



# Lysstyring og smoltifisering - er det egentlig så vanskelig?

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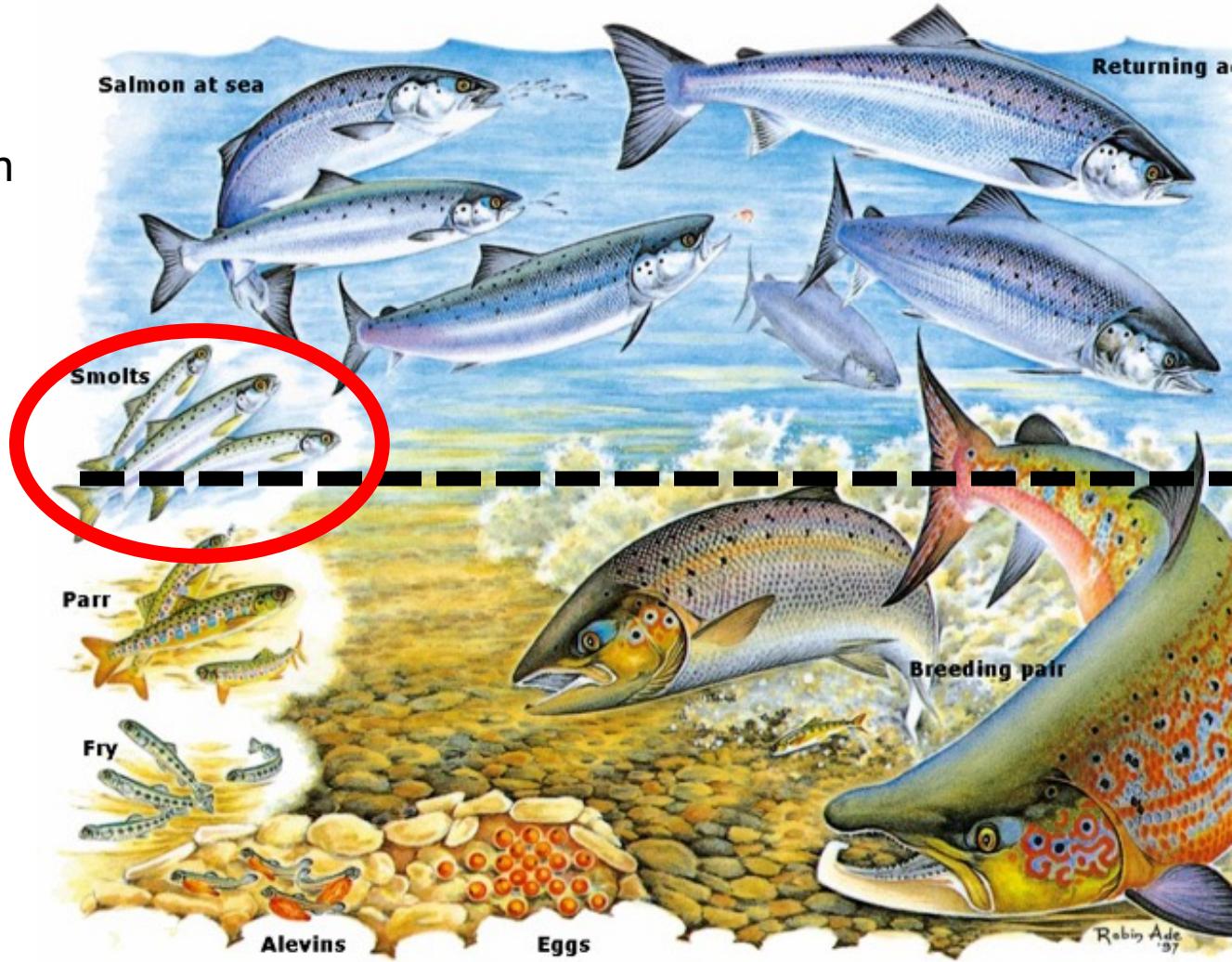
# Livsstadier

