

APPENDIX E TECHNOLOGY AND EQUIPMENT USED IN COMMERCIAL FISHING OPERATIONS

There is a wide range of gear and equipment available for commercial fishers to assist in catching target species. Technological advancements have increased the efficiency of fishing and allowed access to fishing grounds in deep and previously inaccessible waters.

Since the early 1900's trawlers have evolved from large, steam-driven vessels to relatively small, diesel engine-powered boats. In combination with hydraulic winches, the light, powerful diesel engine has allowed the use of large trawl nets on vessels that, despite their smaller size, are much more efficient than older vessels.

Studies in the fields of marine biology, animal behaviour and ecology have increased understanding of target species. Information such as when and where species breed, their ranges and habits, life cycles and physiological needs is available to help manage both species conservation and fisheries.

The use of satellites for remote-sensing and remote-imaging produce a wide range of oceanographic and biological information useful for locating schools of fish. For instance, near real-time imagery of ocean temperature is used by tuna longline fleets to identify temperature fronts associated with high catch rates of tuna.

In recent times there has been widespread use of Global Positioning System (GPS) receivers. GPS allows vessels to be positioned at any location in the world, accurate to within a few tens of metres. Prime fishing areas can now be precisely identified, and the positions of fishing spots or topographic features accurately marked on charts.

The use of sonar and sounding equipment is commonplace in many fishing vessels. Modern sonar allows fishers to locate schools of fish and to position fishing gear accurately to catch the school. Sounders and sonar, in conjunction with other equipment such as GPS and digital charts, allow an operator to build a detailed three-dimensional model of their fishing grounds.

Not all fishing technology is focussed on the removal of target species. An increasingly important aspect of fishing gear design relates to the reduction of bycatch, particularly

with respect to non-target animals like cetaceans, dugongs, turtles and seabirds. Extensive research in Australia has centred on developing bycatch reduction devices (BRDs) for a range of non-target species. The technology used for developing BRDs has had other applications in allowing fishers to fish specifically for the most appropriate size range of target species. Some BRDs allow larger-sized breeding individuals to escape from nets. Others, such as Tori Lines and weighted swivels, keep fishing gear deep under water beyond the diving range of seabirds.

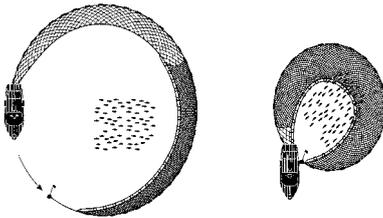
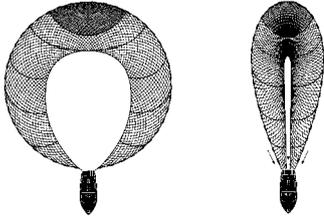
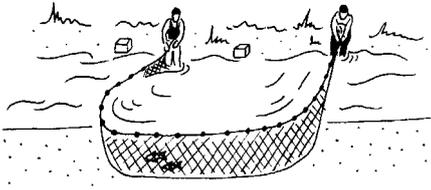
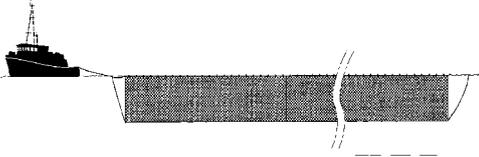
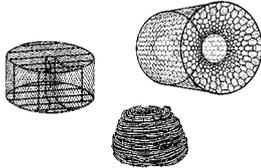
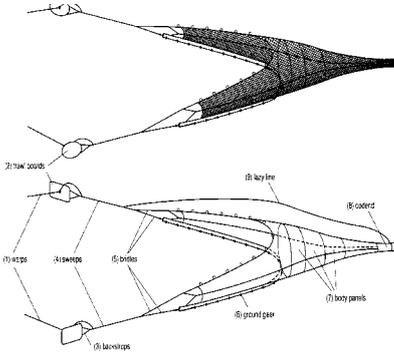
Given that the species caught as catch or bycatch are specific to each fishery or geographic area, the development of bycatch reducing technology is an ongoing process involving extensive experimentation and testing within different fisheries. Developing technological solutions for reducing bycatch and the effect of fishing on the marine environment will most likely remain a priority for the management of the Australian Fishing Zone in the foreseeable future (BRS 2007).

Much of the technology discussed above has been developed using recent advances in computing and engineering; consequently many of the very successful fishing gear technologies have been designed and implemented during the working life of only a single generation of fishers, and, in many cases, within a single generation of some target species. The full impact of this modern equipment on the long-term sustainability of the industry is yet to become apparent. To a large degree this will depend on the ability of target species to adapt to the technology.

In addition to new fishing technology there are numerous types of nets, traps and lines that have been in use by the fishing industry for a long time. Although refined and perfected, the more traditional pieces of equipment have been in use for many generations. Each piece has been developed to catch specific species or for operation in a particular environment.

Table E.1 details some of the different types of nets, traps and lines used by the industry in Australia. Note that not all of these gear types may be used in the East Marine Region.

