**Effects of climate change on thermal suitability of fish in the Irish Sea: Suitability modelling based on volitional temperature preferences.**

## Introduction

Climate change is expected to have significant impacts on fisheries in the Irish and Celtic Seas, including

1. Ocean Warming: Both seas are experiencing increases in water temperatures due to climate change. This warming can disrupt marine ecosystems, alter the distribution of species, and impact fisheries, potentially reducing fish stocks and affecting the livelihoods of coastal communities.
2. Ocean Acidification: Increased carbon dioxide levels in the atmosphere are leading to ocean acidification. This can harm marine life, particularly shellfish which may struggle to build and maintain calcium carbonate structures in more acidic waters.
3. Changes in Marine Ecosystems: The warming waters may lead to shifts in the distribution of marine species. Some cold-water species may move further north, while warm-water species may become more prevalent. This can disrupt local ecosystems and fisheries.
4. Loss of Biodiversity: Rising temperatures and changing ocean conditions can lead to the loss of biodiversity, including the decline of iconic fish species, like seabass, sea trout or Atlantic salmon. These changes can have cascading effects throughout marine food webs.

However, accurate predictions are lacking as the thermal preferences of most species of commercial importance are not well known.

### Aim

The aim of this study was to determine the thermal preferences of three fish species of commercial importance in the Irish Sea, European sea bass, lumpfish and ballan wrasse and to model the likely effects of climate change.

### Methods

We used a Loligo shuttle box system to measure thermal preferences and sea-surface temperature records (EPA SST data collected at depths of 0-13 m at 28 sampling sites around Ireland from 1992 to 2021 to model thermal suitability.

### Results & Conclusions

The empirically derived thermal preferences of the 3 study species in the Irish sea are shown in Figure 1. Lumpfish has the lowest preferred temperature (10.2 C) and seabass the highest one (14.8 C). In terms of current suitability, the results suggest that the surface waters of Irish sea offer currently 86% for seabass but only 13% for lumpfish. With predicted shifts in temperature due to climate change (1.5/decade) suitability is expected to decrease from from **86%** to **37%** for seabass and from **13%** to **7%** for lumpfish. Without mechanisms of adaptation (or migration) this may translate into a 7% reduction in the abundance of sea bass, and a 46% in the abundance of lumpfish.
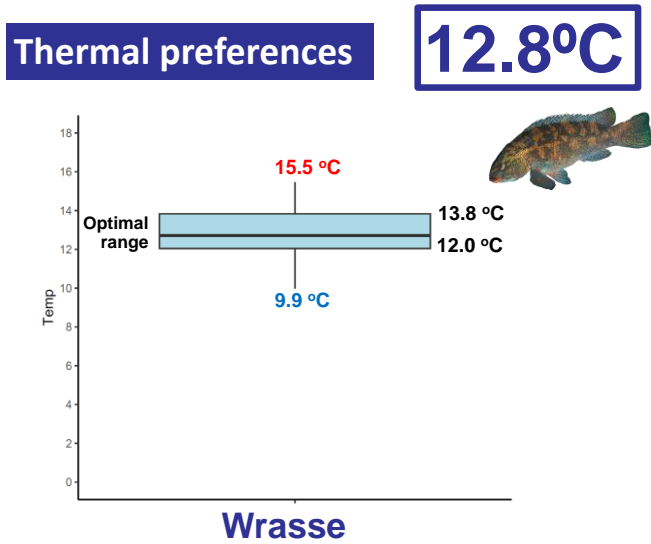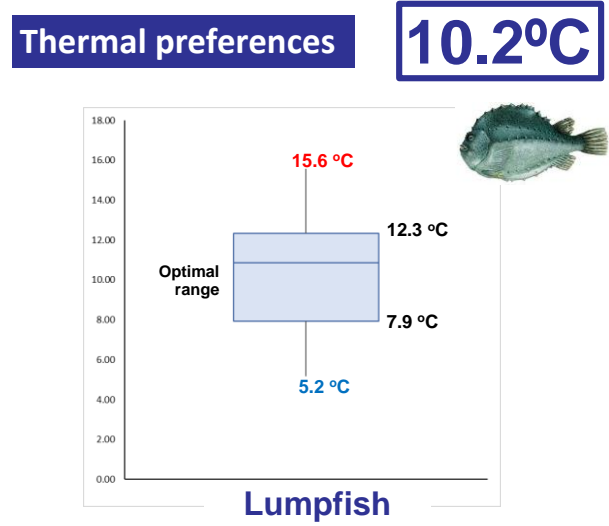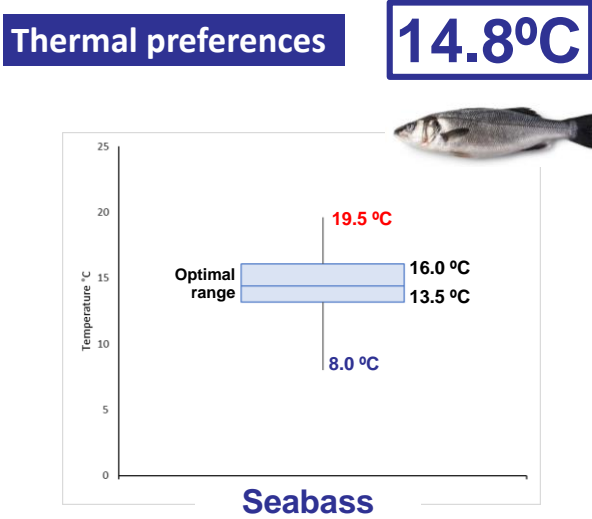
## Thermal preferences — 14.8ºC



**Seabass**

## Thermal preferences — 10.2ºC



**Lumpfish**

## Thermal preferences — 12.8ºC



**Wrasse**

**Figure 1.** Thermal preferences of the study species in the Irish sea

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