## Hva er en smolt?

Smolt begrepet benyttes vanligvis bare om den fisken som er klar for sjøen

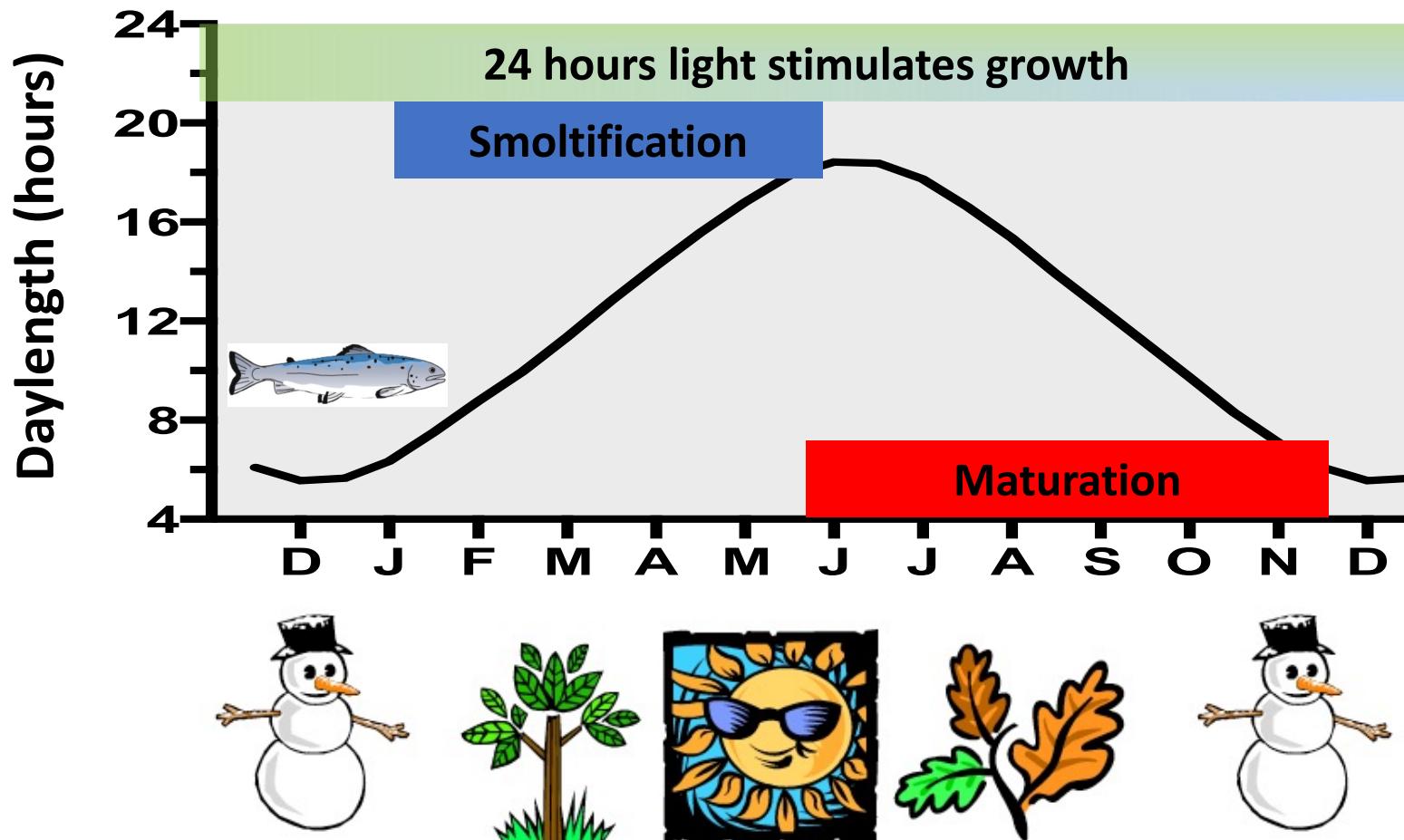
## Hva er smoltifisering?