Table E.1 Nets, traps and lines used in Australia

<p>Purse seine Nets are constructed with a smaller mesh size than the size of fish being sought. A skiff or buoy anchors one end of the net while it is set around a school of fish, after which a purse line is pulled to close the bottom of the net. Used to target high volume schooling species including tuna, in coastal and oceanic waters.</p>	 <p>© BRS</p>
<p>Lampara net Similar to a purse seine, however the net has tapered panels to give a characteristic scoop shape rather than being flat. The net is set around a school and when both ends are retrieved the vessel tows the net forward, closing the bottom then top of the net. Used to catch pilchards and anchovy in inshore waters.</p>	 <p>© BRS</p>
<p>Beach seine The seine net is set parallel to the shoreline, some distance off the beach, usually by a dinghy. One haul line is retained on the beach while the other is returned by the dinghy and both lines are hauled until the seine net and entrapped fish are dragged onto the shore. Beach seine are used to catch many species, including mullet, Australian salmon, whiting and tailor.</p>	 <p>© Marina Larcombe</p>
<p>Gillnet Panels of net are set vertically in the water column, either at the surface or in contact with the seabed. The size of the mesh in the net determines the size range of the species caught, as smaller fish are able to swim through the mesh and fish that are too large tend to bounce off.</p>	 <p>© BRS</p>
<p>Pots and traps Traps are usually baited and set on the seabed with a line to a surface float. A wide range of designs are used to take crustaceans such as lobsters and crabs, and some species of fish. Pots and traps are set in depths from a few metres to over 200 metres.</p>	 <p>© BRS</p>
<p>Bottom otter trawl A cone-shaped net, held open across the seabed by large hydrodynamic plates called otter boards. The otter boards are usually attached to the net by lines called sweeps, which are often quite long, relative to the net width and aid in herding fish towards the net mouth. As the net is pulled along, fish accumulate in the rear section, or cod end, of the net. Depending on the vessel and gear, bottom otter trawling may occur to a depth in excess of 1,500 metres, but generally not below 1,000 metres.</p>	 <p>© BRS</p>

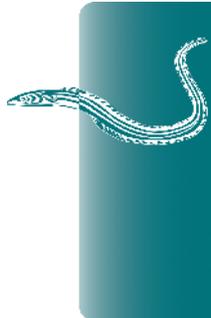


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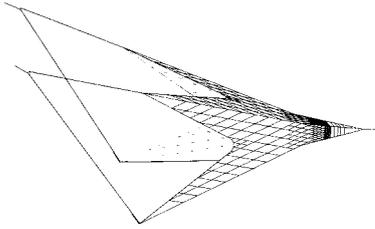
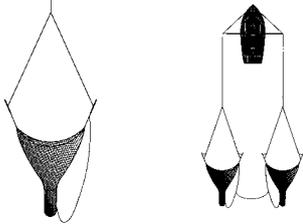
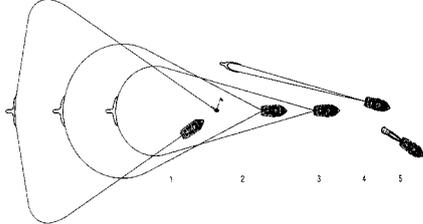
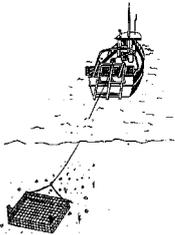
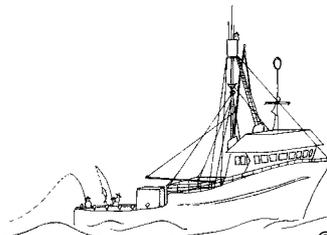
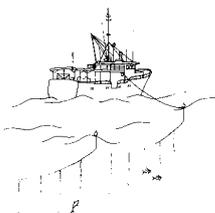
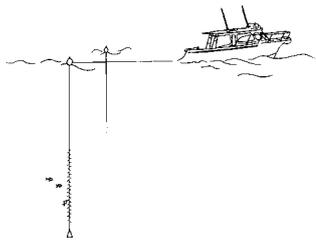
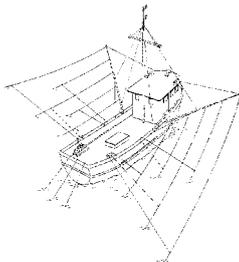
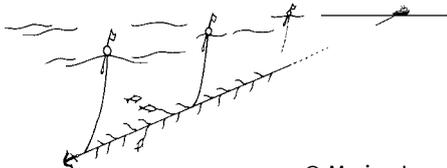
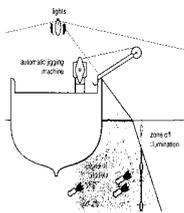
<p>Mid-water trawl</p> <p>Is usually much larger than a bottom trawl and designed to fish off the seabed, in mid-water. The horizontal opening is maintained by otter boards. Floats on the headline (at the top) and weights on the groundline (at the bottom) maintain the vertical opening.</p> <p>Mid-water trawl gear is used to catch species such as blue grenadier (<i>Macrurus novaezelandiae</i>) off western Tasmania.</p>	 <p>© AFMA</p>
<p>Prawn trawl</p> <p>Nets are similar to bottom otter trawls but do not use sweep. Chains are hung below the foot rope to disturb the prawns, causing them to 'jump' into the path of the oncoming net. Arrays of two, three or even four such nets are commonly towed by a single vessel.</p> <p>Prawn trawling of this type is generally limited to waters shallower than about 80 metres.</p>	 <p>© BRS</p>
<p>Danish seine</p> <p>Nets are a cross between a trawl net and a seine net, in terms of shape. The line and net is paid out in a pear shape, and then hauled back to the stationary or slowly moving vessel in a similar fashion to a bottom trawl. The two lines act as 'sweeps', herding fish towards the net. Danish seine gear is used on the continental shelf to catch flat head, whiting and morwong.</p>	 <p>© BRS</p>
<p>Scallop dredge</p> <p>Mainly box-shaped mud dredges, up to 3.5 metres wide, dragged along the seabed and digging into the substrate to collect animals on and within it. Scallop dredges are used in relatively shallow continental shelf waters, to a depth of 100 metres.</p>	 <p>© Marina Larcombe</p>
<p>Pole and line (pole and live bait)</p> <p>Surface swimming schools of tuna are attracted to the vessel using live or dead bait. The tuna, in a frenzy of feeding, take a barbless hook and lure and are hauled aboard using a pole and short, fixed line. Pole and line may be combined with purse seining to attract and aggregate a school of fish, around which the net is set. The pole boat subsequently escapes over the top of the purse seine net.</p>	 <p>© Marina Larcombe</p>
<p>Pelagic longline (drifting longlines)</p> <p>Comprised of a mainline suspended horizontally by buoy lines. Branch lines, each with a single baited hook, are attached to the main line at regular intervals. The line is allowed to 'soak' for several hours before retrieval.</p> <p>Pelagic longlines are used to catch tuna and billfish in oceanic waters, and usually set hooks shallower than 300 metres.</p>	 <p>© Marina Larcombe</p>

