Report on a stranding of the dendrochirotid sea cucumber *Cladolabes perspicillum* and other echinoderms by a low-pressure induced storm surge on the New South Wales coast, Australia

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Introduction

Mass mortalities of echinoderms occur when substantial numbers of individuals of a population die due to the stress of abiotic factors such as freshwater flooding and heat waves (Lawrence 1996). Some of the most dramatic mass mortalities are those observed following storm-induced wave surges when echinoderms, along with a plethora or other marine plants and animals, are washed up and deposited above the high tide line. These events can have long-lasting impacts for the community and ecosystem, although this has not been well studied (Lawrence 1996).

Following the end of the 2016 El Niño, an east coast low (ECL) pressure system developed along the eastern fringe of Australia, from central Queensland to Tasmania, in June. ECLs are intense low pressure systems that develop along the coast. Sometimes referred to as extratropical cyclones, ECLs cause extreme rainfall, storm force winds, and prolonged and heavy swells. While these events are short-lived (several days), they can have severe consequences for coastal regions. The 2016 ECL (5–6 June) coincided with a king tide, resulting in record-breaking waves (max. 17.7 m) pounding parts of the New South Wales (NSW) coast.

The 2016 ECL removed extensive kelp beds and seagrass habitat, and scoured subtidal rocky reefs, resulting in the deposition of vast amounts of marine plants and animals 2–3 m in height along portions of the coast (Fig. 1a). Mixed among the debris, high on the shore at Silver Beach and Quilbray Bay in Kurnell, Botany Bay near Sydney, were many individuals of the dendrochirotid sea cucumber *Cladolabes* (*Urodemas*) *perspicillum* (Selenka, 1867) and other echinoderms (Fig. 1b, c). Around 70 *C. perspicillum* were washed up over a 40-m stretch of beach. While this is not a mass stranding, we have no data on the population density of this species, so it is not possible to judge what proportion of the population this represents. Over 20 years of observing similar storm event depositions at Kurnell, this was the first observation of this sea cucumber in the jetsam (Miskelly pers. Obs.). This contrasts with the common mass stranding of sea urchins associated with these events (Fig. 1d). Following this particular ECL event, 16 species of sea urchins were observed (Table 1) as well as an asteroid (*Astropecten vappa*) and an ophiuroid (*Ophiarachnella ramsayi*).

Cladolabes perspicillum occurs in seagrass habitats and under boulders, and has been dredged from soft sediment areas (Clark 1946; Cannon and Silver 1986). It is a fairly stout species (150–200 mm in length), and is relatively ovoid in shape (Cannon and Silver 1986). Live specimens contract into a round shape (Fig. 1c) and are often found characteristic of Sydney Harbour. There have been other reports of mass standings in New Zealand by storms of dendrochirotid species (e.g. *Caudina coriacea*, *Colochirus ocnoides*) and for tropical aspidochirotid species (e.g. *Holothuria atra*, *Actinopyga echinites*) by typhoon-generated waves (Kerr 1992; Lawrence 1996).

There have been 25 records of *C. perspicillum* in Sydney Harbour from 1887–1981 (Hutchings et al. 2013), and several records from more northern areas in NSW (Rule et al. 2007). There are, however, no details of the biology and ecology of this species. This paucity of information makes it difficult to suggest what the longer-term impact of the stranding of *C. perspicillum* on the local population and ecosystem might be. As characteristic of dendrochirotids, this species is a suspension feeder and its removal is likely to have an impact on local benthic–pelagic coupling. In contrast, many of the sea urchin species that were washed up have been well studied in the context of their role as algal grazers and ecological engineers. For the urchins, the ECL appears to have not only removed a large proportion of the population of many species, but also their kelp bed habitat (Fig. 1a). This is likely to have changed the local habitat and ecosystem, at least in the short term. The lack of before-storm subtidal images and post-storm monitoring limits what can be said for the urchins.

