Approved Conservation Advice for *Epinephelus daemelii* (black cod)

(s266B of the *Environment Protection and Biodiversity Conservation Act 1999*)

This Conservation Advice has been developed based on the best available information at the time this Conservation Advice was approved; this includes existing plans, records or management prescriptions for this species.

Description

Epinephelus daemelii (black cod), Family Serranidae, also known as black rock-cod, is a large marine groper or 'cod' species with colouration that varies from a dark grey-black colour to a more usual blotched or banded black and white pattern (Kuiter, 1993). Black cod have been reliably recorded up 200 cm in length and at least 68 kg in weight, although the majority of larger individuals sighted in recent years are 40–80 cm in length (Pogonoski et al., 2002; Harasti et al., 2004; NSW MPA 2009; Malcolm and Harasti, 2010).

Conservation Status

Black cod are listed as vulnerable. The species is eligible for listing as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as:

- on the basis of historical evidence, it underwent an inferred substantial reduction in numbers during the 1960s and 1970s due to heavy spearfishing pressure. This decline has occurred within the relevant assessment timeframe of 100 years, with generation length estimated at 39.5 years (Allsop and West, 2003; Pears et al., 2006; Francis, unpubl. data, 2011). Recent surveys indicate the species now has a patchy distribution and is rare or absent from much of its former range along the New South Wales (NSW) coastline, and has made little discernible recovery.
- The black cod's geographic distribution along inshore areas of the NSW coastline is precarious for the species' survival, and the species' estimated extent of occurrence of 14,900 km^2 is limited (TSSC, 2011).

Recreational or commercial fishing and/or take of black cod is prohibited both in Commonwealth waters and in NSW waters. Black cod are protected and listed as vulnerable in NSW under the NSW *Fisheries Management Act 1994*. Black cod are also listed as near-threatened on the IUCN Red List (Shuk Man and Ng Wai, 2006).

Distribution and Habitat

In Australia, the distribution of black cod ranges from southern Queensland through NSW to northern Victoria. However, records from Queensland and Victoria are rare, and the single specimen recorded from South Australian waters is considered a vagrant. The NSW coastline forms the species' main range, both in Australia and internationally. Black cod are known to occur to some degree in all six NSW Marine Parks – Lord Howe, Cape Byron, Solitary Island, Port Stephens, Jervis Bay and Batemans Bay.

In Commonwealth waters, small populations of black cod are found off both Lord Howe and Norfolk Islands. A relatively abundant population of black cod is found within the Elizabeth and Middleton Reefs Marine National Nature Reserve in the northern Tasman Sea, approximately 600 km due east of the NSW/Queensland border. Preliminary research based on small sample sizes suggests these populations may be genetically connected to one another and to the NSW coastline populations, presumably through the very small larvae drifting in ocean currents (Appleyard and Ward, 2007; van Herwerden et al., 2009).

The black cod's entire range includes warm temperate and subtropical waters of the south-western Pacific, including south-eastern Australia and the North Island, Kermadec Islands and Poor Knights Islands of New Zealand. No breeding or recruitment appears to occur in New Zealand waters, and individuals occurring there are considered to be vagrants (Pogonoski et al., 2002).

Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs. Black cod are an aggressive, territorial species and individuals may occupy one particular cave for most of their adult life. Recently settled juvenile black cod (i.e. individuals that have recently completed the pelagic, drifting larval stage) are often found in coastal rock pools while slightly older juvenile black cod are often found in estuary systems (Hutchins and Swainston, 1986; Pogonoski et al., 2002; Harasti et al., 2004). The use of estuaries may be an important part of the ecology of juvenile black cod, at least in NSW waters. Larger juvenile black cod appear to move into adult habitats, but hide in rock structures and remain highly cryptic until at least 40 cm in length (Malcolm and Harasti, 2010). There is a general progression to deeper waters as black cod increase in size.

The distribution of this species is not known to overlap with any EPBC Act-listed threatened ecological community. However, black cod frequently utilise the same near-shore rocky reef habitats as the eastern Australian population of grey nurse shark (*Carcharias taurus*), which is listed as critically endangered under the EPBC Act.

