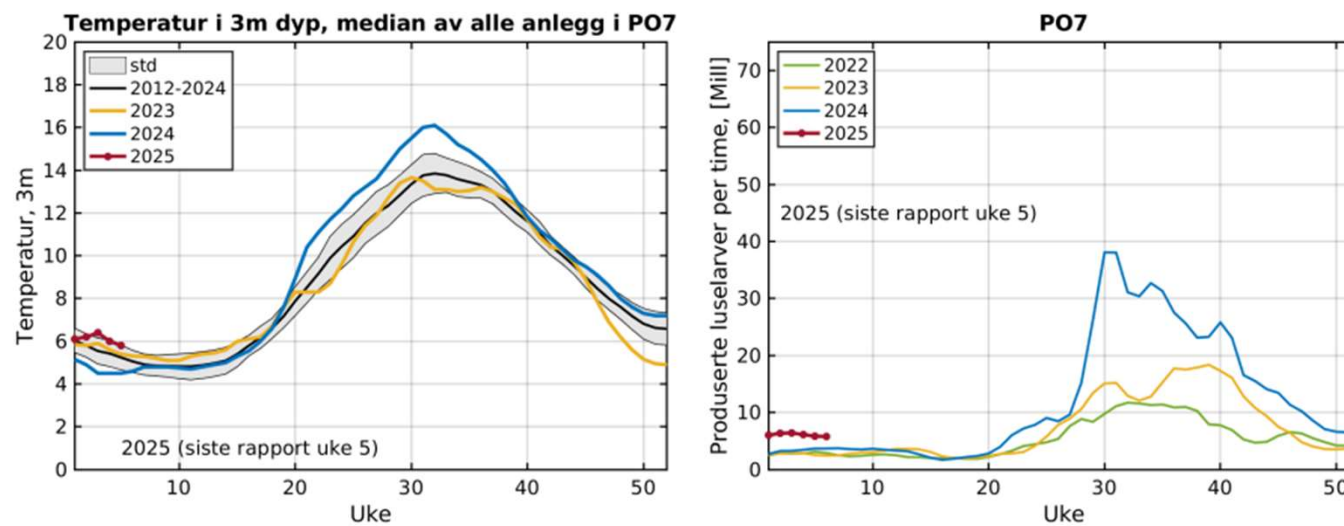


# Hvordan påvirker temperatur smittedynamikk og lusepress?

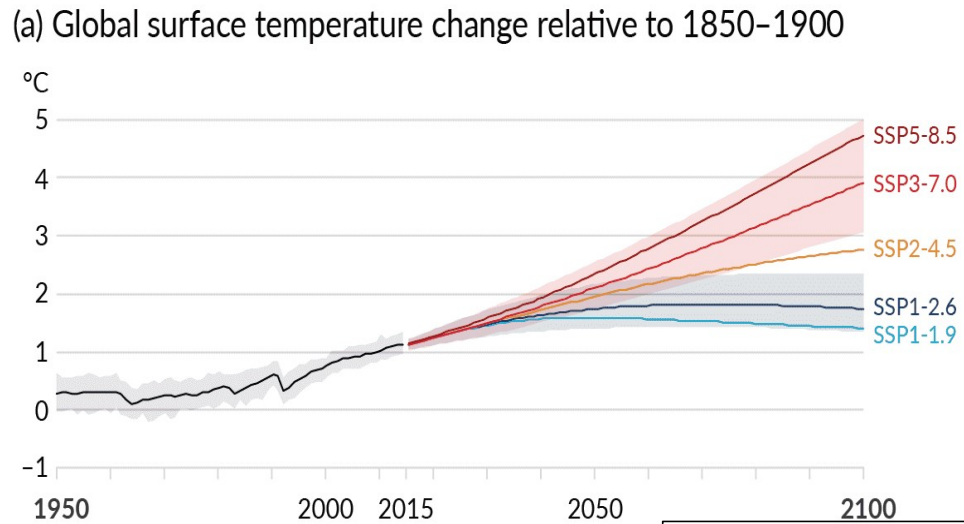
Anne Sandvik, Sussie Dalvin, Ørjan Karlsen, Samantha Bui, ... , Rasmus Skern-Mauritzen

## PO7

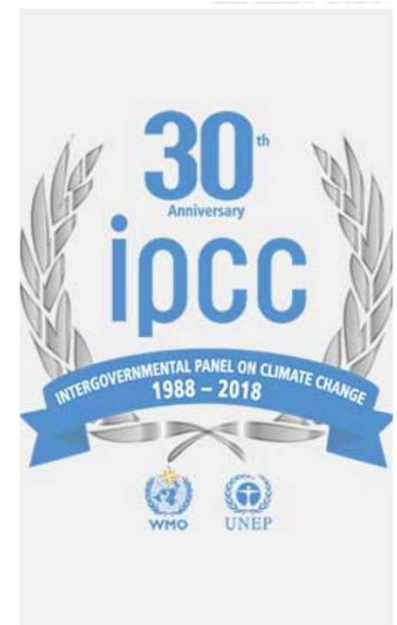
Vurdering frem til uke 6: Vanntemperaturen ligger litt over gjennomsnittet for de siste 13 år.  
Antall produserte luselarver (summert over alle anlegg som rapporterer i PO7) ligger over nivået som var i 2024.