Table E.1 Nets, traps and lines used in Australia

<p>Dropline A single mainline, with numerous baited hooks (usually no more than 100) attached to the bottom portion of the line via branchlines and clips. The main line is set vertically in the water column, between a large surface float and a bottom weight.</p> <p>Droplines are regularly set to depths in excess of 500 metres and catch blue eye trevalla (<i>Hyperoglyphe antarctica</i>), and hapuku (<i>Polyprion oxygeneios</i>) among other species.</p>	 <p>© Marina Larcombe</p>
<p>Troll Troll lines are run from the stern of the vessel and from booms on the side of the vessel. Hooked baits and lures are pulled through the water behind the moving vessel. Trolling is used to catch tuna and mackerel in coastal waters and waters off the continental shelf.</p>	 <p>© FAO</p>
<p>Bottom longline A mainline, with attached branch-lines (snoods) and hooks, that are set across the seabed. Variations may have floats incorporated to lift the baits away from the bottom (trot lines). Bottom longlines are used to catch ling (<i>Genypterus blacodes</i>) and school shark (<i>Galeorhinus galeus</i>) among other species, and may be set in depths exceeding 1 000 metres.</p>	 <p>© Marina Larcombe</p>
<p>Squid jig Occurs at night, with bright lights attracting squid to the vessel's side. Lines with several barbless lures are 'jigged' up and down and squid caught on the lures are hauled onto the vessel.</p> <p>Most vessels in Australia use automated, mechanical jigging machines. Squid jigging occurs mainly in coastal waters.</p>	 <p>© BRS</p>

Source: (Larcombe et al. 2002)

Key References and Further Reading

BRS, 2007, *Fishing Technology*, Bureau of Rural Sciences, Canberra, <<http://www.daff.gov.au/brs/fisheries-marine/info/technology> accessed 25/2/08>.

Larcombe, J., Brooks, K., Charalambou, C., Fenton, M., Fisher, M., Kinloch, M. and Summerson, R., 2002, *Marine Matters - Atlas of marine activities and coastal communities in Australia's South-East Marine Region*, Bureau of Rural Sciences, Canberra.

ABBREVIATIONS AND ACRONYMS

ABS	Australian Bureau of Statistics	GBRMPA	Great Barrier Reef Marine Park Authority
ACAP	The Agreement on the Conservation of Albatross and Petrels	IMCRA	Integrated Marine and Coastal Regionalisation of Australia
AFMA	Australian Fisheries Management Authority	IUCN	International Union for the Conservation of Nature and Natural Resources (World Conservation Union)
AMSA	Australian Maritime Safety Authority	IWC	International Whaling Commission
CAMBA	Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986	JAMBA	Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment 1974
CBD	The Convention on Biological Diversity	MARPOL	International Convention for the Prevention of Marine Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto
CCSBT	Commission for the Conservation of Southern Bluefin Tuna	NSW	New South Wales
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	QFJA	Queensland Fisheries Joint Management
CMS	Convention on Migratory Species (also known as the Convention on the Conservation of Migratory Species of Wild Animals or the Bonn Convention)	QLD	Queensland
CSIRO	Commonwealth Scientific and Industrial Research Organisation	Ramsar	Convention on Wetlands of International Importance (Ramsar Convention 1971)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999	ROKAMBA	Agreement between the Government of Australia and the Government of the Republic of Korea – on the Protection of Migratory Birds, 2007
EEZ	Exclusive Economic Zone	UNCLOS	United Nations Convention on the Law of the Sea

GLOSSARY

abyssal plain

The flat, relatively featureless bottom of the deep ocean, at depths greater than 2000 m. The average depth of the abyssal floor is about 4000 m.

aggregating behaviour

Grouping of fish or other animals. This can be for reasons such as availability of food organisms, or for spawning.