Smoltifisering skjer **forut** for utvandring til sjø, fisken **tilpasser** (adapterer) seg til et marint liv **før** den vandre ut fra elven

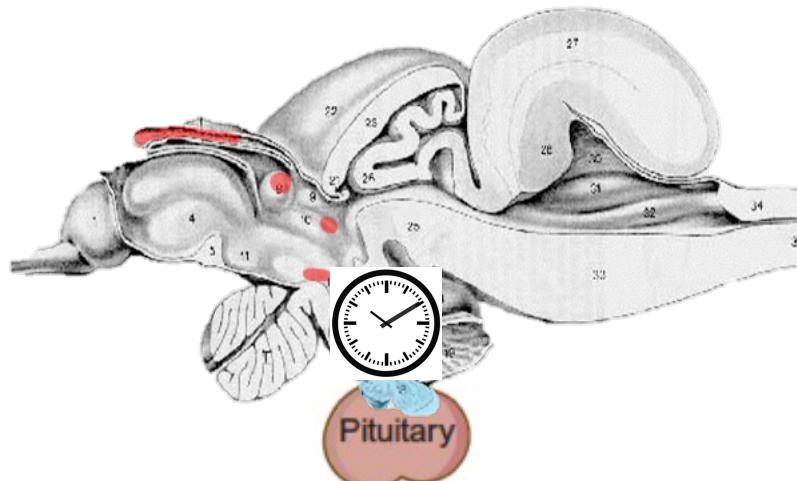


# Light provide calendar information

- Light (day length) the most important ‘timekeeper’ (zeitgeber)



