorities are presented in Section 14.4 – Gaps in molecular knowledge in South Africa and include the need for more research in the Delagoa and Southern Benguela ecoregions, research in sandy beach and coral reef habitats, more genetic data for linefish and studies to assess genetic differences prior to and after exploitation.

Habitat classification, mapping and research to support ecological understanding and impact assessment

- Existing datasets and new sampling opportunities should be used to test the validity of the current habitat classification.
- Research to support the ecological definition of coastal habitat types including appropriate seaward and landward boundaries is needed.
- Research is required to support the delineation and classification of island and associated habitat types. Further research is needed to assess whether habitats such as sandy beaches and reefs that are associated with islands are distinct from those along the mainland coastline.
- Priority habitat types that require improved mapping and distribution data include muds, gravels and other coarse sediment types, hard grounds, submarine canyons and reefs. Mapping of submarine features such as banks, paleo-shorelines, seamounts and canyons is needed to support the development of appropriate spatial management measures to protect seabed features.
- Existing data do not adequately reflect fluvial inputs. Maps of unconsolidated sediment habitat types that are linked to riverine or estuarine systems are needed. An example of such habitat types includes the fluvial fans on the south coast which constitute spawning habitat for white steenbras. Mud banks require improved delineation.
- A systematic bathymetric (depth contours) and geological mapping programme is needed for the South African seabed. Systematic biodiversity surveys are needed to assess the influence of physico-chemical drivers and other proposed determinants of biodiversity pattern. These programmes should underpin improved ecosystem classification, mapping and assessment.
- Key research priorities for broad ecosystem groups and habitat types were identified and reported in Section 2.3 – Overview of habitat types.

- o Long term experiments and monitoring could improve our understanding of all habitat types.
- o For sandy beaches, improved information of the smaller components of beach biodiversity and an improved understanding of connectivity and key ecological processes are needed.
- o Inshore and offshore unconsolidated sediment types are poorly understood with a need further research to improve our understanding of the biodiversity associated with different sediment types (particularly muds and gravels), the key drivers of biodiversity pattern and the impacts of human activities on these habitats. There are 16 different unconsolidated offshore habitat types, many of which have never been sampled. The productive shelf edge habitat types that support valuable fisheries are key research priorities.
- o Inshore reefs and hard grounds are poorly studied in the Agulhas and southern Benguela shelf ecoregions. Improved information of reef biodiversity, ecosystem functioning and the effects of anthropogenic impacts is needed in these regions.
- o There is very limited knowledge about offshore rocky habitat types on the shelf and shelf edge and the biodiversity associated with these habitat types. South Africa has deep water reef building corals although nothing is known about the extent, associated biodiversity and ecological role of these habitat types. Submarine canyons in the Natal, Agulhas and southern Benguela shelf ecoregions have not been researched.
- o Pelagic biodiversity is poorly understood and the pelagic "habitat types" used in the NBA 2011 should be tested and refined. Comparison of these habitat types with the distribution of pelagic species, known foraging areas for pelagic feeders and key movement pathways of pelagic species would be a useful first step. More information on vertical stratification within the ocean is needed to support improved classification and the high levels of variability associated with pelagic habitat types need to be better incorporated into future classification, mapping and assessments of pelagic habitats.

Pressures, changes and assessment of marine and coastal biodiversity

- An improved understanding of emerging pressures on marine and coastal ecosystems is needed. Research should be directed at assessing the actual and potential impact of key emerging pressures including desalination plants, freshwater flow reductions, dredge mining and petroleum activities.
- Research to support the understanding of climate variability and change in marine and coastal ecosystems is a national priority. More detailed research priorities are reflected in Section 12 including further research on shifting species distributions and the potential impact of ocean acidification in South Africa. Research needs to develop predictive capacity in South Africa, support early detection of change and contribute to the development of mitigation and adaptation measures.
- A standardised national survey of recreational fishing effort is a key research priority.
- Estimates of subsistence fishing effort and the effort and catch data for the emerging small scale fisheries sector is a national priority.
- Finer-scale and spatially referenced fishing effort and catch data is needed to support more accurate assessments of habitat impacts, more refined mitigation measures for habitat protection and bycatch management
- The impacts and risks of mariculture in South Africa, particularly finfish culture need to be understood. Research should help to identify risks and threats to indigenous species (including the effects of disease and parasites as well as population and genetic impacts) and habitats.

New farms offer research opportunities using a robust experimental approach to understand impacts and support science-based management advice.

- Research effort to support the mitigation of human impacts on marine and coastal biodiversity is required. There are opportunities and incentives for research that helps to mitigate incidental mortality and bycatch associated with fishing. Key areas for further research innovation include mitigation of mining and petroleum impacts, mariculture impacts, and in managing ballast water.
- The feasibility of removing the invasive crab *Carcinus maenas* warrants assessment.
- Long term in-situ monitoring of habitat condition is needed to calibrate the assessment of habitat condition and ecosystem threat status. This type of research is important in understanding complex changes in marine ecosystems and is a key element in research to understand, predict and respond to climate variability and change.
- Further examination of historical data and patterns is needed to assess ecosystem changes over a longer time period. Funding should be directed at the acquisition, archiving and analysis of historical data sets.
- Improved data are needed to support the assessment and review of Marine Protected Areas (MPAs) in South Africa. Species and habitat data is needed for all MPAs and a central data archive is needed to support MPA assessment. A more co-ordinated National MPA research program could contribute to assessment of the achievement of MPA objectives and the understanding of change in marine ecosystems.
- Ecosystem-based biodiversity targets should to be established for marine and coastal habitats. Porter *et al.* (2011) provide more detailed research priorities to support target setting.
- Research to improve our understanding and evaluation of marine and coastal ecosystem and biodiversity services is needed. Spatial assessment of ecosystem services could facilitate better integration of ecosystem services into marine biodiversity assessment and planning at multiple scales.

Systematic planning and the identification of priority areas

- Research to support the identification and mapping of critical habitats for key resource species (such as nursery, spawning and feeding areas) is needed.
- Sensitive coastal and offshore areas should be identified to support the prevention of significant adverse impacts and the loss of biodiversity and ecosystem services.
- Achievement of the biodiversity and resource management objectives of South Africa's Marine Protected Area (MPA) network need to be reviewed. Comprehensive species and habitat data is needed to support the assessment of South Africa's MPAs.
- Marine ecosystem priority areas and ecological support areas should be identified through systematic biodiversity plans.
- Systematic biodiversity planning is required for the northern section of the Natal bioregion and the west coast of South Africa.