ahermatypic

Pertains to corals that do not have zooxanthellae. Generally non-reef building.

alga

The common name for simple plants which do not have specialised parts such as roots or leaves. They do not have vascular systems, so most are found living in water. Singular of algae

amphipod

A small crustacean belonging to the order Amphipoda that has a laterally compressed body with no carapace.

anthropogenic

Of human origin or resulting from human activity.

anti-cyclonic

Rotation about a vertical axis that is clockwise in the Northern Hemisphere and counter-clockwise in the Southern Hemisphere.

apron/fan

Sediment deposition at the base of a slope or end of a canyon.

assemblage

A collection of plants and/or animals characteristically associated with a particular environment, which can be used as an indicator of the health of that environment.

atoll

A coral island consisting of a ring of coral surrounding a central lagoon.

Australian margin

Refers to the Australian continental margin: the offshore zone consisting of the continental shelf, slope and rise that separates the dry-land portion of a continent from the deep ocean floor.

ballast water

Water carried in ships' tanks to maintain stability when a ship is lightly loaded. It is normally discharged to the sea when the ship is loaded with cargo.

barrier reef

An offshore coral reef ridge which somewhat parallels the coastline.

basin

A sunken area of the deep sea floor that can be small or large with roughly uniform dimensions.

bathymetry

The measurement of ocean depths to determine the sea floor topography.

benthos/benthic

Refers to all marine organisms living upon or in the bottom of the sea.

billfish

Pelagic fish with long, spear-like protrusions at their snouts, such as swordfish and marlin.

biodiversity

Variability among living organisms from all sources (including terrestrial, marine and other ecosystems and ecological complexes of which they are part), which includes diversity within species and between species and diversity of ecosystems.

biofouling

Biofouling (biological fouling) is the undesirable accumulation of plants, animals and micro-organisms on submerged structures such as ships' hulls, wharves and oil rigs.

biogenic

Produced by living organisms.

biogeographic

Relating to large regions with distinct fauna and flora.

biological or ecological productivity

The ability of an ecosystem to produce, grow or yield biomass – whether trees, fish or other organisms.

biomass

The quantity of organic matter within an ecosystem (usually expressed as dry weight per unit area or volume).

bioprospecting

The search for new chemicals derived from biological processes, systems or organisms.

bioregion

A large area of the ocean that is classified as having similar types of plants, animals and ocean conditions, compared to other similarly-sized areas. For the purpose of this document, bioregion means provincial bioregion as defined in the Integrated Marine and Coastal Regionalisation of Australia Version 4.0 <www.environment.gov.au/coasts/mbp/imcra/index.html>.

biota

All of the organisms at a particular locality.

bioturbation

The disturbance and mixing of sediment layers by biological activity (plants or animals).

bryozoans

Marine animals commonly known as moss animals, sea mats or lace coral. The majority of living bryozoans are encrusting (they grow in flat sheets that spread out over the substrate) but others grow upwards into the water column.

calcareous ooze

Very fine (micritic) calcareous skeletal sediments, typically dominated by nanoplankton and deposited in a deep sea environment.

canyons

A relatively narrow, deep depression with steep sides, the bottom of which generally has a continuous slope, developed characteristically on some continental slopes.

carbonate organisms

Life-forms that incorporate calcium and carbon from sea water into their skeletons or shells. They include a range of organisms such as algae, corals and bivalves, and can be microscopic.

carbonate reefs/platforms/atolls/banks

Reefs, platforms, atolls or banks whose structure primarily consists of calcium carbonate.

cay

A small, low island or bank composed of sand and coral fragments.

cetaceans

Members of the mammalian group Cetacea, including whales, dolphins and porpoises.

cold core eddy

Clockwise rotating movements of water formed on the side of a main current that causes deeper layers of cold water to dome upwards towards the centre bringing nutrient rich cold waters to the surface water layers and increasing biological productivity.

Commonwealth waters

The Commonwealth marine area, which includes 'Commonwealth waters' is defined in the EPBC Act as any part of the sea, including the waters, seabed, and airspace, within Australia's Exclusive Economic Zone (EEZ) and/or over the continental shelf of Australia, excluding State and Territory coastal waters. Generally, the Commonwealth marine area stretches from three nautical miles from the territorial sea baseline to the outer limit of the EEZ, 200 nautical miles from the baseline. It may extend further where the edge of the continental shelf extends beyond the outer limits of the EEZ. The territorial sea baseline is normally the low water mark along the coast.

conservation dependent (see also: threatened species)

The definition of a conservation dependant species in the EPBC Act (Section 179) is:

'A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:

- (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or
- (b) the following subparagraphs are satisfied:
 - (i) the species is a species of fish;
 - (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;
 - (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;
 - (iv) cessation of the plan of management would adversely affect the conservation status of the species.'

continental crust

The type of crust underlying the continents, including the continental shelves. The continental crust is commonly about 35 to 70 km thick.

continental rise

The gently sloping surface located at the base of a continental slope.

continental slope

The region of the outer edge of a continent between the relatively shallow continental shelf and the deep ocean.

continental shelf

The section of the seabed from the shore to the edge of the continental slope.

convergence front

An interface or zone of transition between two dissimilar water masses.

copepod

Any small, aquatic crustacean belonging to the subclass Copepoda, characterized by compound eyes and the lack of a carapace, usually having six pairs of limbs on the thorax. Can be found in marine or freshwater environments.

coral

Small, colonial, bottom-dwelling, marine animals that secrete external skeletons of calcium carbonate (calcite).