# Det store bakteppet

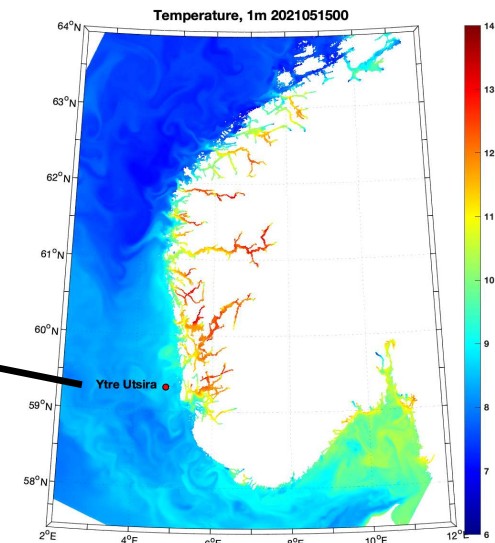
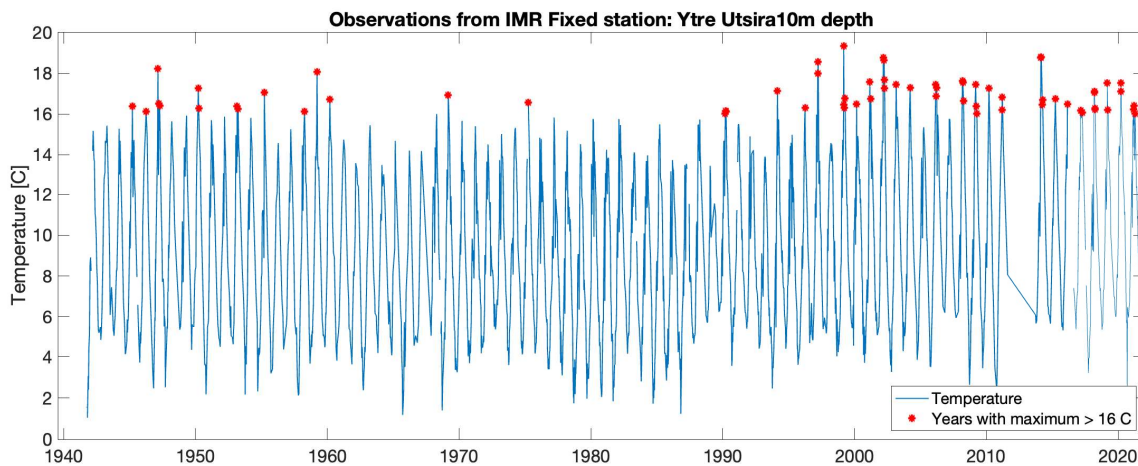


Opphavsrett: IPCC



# Eksempel på at det har blitt varmerer

- observasjoner fra Ytre Utsira 1940 →



❖ Målinger over 16 °C er markert med rød stjerne





Development of the salmon louse  
*Lepeophtheirus salmonis* parasitic stages in  
 temperatures ranging from 3 to 24°C

Lars Are Hamre<sup>1,\*</sup>, Samantha Bui<sup>2</sup>, Frode Oppedal<sup>2</sup>, Rasmus Skern-Mauritzen<sup>3</sup>,  
 Sussie Dalvin<sup>4</sup>

<sup>1</sup>SLRC - Sea Lice Research Centre, Department of Biological Sciences, University of Bergen, Postbox 7803, 5020 Bergen, Norway  
<sup>2</sup>Institute of Marine Research, 5044 Malmøya, Norway  
<sup>3</sup>Institute of Marine Research, 5017 Bergen, Norway  
<sup>4</sup>SLRC - Sea Lice Research Centre, Institute of Marine Research, 5017 Bergen, Norway