# Smoltifisering styres av miljøparametere



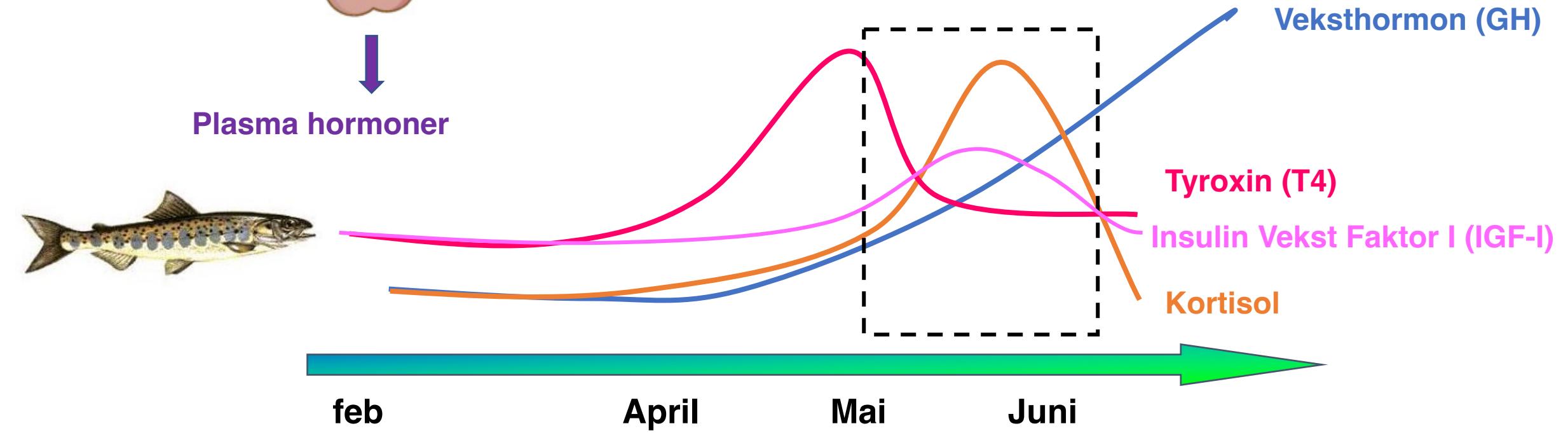
Endringer i daglengde veldig viktig



Temperatur viktig for utviklingshastighet



**'Smoltvindu'**

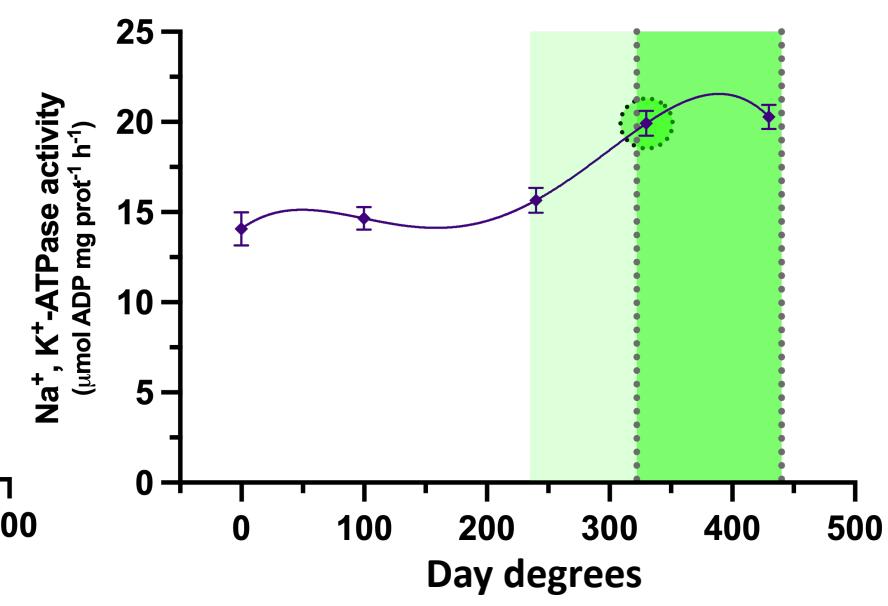