Cretaceous

Of or belonging to the geologic time, system of rocks, and sedimentary deposits of the third and last period of the Mesozoic Era, characterized by the development of flowering plants and ending with the sudden extinction of the dinosaurs and many other forms of life.

critically endangered (see also: threatened species)

The definition of a critically endangered species in the EPBC Act (Section 179) is:

‘A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.’

crustacea/crustaceans

A class of arthropods that have gills and bodies covered by a hard shell (e.g. crabs, lobsters, shrimps).

cyanobacteria

A large and varied group of bacteria which possess chlorophyll a and which carry out photosynthesis in the presence of light and air, producing oxygen. They were formerly regarded as algae and were called “blue-green” algae.

cyclone

An area of low pressure where winds blow counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

decapods

An order of Crustacea comprising lobsters, crabs and shrimps that have five pairs of legs.

demersal

Living on or near the bottom of the sea.

deposit feeders

Animals such as worms, molluscs, echinoderms and crabs that feed on the particles of organic material in sediments, usually in the top layer which generally has higher levels of organic matter.

detritivores

Animals that eat detritus.

detritus

Any loose, unconsolidated debris such as finely divided rock or the finely divided remains of animal, plant or bacterial tissue.

diatom

Microscopic alga with cell walls made of silicon. Diatoms usually have two separated asymmetrical sides.

dinoflagellate

A single-celled organism found in fresh and marine waters, which combines characteristics of both plants (e.g. photosynthesis) and animals (e.g. uses external organic sources of nutrition).

doldrums

Region near the equator characterized by low pressure and light shifting winds.

downwelling

A downward current of surface water in the ocean.

East Australian Current

A current that originates in the Coral Sea and flows southward along the east coast of Australia.

echinoderms/echinoids

Exclusively marine animals distinguished from all others by an internal skeleton composed of calcite plates, and a water-vascular system to serve the needs of locomotion, respiration, nutrition, or perception. Includes starfishes, sea cucumbers, sand dollars, brittle-stars, basket stars, sea lilies, feather stars and sea

urchins. Echinoids are a group (class) of echinoderms including sea urchins, heart urchins and sand dollars. They are spiny and globular to disc-like in shape.

ecological community

The definition of an ecological community in the EPBC Act is an assemblage of native species that:

- (a) inhabits a particular area in nature; and
- (b) meets the additional criteria specified in the regulations (if any) made for the purposes of this definition.

More broadly, an ecological community is a grouping of species that commonly occur together in a way that is recognisably different from other groupings.

ecologically sustainable development

The principles of ecologically sustainable development are defined in the EPBC Act as:

- (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;
- (b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- (c) the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generation;
- (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision;
- (e) improved valuation, pricing and incentive mechanisms should be promoted.

ecosystem

A dynamic complex of plant, animal and micro-organism communities and their non-living environment that interacts as a functional unit.

ecosystem approach

An approach to managing human impacts on the environment that attempts to take into account the complex relationships between organisms and physical processes in a particular ecosystem.

ecosystem services

The role played by organisms and environmental processes in creating a healthy environment for human beings, from production of oxygen to soil formation and maintenance of water quality.

eddies

Circular movements of water formed on the side of a main current.

elasmobranch

A cartilaginous fish of the subclass Elasmobranchii, which includes skates, rays and sharks.

El Niño Southern Oscillation (see also: La Niña)

The El Niño phenomenon is an abnormal warming of surface ocean waters in the eastern tropical Pacific and is one part of the Southern Oscillation, a Pacific Ocean circulation pattern. The Southern Oscillation is the pattern of reversing surface air pressure between the eastern and western tropical Pacific: when the surface pressure is high in the eastern tropical Pacific it is low in the western tropical Pacific and vice versa. El Niño is often associated with drier than normal conditions in northern and eastern Australia.

endangered species (see also: threatened species)

The definition of an endangered species in the EPBC Act (Section 179) is:

A native species is eligible to be included in the endangered category at a particular time if, at that time:

- (a) it is not critically endangered; and
- (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

endemic

Native to a particular area and found nowhere else.

Eocene

Of or belonging to the geologic time, rock series, or sedimentary deposits of the second epoch of the Tertiary Period, characterized by warm climates and the rise of most modern mammalian families.

epibenthic

Living on the top surface of the sea floor. Epibenthic organisms may be freely moving (motile) or permanently attached to a surface (sessile).

epifauna

Animals living attached to rocky reefs or on the seafloor. They include hydroids, sea-pens, small bryozoans and sponges (compare to infauna).

euphotic

The euphotic zone is the depth of the water in a lake or an ocean that is exposed to sufficient sunlight for photosynthesis to occur. It extends from the surface down to a depth where light intensity falls to one per cent of that at the surface (also called euphotic depth).

eutrophic

Refers to any environment with high levels of nutrients, usually compounds containing nitrogen or phosphorus. This may lead to an increase in the ecosystem's primary productivity (compare to oligotrophic).

exclusive economic zone

The sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from the shoreline.

fauna

The entire group of animals found in an area.

