The Committee Manager
The Senate Environment and Communications References Committee
PO Box 6100, Parliament House, Canberra
ACT 2600

Re: OzFish Unlimited submission to the inquiry into Climate-related marine invasive species

Prepared by
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Dear Committee Secretary Stephen Palethorpe,

OzFish Unlimited welcomes the opportunity to provide a submission to The Senate Environment and Communications References Committee's inquiry into Climate-related marine invasive species. Here, we discuss how anthropogenic climate change is causing marine species invasions poleward, the ecological consequences, and how recreational fishers can contribute to data collection and management.

About OzFish Unlimited

OzFish Unlimited's objective is to assist the millions of Australian recreational fishers to take control of the health of their rivers, lakes, and estuaries, and shore up the future of the sport they love. OzFish Unlimited does this by partnering with fishers and the broader community to invest time, knowledge and money into the protection and restoration of our waterways, counteracting decades of degradation. OzFish Unlimited empowers recreational fishers to improve fish habitat. It's an innovative approach to drive real and lasting change, harnessing the collective power of recreational fishers to undertake fish habitat protection and restoration in Australia's rivers, lakes and estuaries. We make local fishing grounds healthier, vibrant and more productive, share habitat protection and restoration knowledge, and provide events, resources, education and research that supports fishing groups to achieve local outcomes. We have completed over 150 projects nationwide. These projects are starting to restore the more than a century of habitat loss and degradation.

Responses to inquiry Terms of Reference:

The spread of climate-related marine invasive species, particularly long spined sea urchins *(Centrostephanus rodgersii)* along the Great Southern Reef, with particular reference to:

(a) the existing body of research and knowledge on the risks for and damage to marine biodiversity, habitat and fisheries caused by the proliferation and range shifting of non-endemic long spined sea urchins;

Excess heat generated through increasing atmospheric CO_2 is primarily stored in the oceans, accounting for ~93% of global warming (Cheng et al., 2017; Levitus et al., 2012). Therefore, marine organisms' temperature thresholds may be surpassed in areas where they once persisted, yet allow overwintering poleward, where temperatures once dropped below the critical minima (Bates et al., 2014). Hence, poleward range shifts are occurring as ocean temperature increases (Hughes, 2000; Parmesan & Yohe, 2003; Perry et al., 2005). Continued range shifts are likely to result in increased species richness poleward yet decreased richness in the tropics and are modelled to equal up to 55% of the initial species richness in an area by 2040 – 2060 (Cheung et al., 2009). Thus, species will be invading new habitat, which can have ongoing ecosystem impacts (Figueira & Booth, 2010; Yamano et al., 2011). In Australia, these impacts will be most prominent in subtropical and temperate regions.

Due to anthropogenic climate change, the East Australian Current (EAC) is strengthening (Cai et al., 2005; Ridgway, 2007). Over the past 60 years, it has extended 350-km south and has warmed 2.3°C in southern regions (Ridgway, 2007). Therefore, ocean warming is occurring at an accelerated rate, making this area a climate change hotspot (Hobday & Lough, 2011; Ridgway, 2007). Climate change impacts in regions influenced by the EAC include the dieback of kelp forests, overwintering of vagrant species, southern range expansions and tropicalisation of subtropical and temperate ecosystems (Booth et al., 2007; Figueira & Booth, 2010; Malcolm & Scott, 2017; Vergés et al., 2016). Range expansions documented in Eastern Australia include:

- *Seriola dumerili* (greater amberjack);
- *Seriola lalandi*, (yellowtail kingfish);
- *Stichodactyla haddoni* (Haddon's sea anemone);
- *Entacmaea quadricolor* (bulb-tentacle sea anemone);
- *Amphiprion latezonatus* (wide-band anemonefish);
- Damselfishes;
- Phytoplankton;
- Several species of heterobranch sea slugs;
- Numerous intertidal invertebrates; and
- *Centrostephanus rodgersii* (long-spined sea urchin).

C. rodgersii expanded to Tasmania in the 1970s, since then the population of *C. rodgersii* in Tasmania has grown to an estimated 20 million. A survey led by the Institute for Marine and Antarctic Studies (IMAS) in 2016/17 estimated that 15.2% of Tasmania's East Coast reef (4 – 40 m depth) was comprised of urchin barrens. This is up from 3.4% in IMAS' 2001/02 survey. Impacts of this species within Tasmania are well documented and include competing with native species for resources and the prolific creation of kelp and macroalgae barrens resulting of overgrazing (Perkins et al., 2015). Barrens mean less food is available for herbivores, and species which utilise kelp as habitat, influencing fish assemblages (Filbee-Dexter & Scheibling, 2014). Moreover, commercially, and recreationally important species including abalone abundance has decreased as a consequent of barrens (Strain & Johnson, 2005).

