



To whom it may concern:

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Response to the Tasmanian Sardine Fishery Policy Paper

**Tasmanian
Independent
Science Council**

The *Tasmanian Sardine Fishery Policy Paper* proposes development of a limited purse-seine fishery for sardine in the offshore waters around Tasmania, primarily in Bass Strait where spawning is concentrated. A Total Allowable Catch (TAC) of 7500 t is proposed, based on a 5% harvest rate of a 150,000 t estimate for the sardine spawning stock, with a commitment not to increase the quota without further research, in particular further sardine surveys.

The Tasmanian sardine stock, which spawns in summer predominantly in Bass Strait, was virtually unstudied prior to a single Daily Egg Production Method (DEPM) survey carried out in December 2023/January 2024 by Ward et al. (2024). This survey should be considered provisional, because only the sardine egg distribution and production were surveyed; adult female fecundity, the other key parameter in the DEPM biomass model, was not surveyed and was assumed equal to the mean fecundity observed in the adjacent South Australia sardine stock. This is a major assumption. Sardines are indeterminate spawners, producing new batches of eggs throughout the spawning season, so fecundity varies in relation to the temperature and feeding conditions through the spawning season, as well as from one region and stock to another and based on the age and size structure of the population. The hydrography and productivity of the South Australia and Tasmanian sardine spawning grounds differ significantly. Fecundity is surveyed routinely as part of the SA DEPM sardine surveys. **It is recommended that measurement of adult female fecundity be included in future Bass Strait sardine DEPM surveys.**

DEPM biomass estimates for sardine are noted for their variability, due to variability in daily egg production, spawning area and adult reproductive parameters, so a management policy based on a single provisional survey must be proposed with caution. Ward et al. (2024) proposed an initial TAC of ~30,000 t, based on a 15% exploitation rate of their provisional estimated spawning biomass of 200,000 t. This was criticized at public meetings as insufficiently precautionary. The TAC (7500 t) proposed in the present policy paper is based on a more conservative biomass estimate (150,000 t) and a more precautionary exploitation rate (5%), significant improvements over the initial proposal. As noted in the *Policy Paper*, this also decreases the fishery's potential ecological impacts, i.e. impacts on the seabirds, mammals, gamefish and other predators that naturally feed on sardines.

Despite the provisional nature of the single DEPM survey Tasmanian sardine stock carried out to date, **the *Policy Paper* states: It is proposed that the TSF could continue fishing at this precautionary initial catch limit without the need for further fishery-independent stock assessments. This is provided there is an annual review of the catch and effort from the TSF. (p 14)**

This is a serious deficiency in the current proposed policy, based on two incorrect assumptions: 1) sardine populations exhibit long-term stability, such that a constant quota is a viable long-term management strategy, and 2) catch and effort data provide reasonable indices of population size for sardine. But sardine (*Sardinops* spp) populations globally are the poster child for extreme population variability, often undergoing orders of magnitude variability in population size under fishing pressure and even in the absence of fishing (see Barange et al. 2009 for a comprehensive review). A constant TAC, particularly for a relatively short-lived species as sardine, is a recipe for disaster. Furthermore, “analyses based on catch per unit effort offer limited value” (Barange et al. 2009, p. 191): sardines are a highly aggregated schooling species, so CPUE poorly reflects changes in population size, i.e. catch rates typically remain high until the stock is severely depleted. In conclusion, **for a short-lived species that typically exhibits highly volatile population dynamics, such as sardine, sustainable management requires regular fishery independent DEPM (or acoustic) surveys.** It should be noted that sardine populations across temperate Australia underwent two disease-related population crashes in the 1990s, and in 2025 a harmful algal bloom forced the closure of parts of the SA sardine fishery, with still unknown impacts on the population. In this era of climate change and its poorly understood impacts on marine ecosystems, sustainable management must be predicated upon regular fishery-independent monitoring.