filter feeder

Animals that feed by straining suspended particles from water (also known as suspension feeders). Animals that use this method of feeding include corals, krill, sponges and whale sharks.

finning

Removal of the fins from shark species. Shark fins are regarded as a delicacy in Chinese cooking. Because shark meat is worth very little, finless and often still-living sharks may be thrown back into the sea to make room on board ship for more of the valuable fins. If returned to the ocean, finless sharks are unable to move and die from suffocation or are eaten by other animals.

flora

The entire group of plants found in an area.

foraminifer

Members of the order Foraminifera, a large group of mainly marine single-celled organisms with calcareous shells perforated by small holes.

genus

The scientific grouping of plants and animals immediately above the species level; when combined with the species name this provides a unique identifier for a plant or animal in scientific nomenclature (plural: genera).

geomorphology

The study of landforms and the processes that shape them.

guano

Accumulation of bird (or bat) faeces and the soil it interacts with.

Gulf of Papua

A large 400 km wide delta extending out from the south shore of Papua New Guinea that receives the outflows of the Fly, Turama, Kikori, and Purari Rivers.

gyre

A gyre is any manner of swirling vortex. It is used to describe both wind and ocean currents.

habitat

The area or region where a particular type of plant or animal lives and grows.

hermatypic

Reef building corals with zooxanthellae.

Hiri Current

A current that originates in the Coral Sea and flows northward along the east coast of Australia into the Gulf of Papua.

hydroids

Small invertebrates whose colonies can take many growth forms including flower-like, tree-like or feathery. Hydroids are best represented in cool temperate southern Australian seas.

hydrography

The science of the measurement, description and mapping of the surface waters of the earth, especially in relation to navigation.

hydrology

The study of the movement, distribution, and quality of water throughout the earth.

hypersaline

Water with excessive or supersaturated salt content, well in excess of that of sea water.

infauna

Animals that inhabit the sandy or muddy surface layers of the ocean bottom, i.e. those that live buried or dig into the substrate (compare to epifauna).

invertebrates

An animal without a backbone (e.g. insects, worms, snails, mussels, prawns and cuttlefish).

isobath

A mapping line connecting points of equal depth below the sea's surface.

isotherm

A line on a map joining areas of equal temperature.

karst

An area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns.

krill

Shrimp-like marine invertebrate animals, dense swarms of which occur in ocean waters. They feed mainly on phytoplankton and themselves comprise the main food of filter-feeding whales. Krill are up to 5 cm in length and are found in both surface and bottom waters.

lagoon

A shallow body of water, especially one separated from a sea by sandbars or coral reefs.

La Niña (see also: El Niño)

The La Niña phenomenon is an abnormal warming of surface ocean waters in the western tropical Pacific, north of New Guinea, accompanied by cooling in the tropical eastern Pacific Ocean, and is one part of the Southern Oscillation, a Pacific Ocean circulation pattern. La Niña is often associated with above average rainfall in eastern Australia.

living fossil

Any living species which very closely resembles fossil relatives in most anatomical details.

macroalgae

The algae are a major group of plants without a vascular or vein system, which live in fresh or marine waters. Macroalgae are the large, visible algae, such as kelps, as opposed to microalgae, the microscopic algae that form phytoplankton.

macroplankton

The component of plankton that consists of large organisms (plant or animal) 2–20 cm in size.

macrophytes

Large water plants such as seagrasses and kelps.

marginal plateau

A relatively flat shelf adjacent to a continent and similar topographically to, but deeper than, a continental shelf.

marine conservation values

Marine conservation values are defined for the purpose of marine bioregional planning, as including:

- (a) Protected species and communities, including: (i) species and communities listed as threatened under the EPBC Act; (ii) species listed as migratory under the EPBC Act; (iii) species listed as cetaceans (including all whales, dolphins and porpoises) under the EPBC Act; and (iv) species listed as marine species under the EPBC Act;
- (b) Key ecological features of the marine environment, including: (i) species and communities considered to play an important ecological role in the Region; and (ii) habitats or areas considered to be ecologically important at a regional scale; and
- (c) Protected places, including: (i) heritage places (including World Heritage, National Heritage and Commonwealth Heritage); (ii) historic shipwrecks; (iii) Commonwealth marine reserves; and (iv) listed critical habitats.

marine protected area

Any area of intertidal or subtidal terrain, together with its overlying water and associated plants, animals, historical or cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.

marine reserve

A marine protected area that is highly protected and is effective as a complete sanctuary; no extractive uses are permitted, and very few (or no) other human uses (including scientific research) are permitted.

marine snow

In the deep ocean, a continuous shower of mostly organic detritus falling from the upper layers of the water column. The composition of marine snow includes dead or dying animals and plants (plankton), protists, fecal matter, sand, soot and other inorganic dust. The

'snowflakes' (which are more like clumps or strings) are aggregates of smaller particles held together by a sugary mucus exuded as waste products by bacteria and phytoplankton. These aggregates grow over time and may reach several centimetres in diameter, travelling for weeks before reaching the ocean floor.

marine species (listed)

A marine species included in the list referred to in Section 248 of the EPBC Act.