# Høy temperatur gir raskere utvikling

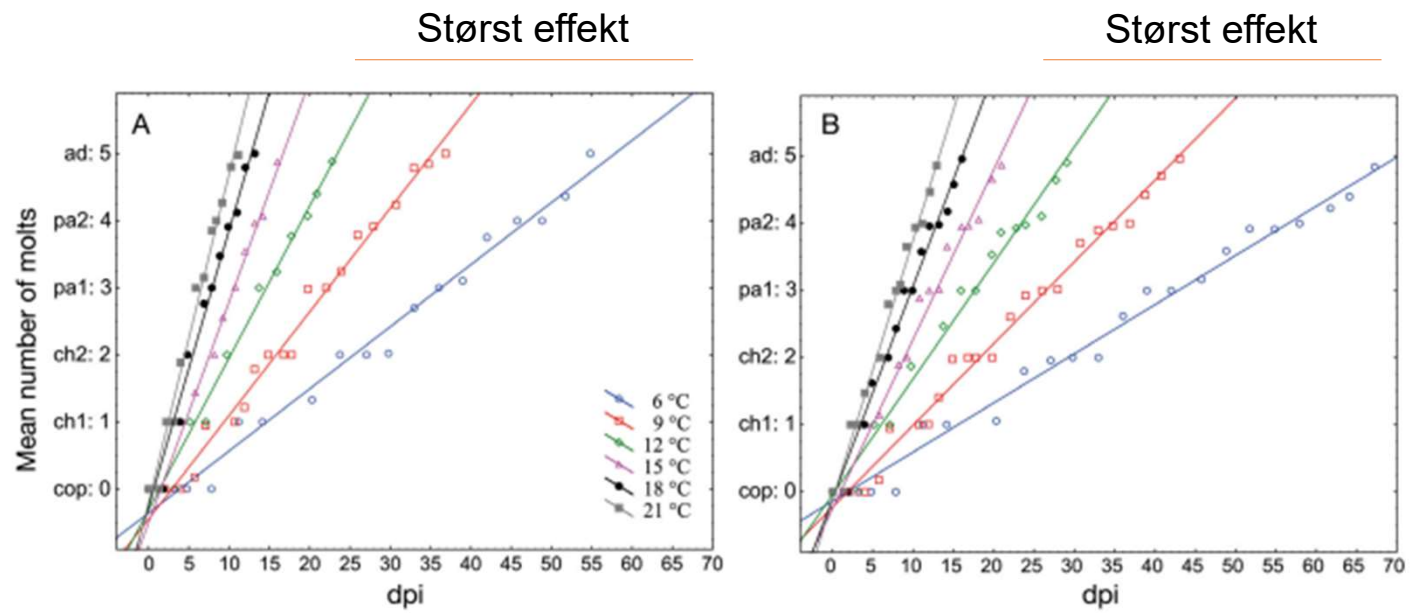


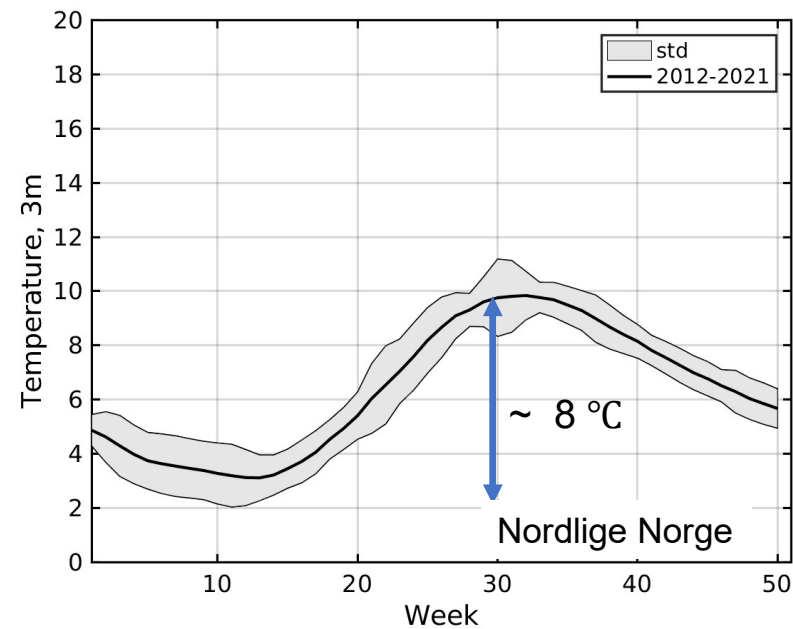
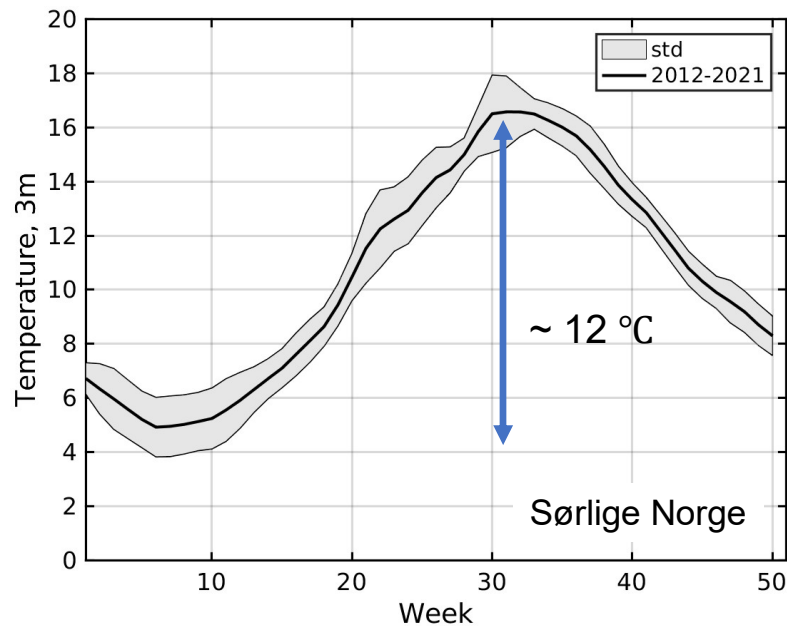
Fig. 2. Mean number of molts (MnM) vs. days post infection (dpi) for *Lepeophtheirus salmonis* (A) males and (B) females. Lines represent the predicted MnM as a function of dpi at each of the temperatures tested:  $MnM(T) = a + rM(T)dpi$ , where the mean daily growth rate is  $rM(T) = bT^2 + cT + d$ . The values of the constants  $a$ ,  $b$ ,  $c$  and  $d$  are listed in Table 3