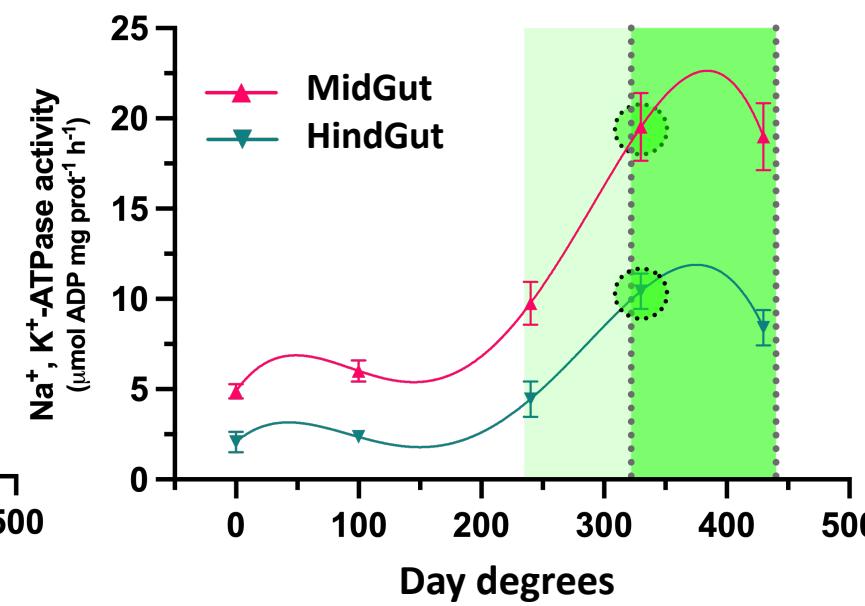
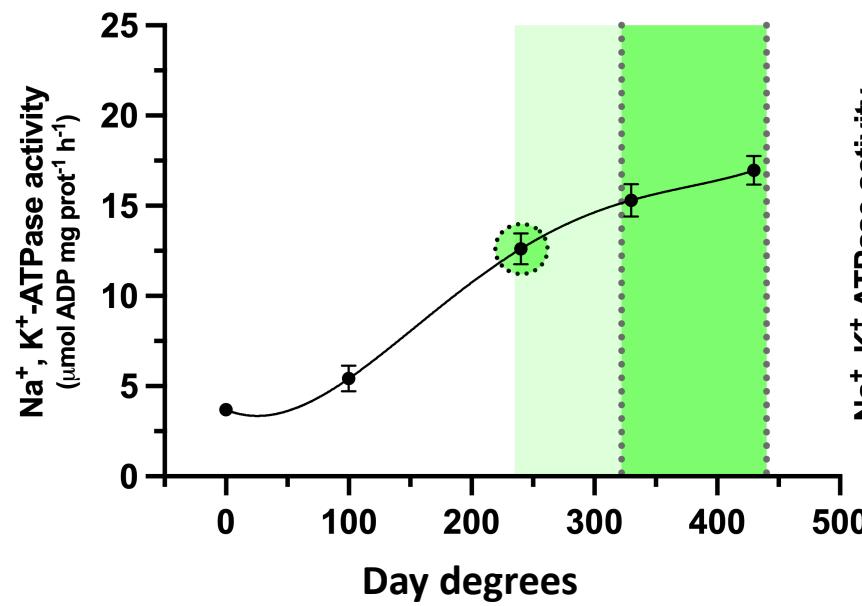
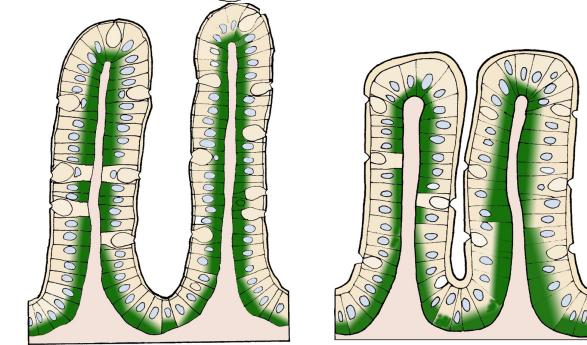
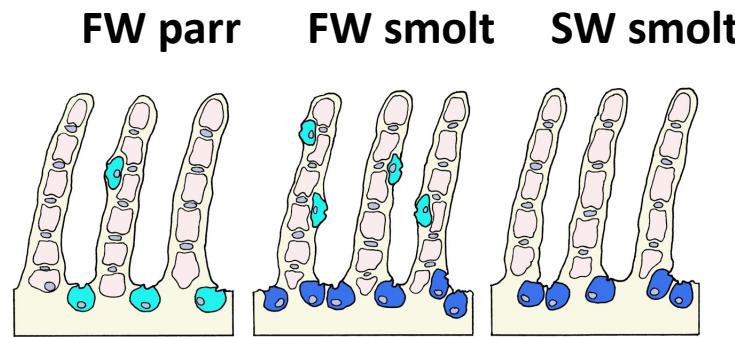
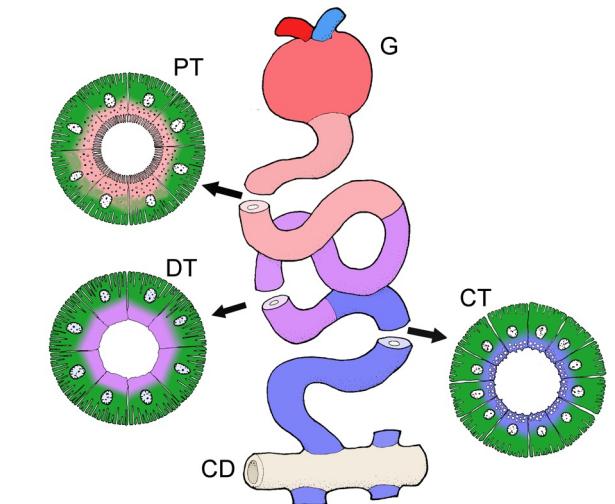
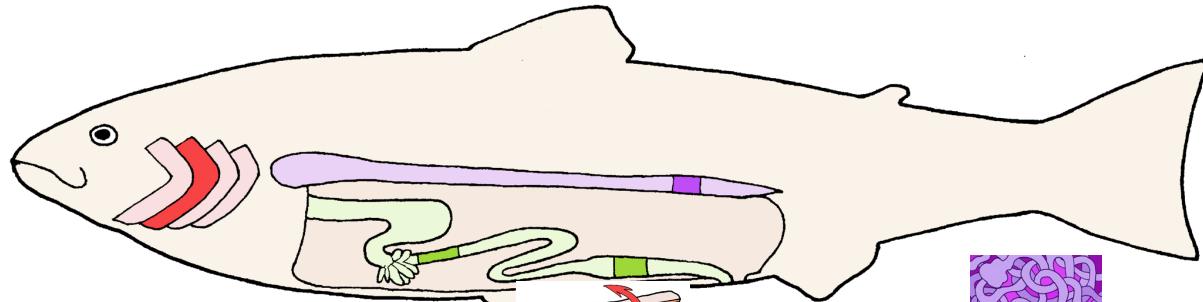