The list contains the following:

- (a) all species in the family Hydrophiidae (seasnakes);
- (b) all species in the family Laticaudidae (seasnakes);
- (c) all species in the family Otariidae (eared seals);
- (d) all species in the family Phocidae (true seals);
- (e) all species in the genus *Crocodylus* (crocodiles);
- (f) all species in the genus *Dugong* (dugongs);
- (g) all species in the family Cheloniidae (marine turtles);
- (h) the species *Dermochelys coriacea* (leatherback turtles);
- (i) all species in the family Syngnathidae (seahorses, sea-dragons and pipefish);
- (j) all species in the family Solenostomidae (ghost pipefish);
- (k) all species in the class Aves (birds) that occur naturally in Commonwealth marine areas.

megabenthic/megabenthos

Large invertebrates living upon or in the bottom of the sea, such as clams, sea stars, sea cucumbers, crabs and lobsters.

mesopelagic

A pelagic zone extending from 200 m down to around 1000 m below sea level (also known as the middle pelagic or twilight zone). Although some light penetrates this deep, it is insufficient for photosynthesis.

meso-scale

Of intermediate size (e.g. hundreds of kilometres).

mesotidal

Tidal ranges can be defined as the difference between mean high and mean low spring tides. Where the mean spring tide range is between 2 and 4 m it is termed mesotidal.

Mesozoic

An era of geologic time between 245 and 66 million years ago that was the major period of dinosaur dominance.

microalgae

Microscopic algae and diatoms which form the base of the ocean food chain; sometimes called microphytes.

micro-organism

A microscopic organism (animal or vegetable).

migratory species (listed)

A migratory species included in the list referred to in Section 209 of the EPBC Act. Under the Act, migratory species has the meaning given by Article 1 of the Bonn Convention: 'the entire population, or any geographically separate part of the population, of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.'

mollusc

Soft-bodied animals, including a variety of marine, fresh water and terrestrial snails; clams, oysters, mussels, scallops, squids, octopus, and nautilus.

monsoonal winds

The moist, north-westerly winds from the Indian Ocean and southern Asian ocean waters. Monsoonal winds are a seasonal reversal of the trade winds, which blow from a south-easterly direction.

morph

Local variety of a species, distinguishable from other populations of the species by morphology or behaviour.

neritic

Of or pertaining to the shallow waters near land.

nutricline

transition between low nutrient surface water layers and high nutrient deeper water layers.

oceanography

The study of the physical aspects of the ocean, the movements of the sea, and the variability of these factors in relationship to the atmosphere and the ocean bottom.

oligotrophic

Refers to any environment that offers little to sustain life. This term is usually used to describe bodies of water or soils with very low nutrient levels (compare to eutrophic).

paleo-

Relating to the geological past.

pelagic

Associated with the surface or middle depths of the water column, e.g. fish swimming freely in the open sea.

phytobenthos

Microscopic plants that live in the surface layers of the seabed, particularly in shallow water and intertidal areas.

phytoplankton

Small plants, mostly microscopic, which are suspended in water and free-drifting; usually found near the water surface where there is sufficient light to support photosynthesis.

pinnacle

High tower or spire-shaped pillar of rock or coral that may extend above the surface of the water.

planktivores

Organisms that eat plankton.

plankton

Any small or microscopic drifting organism (plant or animal) that inhabits the water column of oceans, seas, and fresh water.

Pleistocene

A geologic period, usually thought of as the Ice Age, which began about 1.6 million years ago and ended with the melting of the large continental glaciers creating the modern climatic pattern about 11,500 years ago.

Pliocene

Epoch of geologic time 5.2 - 1.64 million years ago.

polychaetes

Members of the class Polychaetae, a group of mainly marine annelid worms, also known as bristle worms. There are more than 10,000 known species in this class.

propagule

A dispersive structure, such as a seed, fruit, eggs or sperm, released from a parent organism for reproductive purposes.

proponent

In the context of the EPBC Act, this refers to the person who is proposing an action (as designated under Division 2 of Part 7 of the Act).

province

A large-scale biogeographic unit derived from evolutionary processes in which suites of endemic species co-exist.

prospective

Referring to the expectation of finding something, e.g. commercial mineral deposits.

quaternary

Of or belonging to the geologic time, system of rocks, or sedimentary deposits of the second period of the Cenozoic Era, from the end of the Tertiary Period through the present, characterized by the appearance and development of humans and including the Pleistocene and Holocene epochs.

Ramsar-listed wetlands

The Convention on Wetlands of International Importance, known as the Ramsar Convention, was signed in 1971 in Ramsar, Iran, and is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

recruitment

The influx of new members into a population by reproduction or immigration.

reef

A rock mass (often coral) which lies at or near the water surface.

refugia

Locations of isolated or relict populations of once widespread animal or plant species (singular: refugium).

relict

- i) An organism or species surviving as a remnant of an otherwise extinct flora or fauna in an environment much changed from that in which it originated;
- ii) a geological feature that is a remnant of a pre-existing formation after other parts have disappeared.

saddle

A dip in a ridge or between adjoining seamounts that resembles the shape in a riding saddle.

salinity

The degree of salt in water.

seamount/guyot

An underwater mountain rising from the ocean floor and having a peaked or flat-topped summit below the surface of the sea.

sedimentology

The study of sediments and the processes that deposit them.

sea cucumber (see also trepang)

An echinoderm of the class Holothuroidea with an elongated body and leathery skin. Sea cucumbers are edible and have been harvested and traded in northern Australia and South-east Asia for hundreds of years. When processed for eating, the sea cucumber is known as *bêche-de-mer* or trepang.