Bemærkelsesverdig god korrelasjon med alle lusestammer



# Temperatur i 3m dyp

- ukentlige målinger fra alle aktive akvakultur lokaliteter



- Forskjellen mellom vinter og sommer temperatur er størst i sør
- Økningen i nord er i det temp-område der det har størst effekt

# Høyere temperatur gir flere larver

## 1. Økning i antall lakseluslarver

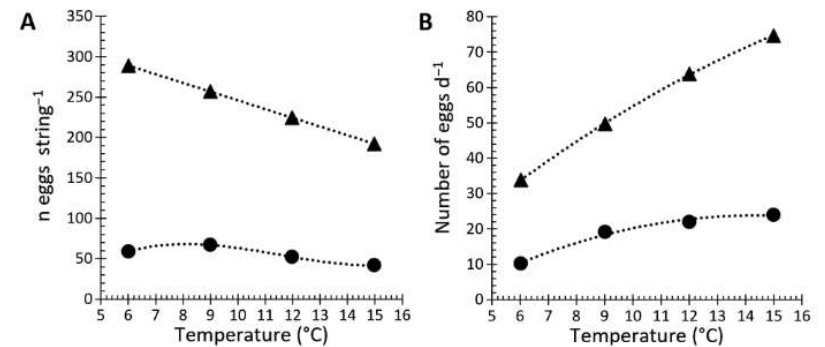
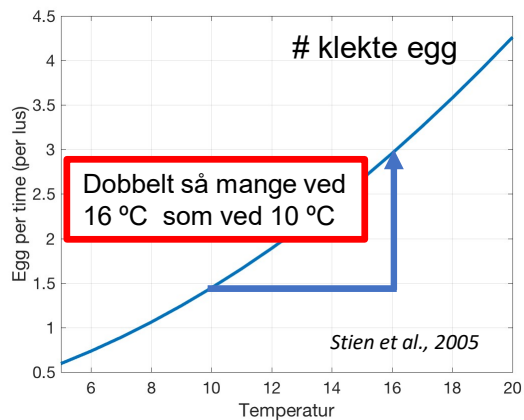


Fig. 4. (A) Mean number of eggs per egg string and (B) mean daily egg production in *Caligus elongatus* females carrying complete egg string pairs, at temperatures from 6 to 15°C (circles). Mean number of eggs per string and estimated mean daily egg production for *L. salmonis* females with complete egg string pairs are plotted for comparison (triangles; calculated based on data on egg batch production frequency in Hamre et al. 2019 and number of eggs per egg string in Samsing et al. 2016). The linear regression for number of eggs per string versus temperature for *L. salmonis* given in panel (A) was extrapolated from published data for temperatures 5–20°C (Samsing et al. 2016). Here, the 15°C data were excluded from the regression, because they appeared incorrect (Fig. 4 in Samsing et al. 2016) and deviate from other measurements at this temperature (unpubl. data from the experiment in Hamre et al. 2019). Second-order polynomials fitted to the mean daily egg production data are for *C. elongatus*, eggs d<sup>-1</sup> = -0.1933T<sup>2</sup> + 5.5346T - 15.768, and for *L. salmonis*, eggs d<sup>-1</sup> = -0.1387T<sup>2</sup> + 7.4654T - 6.0078, where T is temperature in °C.