(b) management options, challenges and opportunities to better mitigate or adapt to these threats, and governance measures that are inclusive of First Nations communities;

Mitigating ocean warming and the increasing intensity of the east Australian current, which are resulting in climate-related species invasions, will undoubtably be the most effective management pathway. However, with global temperatures modelled to continue rising, other management options are necessary. Heathy ecosystems will be resistant and resilient to invading species, with existing biota having an increased ability to compete with forging species and recover from disturbances. For instance, reducing nutrient and sediment-rich runoff from land-based activities, and promoting sustainable fishing practises will increase overall health, meaning marine species have more energy to partition into competing for resources. Several management options have been explored for *C. rodgersii* invasions, including promoting abundance increases in southern rock lobsters or translocation of natural predators eastern blue groper, increasing fishing pressure on *C. rodgersii*, and physical removal of *C. rodgersii* by divers. Another concept being explored is an urchin-culling autonomous underwater vehicle (AUV). These can operate at depths where diving is difficult, and work by identifying and spiking invasive sea urchins. Early detection is a key step in implementing management actions and halting the formation of barrens.

Fishers are on the water frequently and can be significant stewards of their environment, given the right techniques, advice, and tools they will incorporate caring for the marine environment into their fishing practices. Additionally, they have a thorough understanding of the environments they fish, and changes over time. Thus, recreational fisher knowledge has successfully been used to

identify, track, and model climate-related marine invasive species, including in eastern Australia (Champion *et al.*, 2018; Grason *et al.*, 2018).

OzFish has partnered with the University of Tasmania, IMAS, the Climate Foundation, and TARFish to develop and roll out the Kelp Tracker app. This app allows recreational fishers and community members to 'log' their sightings of endangered and disappearing giant kelp (*Macrocystis pyrifera*). This data help map the remaining giant underwater forests, as well as identifying kelp strains that are more naturally resistant to warming waters. These 'warm-tolerant' strains have the potential to be used for restoration efforts, to give restored kelp the best chance of long-term survival. Through investment in helping fishers understand ocean habitats and species and building online platforms and tools to allow recreational ocean fisher to test, record and share information while fishing at sea, the three million Australian's that recreationally fish each year will have the ability to contribute to data on climate-related marine invasive species.

(c) funding requirements, responsibility, and pathways to better manage and co-ordinate stopping the spread of climate-related marine invasive species;

Long-term funding for citizen science monitoring and physical removal of climate-related marine invasive species that are having negative impacts on ecosystem function will have tangible outcomes for cost-effective management. Such activities should be coordinated by groups with knowledge of such threats and experience in coordinating large-scale volunteer projects. Greater expenses will also need to be invested into creating resistance and resilience for impacted ecosystems.

Moreover, many local communities have strong connections to fishing and diving locations and are often willing to 'take matters into their own hands'. By finding these communities and providing training, tools, education, and resources, management and monitoring can be carried out a low cost. This will create stewardship and lead to ongoing, self-sustaining management.

(d) the importance of tackling the spread of invasive urchin 'barrens' to help facilitate marine ecosystem restoration efforts (such as for Tasmanian Giant Kelp *Macrocystis pyrifera*); and

Over 95% of *Macrocystis pyrifera* (Tasmanian giant kelp) has been lost, with severe consequences, such as potential decrease in *Jasus edwardsii* (southern rock lobster) recruitment (Hinojosa *et al.*,

2015). It is well documented that overgrazing by *R. rodgersii* results in urchin barrens and the loss of *M. pyrifera.* Thus, tackling the spread of invasive urchin barrens is a critical step in restoring Tasmania's iconic giant kelp forests.

(e) any other related matters.

Anthropogenic climate change is causing marine species to expand poleward, with the invasion of subtropical and temperate ecosystems coinciding with a loss of biodiversity in the tropics. Consequently, a global shift in the distribution of species, interactions, and ecosystem functions is occurring. Mitigating climate change is the most effective way to reduce these threats. However, with warming modelled to increase, other options such as mobilising citizen scientists and utilising fisher observations will be a crucial step in managing and collecting data on climate-related marine invasive species.

OzFish Unlimited thanks the committee for considering our submission, and we would welcome the opportunity to present the inquiry with further evidence should it be required.

Yours Sincerely

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OzFish Unlimited

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