seismic

Relating to earthquakes or other vibrations of the Earth and its crust. Also relates to geological surveying methods that involve vibrations produced artificially by explosions. A seismic source generates controlled seismic energy that is used in seismic surveys. A seismic source can be simple, such as dynamite, or it can use more sophisticated technology, such as a specialized air gun. The source provides a pulse of energy that generates seismic waves, which travel through a medium such as water or layers of rocks. Some of the waves then reflect and refract to receivers, such as geophones or hydrophones.

semidiurnal

Half daily.

sessile

Sessile animals are fixed and immobile. They are usually permanently attached to a solid substrate of some kind, such as a rock or the hull of a ship in the case of barnacles. Other sessile animals such as corals lay down their own substrate. Sessile animals typically have a free-moving (motile) phase in their development.

shelf break

The area of the seabed where the continental shelf meets the steeper slope, commonly around depths of 200 m.

socio-economic

Of or relating to both social and economic considerations.

South Equatorial Current

An equatorial current that flows west across the Pacific just south of the equator, carrying low salinity water.

spawning

A reproductive strategy where eggs and sperm are released into water.

speciation

The evolutionary differentiation of a pre-existing species into one or more distinct species.

sponge

Primitive multicellular marine animal whose porous body is supported by a fibrous skeletal framework; usually occurs in sessile colonies.

State/Territory waters

State or Territory waters are a belt of water that extends from the territorial sea baseline for three nautical miles seawards, and are under the jurisdiction of the adjacent Australian State or Territory. The normal territorial sea baseline is the low water mark measured along the coast.

stock

A group of individuals of a species, usually occupying a particular spatial range. Stocks are used as a unit for managing and assessing fisheries.

Sub-Antarctic water

Antarctic intermediate and bottom layers of water that move north from the Antarctic region.

substrate

A surface on which organisms live.

subtropical

Relating to or occurring in a region intermediate between tropical and temperate.

subtropical convergence

Interface between the cooler waters of the Tasman Sea and colder sub-Antarctic waters and runs south-eastward across the Tasman Sea around the 45° S latitude.

supratidal

Pertaining to the shore area above the high-tide level.

syngnathid

A family of fish which includes the seahorses, the pipefishes, and the weedy and leafy sea dragons.

Tasman Front

Interface between the warm waters of the Coral Sea and the cooler Tasman Sea waters and runs south-eastward across the Tasman Sea. The front moves north-south seasonally between 30° and 34° S.

taxon

Any unit used in the science of biological classification (taxonomy). The most commonly used units are genus and species (plural: taxa).

tectonic

Corresponding with the broad architecture of the outer part of the earth.

teleost

A large and extremely diverse group of ray-finned fish in the infraclass Teleostei, one of the three major subdivisions of the class Actinopterygii, the most advanced of the bony fish.

temperate

The regions in which the climate undergoes seasonal changes in temperature and moisture. Temperate regions of the earth lie primarily between 30° and 60° latitude in both hemispheres.

terraces

A relatively level bench or step-like surface breaking the continuity of a slope.

terrigenous

Sediments derived from the erosion of rocks on land, consisting of sand, mud and silt carried out to sea by rivers. Deposition of these sediments is largely limited to the continental shelf.

trade winds

Surface air from the sub-tropic latitudes (30° to 35° S) that moves back toward the equator and is deflected by the Coriolis Force, causing the winds to blow from the north-east in the northern hemisphere and from the south-east in the southern hemisphere.

threatened species

Threatened species are listed under the EPBC Act (Section 178) in six categories:

- (a) extinct;
- (b) extinct in the wild;
- (c) critically endangered;
- (d) endangered;
- (e) vulnerable; and
- (f) conservation dependent.

The definitions for these categories of listing are detailed in Section 179 of the EPBC Act.

trench

A very deep and narrow depression in the sea floor of non-uniform dimensions and with steep sides.

trepang (see also sea cucumber)

The Indonesian word for sea cucumber or holothurian. Trepangers were originally Moluccan fishermen who visited the north coast of Australia to collect and process sea cucumbers for eating.

trophic level

The position an organism occupies in a food chain; levels include primary producers, herbivores, primary, secondary and tertiary carnivores, and decomposers.

tropical

The area between 23.5° N and S of the equator. This region has small daily and seasonal changes in temperature, but great seasonal changes in precipitation.

trough

A long depression in the sea floor that is flat bottomed with steep sides.

turbidity

The cloudiness in water that is caused by particles, usually of fine sediment or microscopic particles of biological material.

upwelling

The phenomenon of deep ocean water rising to the surface, usually bringing nutrients that can increase biological productivity.

vulnerable species (see also: threatened species)

The definition of a vulnerable species in the EPBC Act (Section 179) is:

A native species is eligible to be included in the vulnerable category at a particular time if, at that time:

- (a) it is not critically endangered or endangered; and
- (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

warm core eddy

Anti-clockwise rotating movements of water formed on the side of a main current that cause warm surface water layers to dome downwards towards the centre pushing cold water layers deeper below surface water layers.

zooplankton

Animal component of the plankton community.

zooxanthellae

Microscopic algae that live symbiotically within the cells of some marine invertebrates, especially coral.