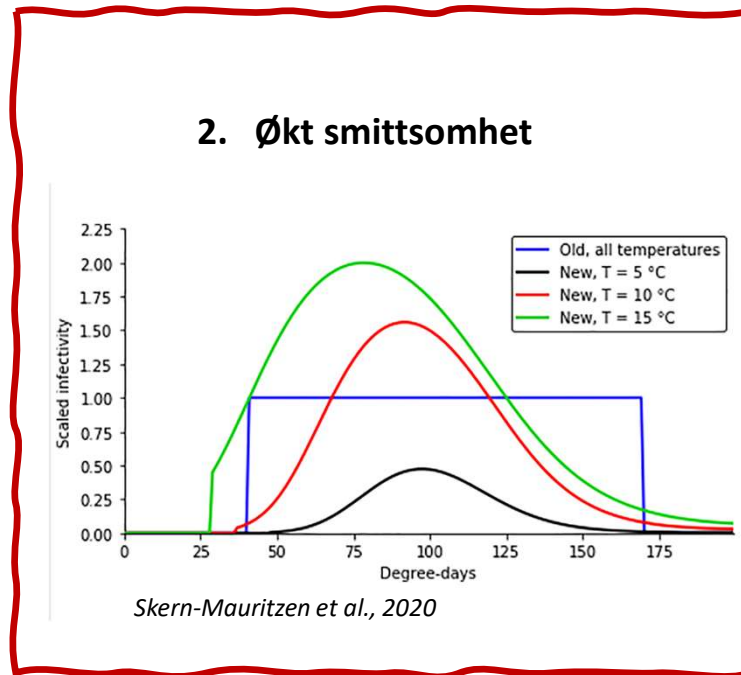


## Effect of temperature on development rate and egg production in *Caligus elongatus* and other sea louse species

Lars Are Hamre<sup>1,\*</sup>, Sussie Dalvin<sup>2</sup>, Gine Myhre<sup>3</sup>, Samantha Bui<sup>3</sup>

<sup>1</sup>SLRC – Sea Lice Research Centre, Department of Biological Sciences, University of Bergen, Postbox 7803, 5020 Bergen, Norway  
<sup>2</sup>Institute of Marine Research, 5017 Bergen, Norway  
<sup>3</sup>Institute of Marine Research, 5984 Matredal, Norway

# Høyere temperatur gir mer smittsomme larver



Parasite development affect dispersal dynamics; infectivity, activity and energetic status in cohorts of salmon louse copepodids

Rasmus Skern-Mauritzen<sup>a,\*</sup>, Nini H. Sissener<sup>a</sup>, Anne D. Sandvik<sup>a</sup>, Sonnich Meier<sup>a</sup>, Pål N. Sævik<sup>a</sup>, Morten D. Skogen<sup>b</sup>, Tone Vågseth<sup>b</sup>, Sussie Dalvin<sup>c,d</sup>, Mette Skern-Mauritzen<sup>a</sup>, Samantha Bui<sup>b</sup>

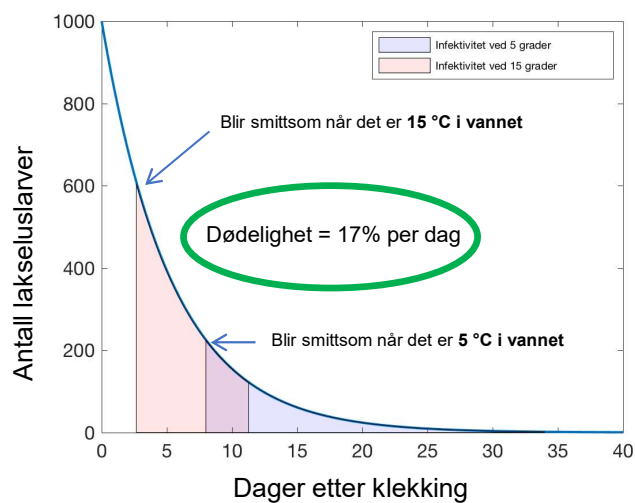
<sup>a</sup> Institute of Marine Research, 5005 Bergen, Norway  
<sup>b</sup> Institute of Marine Research, 5018 Marnild, Norway  
<sup>c</sup> Department of Biology, University of Bergen, 5020 Bergen, Norway