Threats

Historical Threats

Overfishing by commercial and recreational line fishers caused the first localised declines of the black cod in the early 1900s (Roughley, 1916; McCulloch, 1922). The rise in popularity of recreational spearfishing subsequently caused substantial declines in black cod in the 1960s and 1970s (Du Cros, 1960; Andrewartha and Kemp, 1968; Lincoln-Smith et al., 1989; Pogonoski et al., 2002; AUF, 2011; FathomOz, 2011) . Fishing for or take of the species became illegal in 1983 in all NSW waters under NSW Fisheries legislation (Pogonoski et al., 2002; Harasti et al., 2004; NSW I&I, 2009).

It is likely that the species' decline has largely halted in NSW since the prohibition of targeted fishing for the species in 1983. However, the removal of large male fish (100 cm+), which were preferentially targeted by spearfishers, may have skewed the sex ratios of remnant populations to some degree (e.g. Coleman et al., 1996) and thus impaired breeding. The species remains absent from many of the locations along the NSW coastline where it was once abundant (Pogonoski et al., 2002; Harasti et al., 2004; NSW I&I, 2009; NSW MPA, 2009; Cardno Ecology Lab, 2010, cited in Malcolm and Harasti, 2010; Malcolm and Harasti, 2010).

Current Threats

Current identified threats to the black cod are incidental by-catch by recreational and commercial fishers and illegal fishing activities.

By-catch of black cod by recreational (line) fishers is known to occur. There are concerns that not all black cod that are accidentally captured are recognised and released. New fishing technologies in the form of very thin, strong gelspun polyethylene lines, soft plastic lures and Global Positioning Systems (GPS) have also increased the effectiveness of recreational fishing, particularly in deeper waters, and may increase the risk of recreational by-catch of the species.

By-catch of black cod by commercial fishers is also known to occur. Commercial fishing by-catch is thought to be limited, however the NSW Ocean Trap and Line Fishery has been assessed as posing a moderately-high risk to the species (NSW I&I, 2009). Commercial fishers are not allowed to retain black cod in either state or Commonwealth waters.
There is evidence that black cod caught in deeper water (50–100 m) by commercial or recreational fishers do not survive after being released at the surface, as they suffer severely from 'barotrauma' or swim-bladder decompression. The swim-bladder regulates buoyancy and this organ is damaged by the rapid pressure change caused by the fast ascent to the surface following capture (Pogonoski et al., 2002; NSW I&I, 2009).

Instances of illegal take of black cod by recreational spear and line fishers along the NSW coastline are occasionally reported.

Modification of estuarine habitats is considered a potential threat to juvenile black cod.

Research Priorities

Research priorities that would inform future regional and local priority actions include:

- Research into the reproductive biology of black cod.
- Research into the ecology and movements of larval and juvenile black cod.
- Coordinated regular assessments of numbers and trends in black cod populations along the NSW coastline, including surveys for juveniles in areas where adult black cod are currently absent.
- Further research into the relative impacts of by-catch of black cod by commercial fishers and recreational line fishers, including release of specimens suffering barotrauma.
- Research into the extent of illegal fishing, particularly spearfishing.
- Collection and analysis of more samples to confirm genetic connectivity between black cod populations along the NSW coastline and Elizabeth and Middleton Reefs.

Regional Priority Actions

Conservation and Recovery

- Monitor known black cod populations to identify key threats.
- Monitor the progress of recovery in black cod numbers, including the effectiveness of management actions and the need to adapt them if necessary.
- Increase enforcement of fishing regulations.
- Increase monitoring of Marine Protected Areas where black cod occur.
- Consider a complete closure to fishing in the Elizabeth and Middleton Reefs Marine National Nature Reserve to protect the high conservation value black cod populations that occurs there.
- Implement protocols that ensure that illegally caught black cod that are seized by authorities, and are not releasable, are utilised for research into the species' biology, particularly age and sexual maturity.

Conservation Information

- Raise awareness of black cod within the local community and particularly fishing groups.

Local Priority Actions

Conservation and Recovery

- Erect information signs, with colour illustrations of black cod and information on how to release fish, in locations where incidental captures of juvenile or adult black cod regularly occur.

This list does not necessarily encompass all actions that may be of benefit to black cod, but highlights those that are considered to be of highest priority at the time of preparing the Approved Conservation Advice.

Existing Plans/Management Prescriptions that are Relevant to the Species

Black Cod (*Epinephelus daemelii*) Recovery Plan [NSW] (2011). NSW Department of Industry and Investment.

These prescriptions were current at the time of publishing; please refer to the relevant agency's website for any updated versions.

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