In reviewing the potential ecosystem impacts of the proposed sardine fishery, **the policy paper concluded: ‘Significant research has been undertaken into the role of sardines as a low trophic level species, i.e. a part of the diet of other species. This research indicates that sustainable commercial fishing for small pelagic species, including Australian sardine, has only minor impacts on other parts of the ecosystem.’** This conclusion is based on a modelling study, which assumed that predators can readily switch to other prey in the absence of sardines (Smith et al. 2015). However, the policy paper fails to reference the studies resulting from the ‘natural experiment’ created by the mass mortality (a decline of ~70% in adult biomass) of sardines across temperate Australia in 1995 and 1998. Significant impacts on growth, mortality and reproductive success were reported for little penguins and crested terns, which depend on sardines (Dann et al. 2000, McLeay et al. 2008). Australasian gannets in Australia appeared to switch to alternative prey but the largest wreck of Australasian gannets ever recorded was observed in New Zealand in 1995 following the die-off of sardines there (Bunce and Norman 2000). If the fish population remains at its current level and the fishery remains at its proposed cautionary level, the ecosystem impacts are likely to remain small but those are critical assumptions, reinforcing the need for ongoing monitoring and research.

The *Policy Paper* is missing a vital opportunity presented by the onset of a significant sardine fishery and a concomitant research program. The DEPM surveys are a major costly undertaking, requiring approximately a month of vessel time to quantitatively sample the plankton throughout the sardine spawning ground, followed by the need to sort the plankton samples for sardine eggs. The current objective of this survey, along with the similar survey undertaken in waters off SA, is essentially to provide a single number: the spawning stock biomass of sardine in those waters. However, the requisite plankton tows provide quantitative samples for ALL species spawning at that time in those waters: jack mackerel, blue mackerel, yellowtail kingfish, snapper, garfish and many reef fish. Quantitative indices of their abundance – and indeed, the abundance of all species with a larval phase off southern Australia in summer – are potentially available from these surveys if their larvae are removed along with the sardine eggs during the sorting process, identified and enumerated. This approach has been followed by the DEPM survey program off California (the California Cooperative Oceanic Fisheries Investigations (CalCOFI)) since 1949 and later adopted by Mexico for its DEPM surveys off Baja California, providing arguably the world's foremost ocean monitoring program. At a time of ocean warming, of periodic harmful algal and jellyfish blooms and shifting species' distributions, and of declining regional fisheries due to inadequate assessment, there is vital need for such monitoring. And it can be achieved at modest incremental cost as part of ongoing DEPM surveys. The cost of the program could be shared by federal and state (Tasmania and South Australia) marine and coastal management agencies and undertaken in conjunction with the CSIRO and universities, the model followed by CalCOFI. Citizen science-based visual surveys have reported major declines of nearshore temperate Australian reef fishes (Edgar et al. 2023) but in the absence of monitoring, we are essentially flying blind with regard to our pelagic and offshore fishes into a future that we know is undergoing rapid change and increasing uncertainty. **We recommend that a multi-institutional ocean monitoring program be included in any future DEPM survey programs.** Such a program would contribute significantly to ecosystem-based management of the sardine fishery and to any future certification of the fishery's sustainability.

In summary, the present *Policy Paper* is more precautionary and represents a significant advance over an earlier proposal for development of the Tasmanian sardine fishery. However, several critical deficiencies should be addressed:

- 1) There is no commitment to addressing the lack of measurement of the Tasmanian sardine stock's fecundity, a key parameter in the DEPM biomass equation.
- 2) There is no commitment to ongoing fishery-independent surveys of the Tasmanian sardine stock in the absence of demand for an increased TAC. There has only been a single provisional survey. Sardine stocks off temperate Australia and globally are notable for their precipitous, order of magnitude changes in biomass. The state of Australian marine ecosystems is poorly understood but appear subject to dramatic change in recent years: the die-off of kelp forests, decline of reef fishes, recurring harmful algal blooms and jellyfish outbreaks, and massive disease and mortality

events in regional aquaculture. Management based on an assumption of long-term stability is almost certainly doomed to fail.

- 3) There is need to incorporate ecosystem monitoring within the DEPM plankton sampling program. Using the highly successful, 75-year CalCOFI program as a model, it should be multi-institutional, funded at the state and federal level and carried out by state and federal institutions, such as IMAS, CSIRO, and state and federal fishery and marine management agencies.

Yours sincerely,



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