# Højere temperatur gir mindre predasjon (...?)

## 3. Hurtigere utviklingstid



...men vi har litt mangelfull kunnskap om predasjon på luselarver





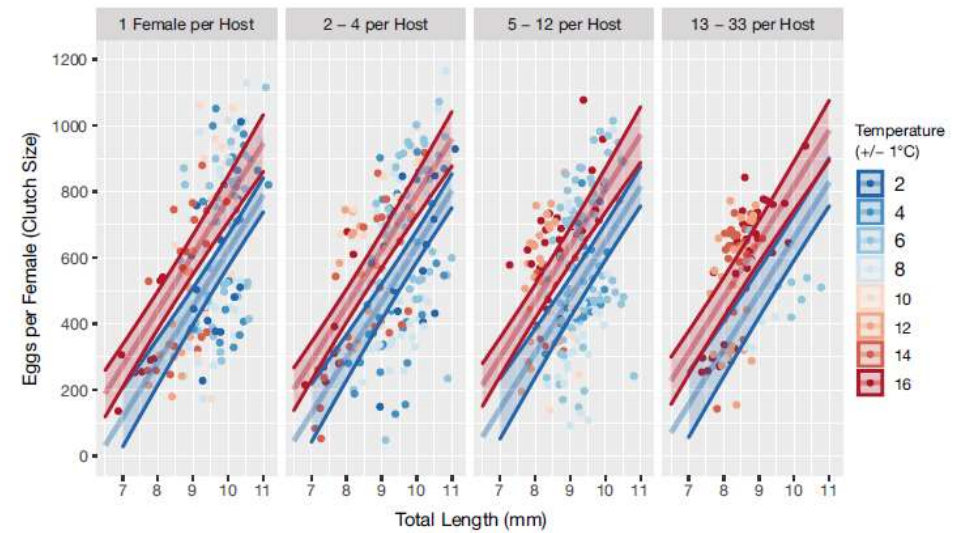
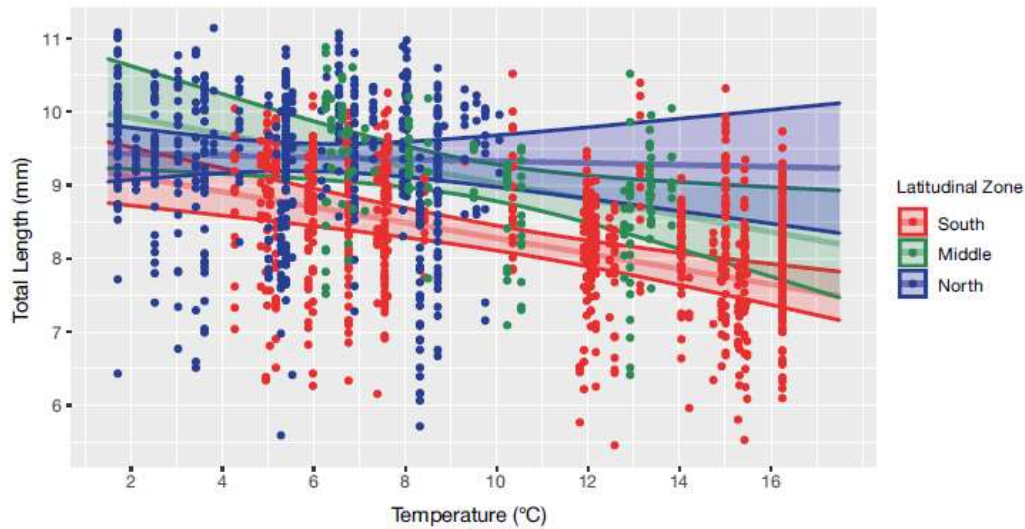