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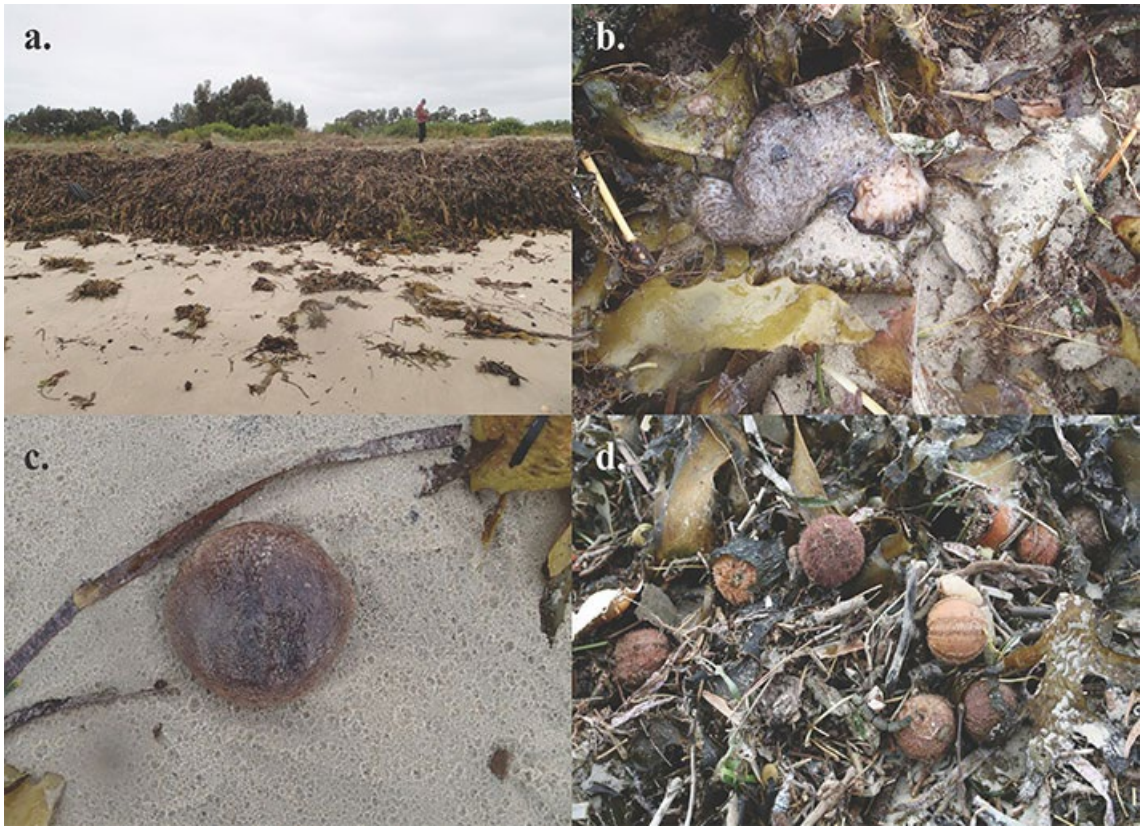

Figure 1. Images of (a) marine debris above the high tide mark at Silver Beach, New South Wales, Australia, and (b and c) *Cladolabes perspicillum*, and (d) echinoids found in the jetsam of the 2016 east coast low pressure system.

Table 1. Species of Echinoidea washed up at Silver Beach, Kurnell, New South Wales during the July 2016 east coast low storm

Family	Species
Brissidae	*Brissus agassizii*
	Rhynobrissus hemiasteroides
Cidaridae	*Phyllacanthus parvispinus*
Diadematidae	*Centrostephanus rodgersii*
Echinometridae	*Heliocidaris erythrogramma*
	Heliocidaris tuberculata
Loveniidae	*Echinocardium cordatum*
	Lovenia elongata
Schizasteridae	*Protenaster australis*
Temnopleuridae	*Holopneustes inflatus*
	Holopneustes purpurascens
	Salmaciella oligopora
	Salmacis sphaeroides
	Temnopleurus alexandri
	Temnoplerus toreumaticus
Toxopneustidae	*Tripneustes gratilla*

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