# Finns det ikke lyspunkter?

## Disentangling the key drivers of salmon louse *Lepeophtheirus salmonis* fecundity using multiyear field samples

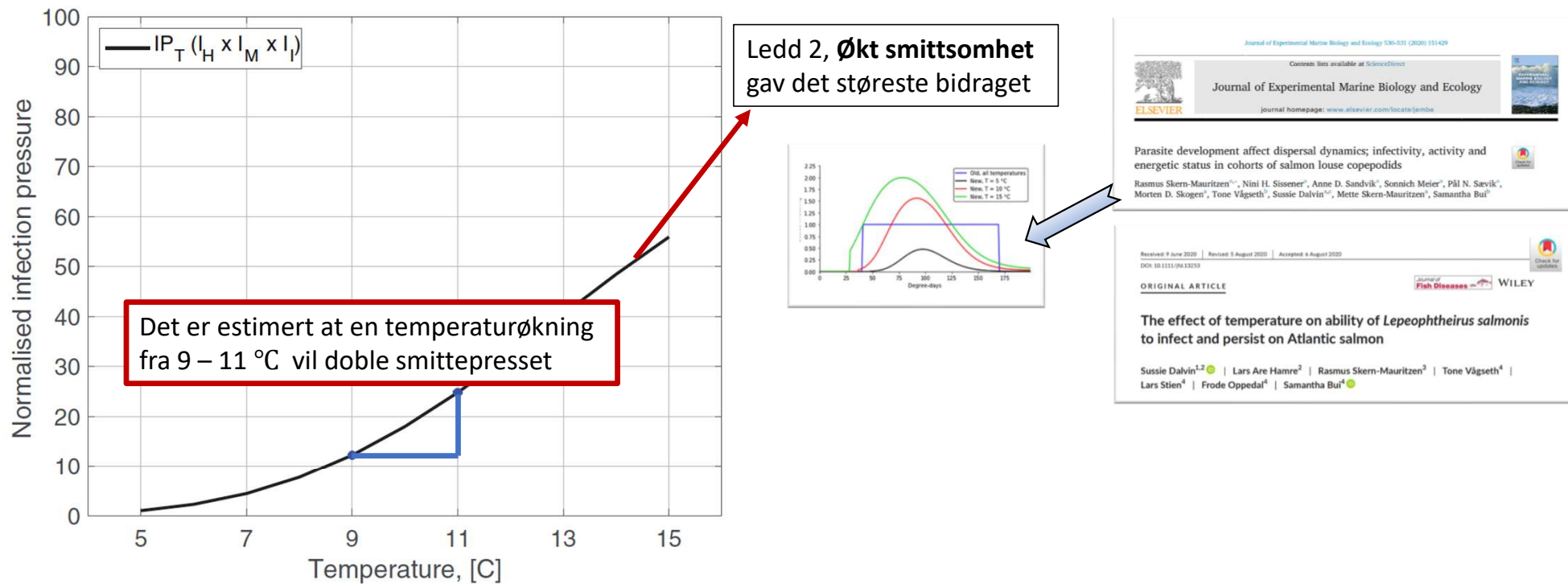
Cameron Thompson<sup>1\*</sup>, Samantha Bui<sup>2</sup>, Sussie Dalvin<sup>1</sup>, Rasmus Skern-Mauritzen<sup>1</sup>

<sup>1</sup>Institute of Marine Research, 5005 Bergen, Norway  
<sup>2</sup>Institute of Marine Research, 5984 Matre, Norway



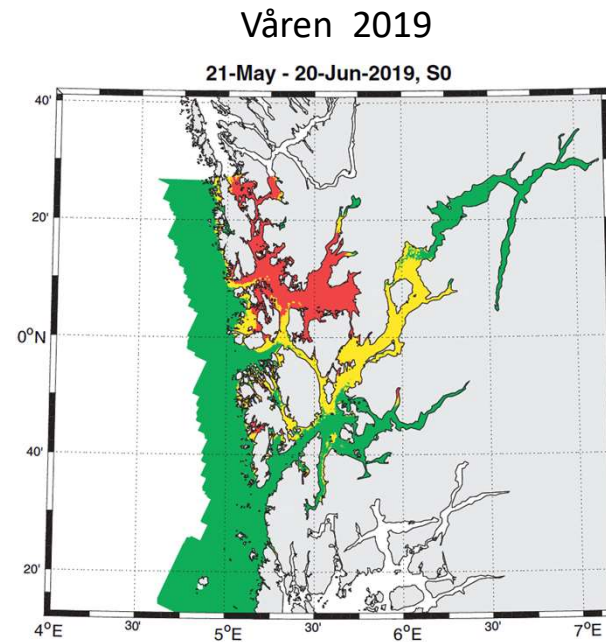
# Effekten av varmere klima (høyere temperatur)

- Totalt smittepress,  $IP_T$  (Ledd 1 \* Ledd 2 \* Ledd 3)

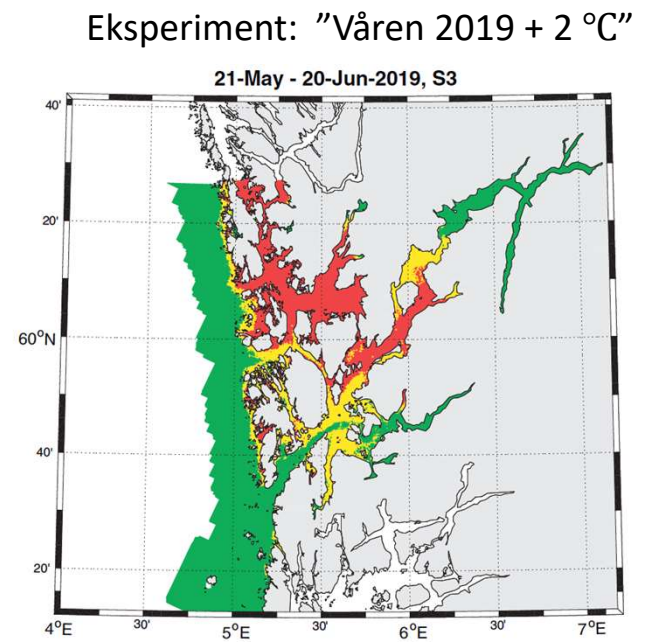


**Figure 2.** Normalized total infection pressure,  $IP_T$ , for temperatures 5–15°C relative to 5°C (left panel) and the different infectivity components: hatching rate ( $I_H$ ), mortality ( $I_M$ ) and infectivity ( $I_I$ ) also normalized to 5°C (right panel).

# Effekten av varmere klima (høyere temperatur)






ROC-index = 21.9

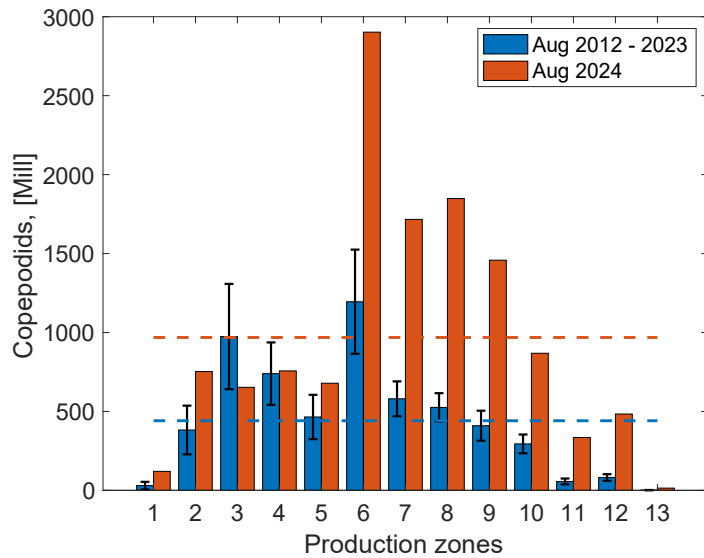


ROC-index = 30.9

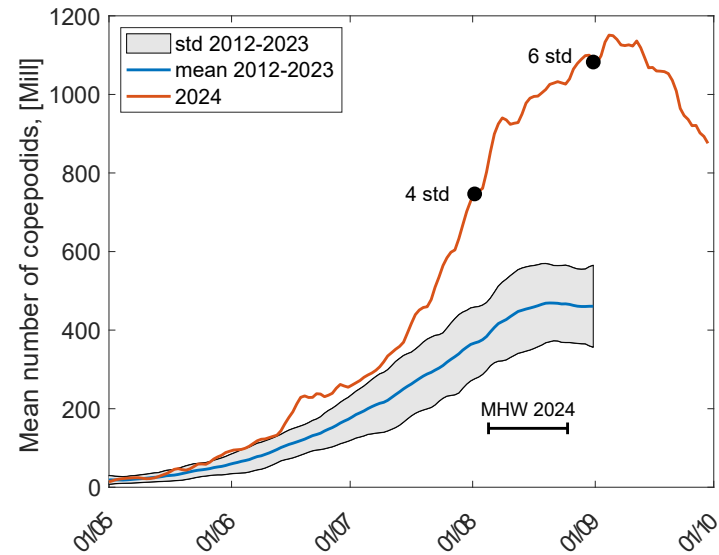
**Figure 3.** ROC maps that display areas where wild salmonids, occupying the area for the given time period, are expected to be infected by more than 10 lice (red colour), between 1 and 10 lice (yellow colour), and less than 1 lice (green colour).

-  High risk
-  Moderate risk
-  Low risk

# Lusepress August 2024



Abundance of salmon lice at each production zone in August for 2024 (red) and the 2012–2023 period (blue). Blue and red dashed lines represent the mean number of copepodids across all production zones for 2012–2023 and 2024, respectively. Black lines indicate the 95% confidence interval.



Hele Norge, dag for dag, middel foa august ca 1000 Mill



# Hva kan vi gjøre?

Lave inngangsverdier

Tiltak for lav smitte

Lukkede anlegg

Nedsenkbare anlegg

Effektiv behandling