# Smoltification involves a biological cascade of changes

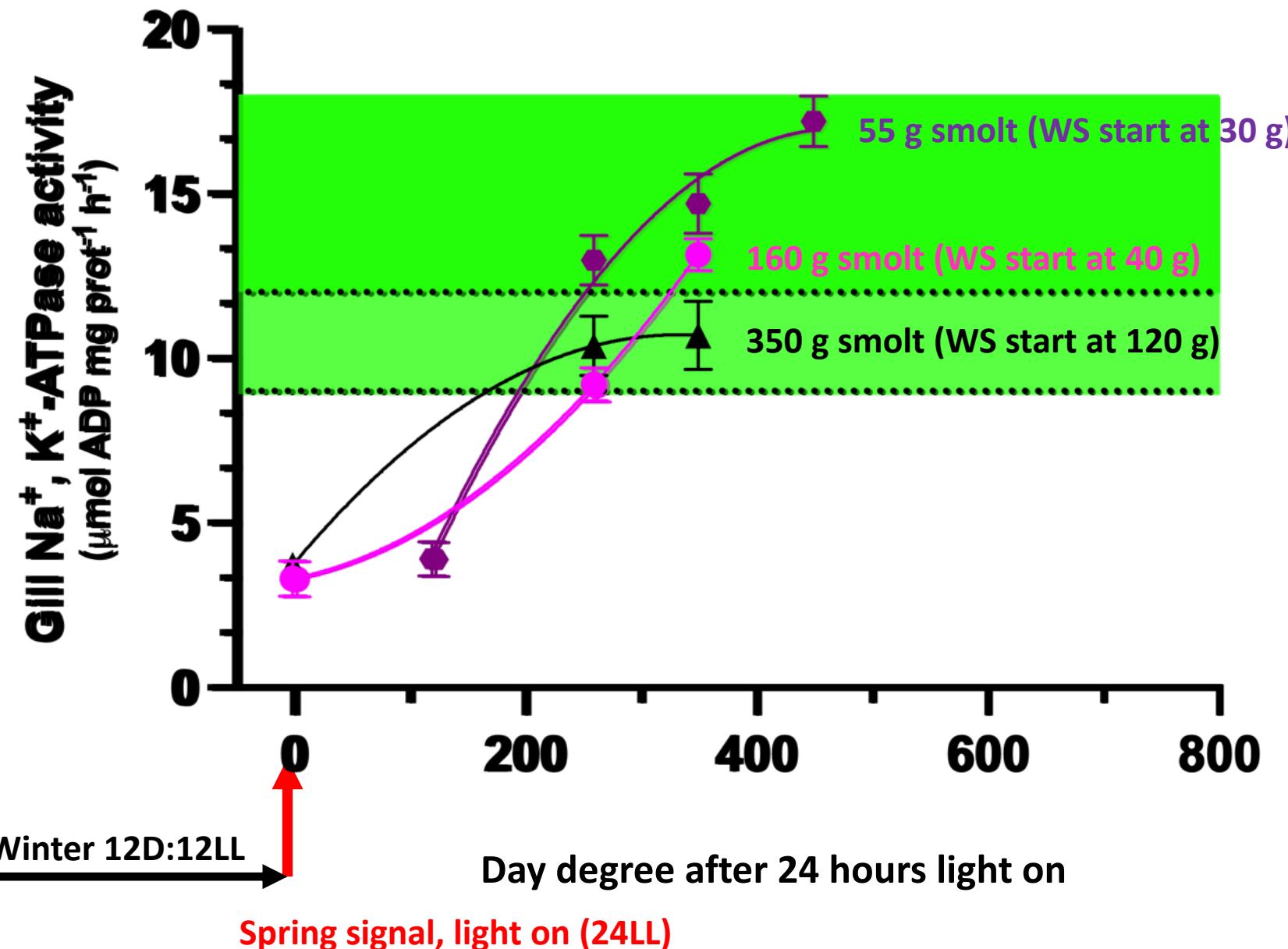


## □ Physiology

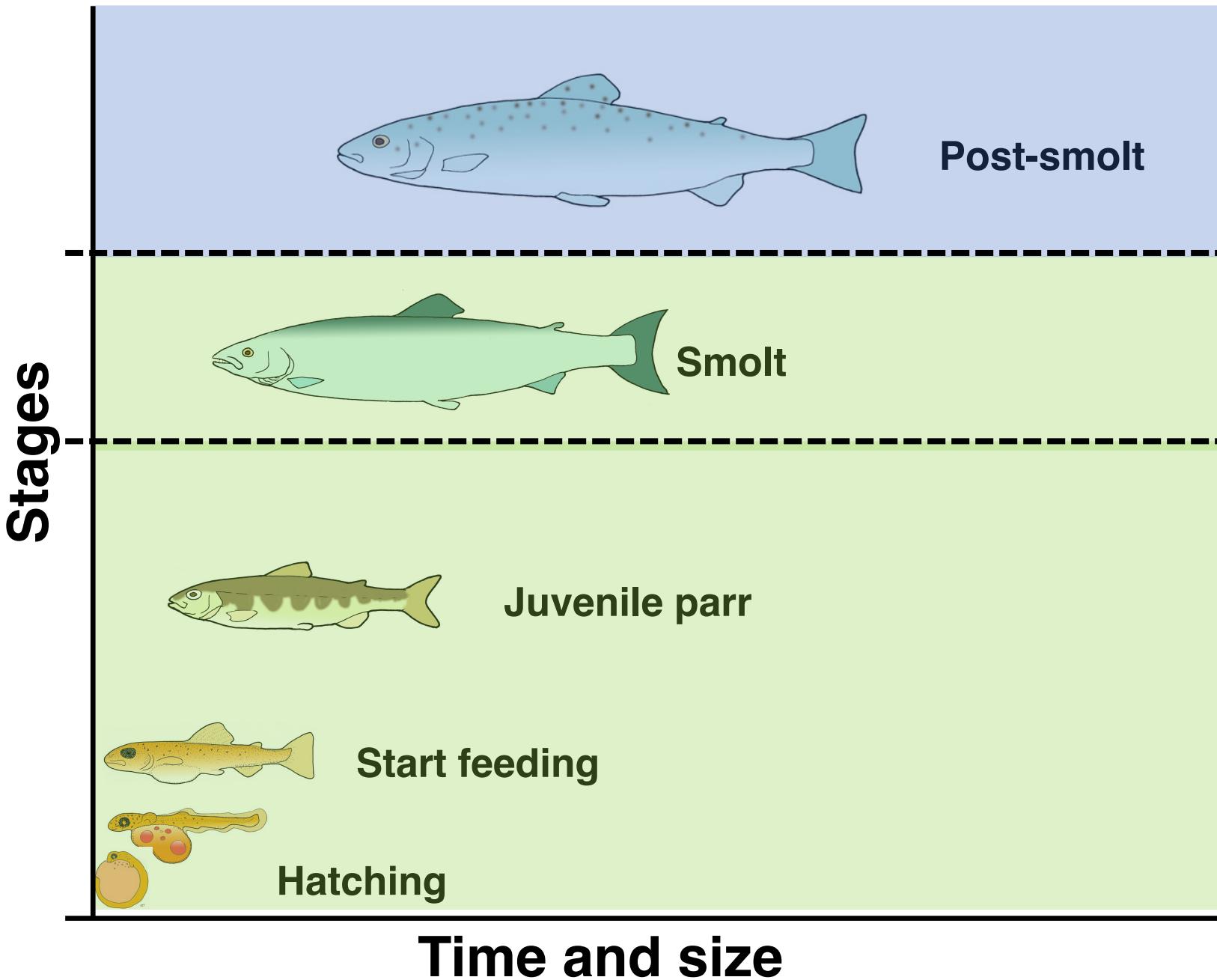
- Salinity tolerance
- Retinal pigmentation
- Olfactory sensitivity
- imprinting
- Buoyancy
- Lipid and glycogen utilization
- Metabolic rate
- Scope for growth



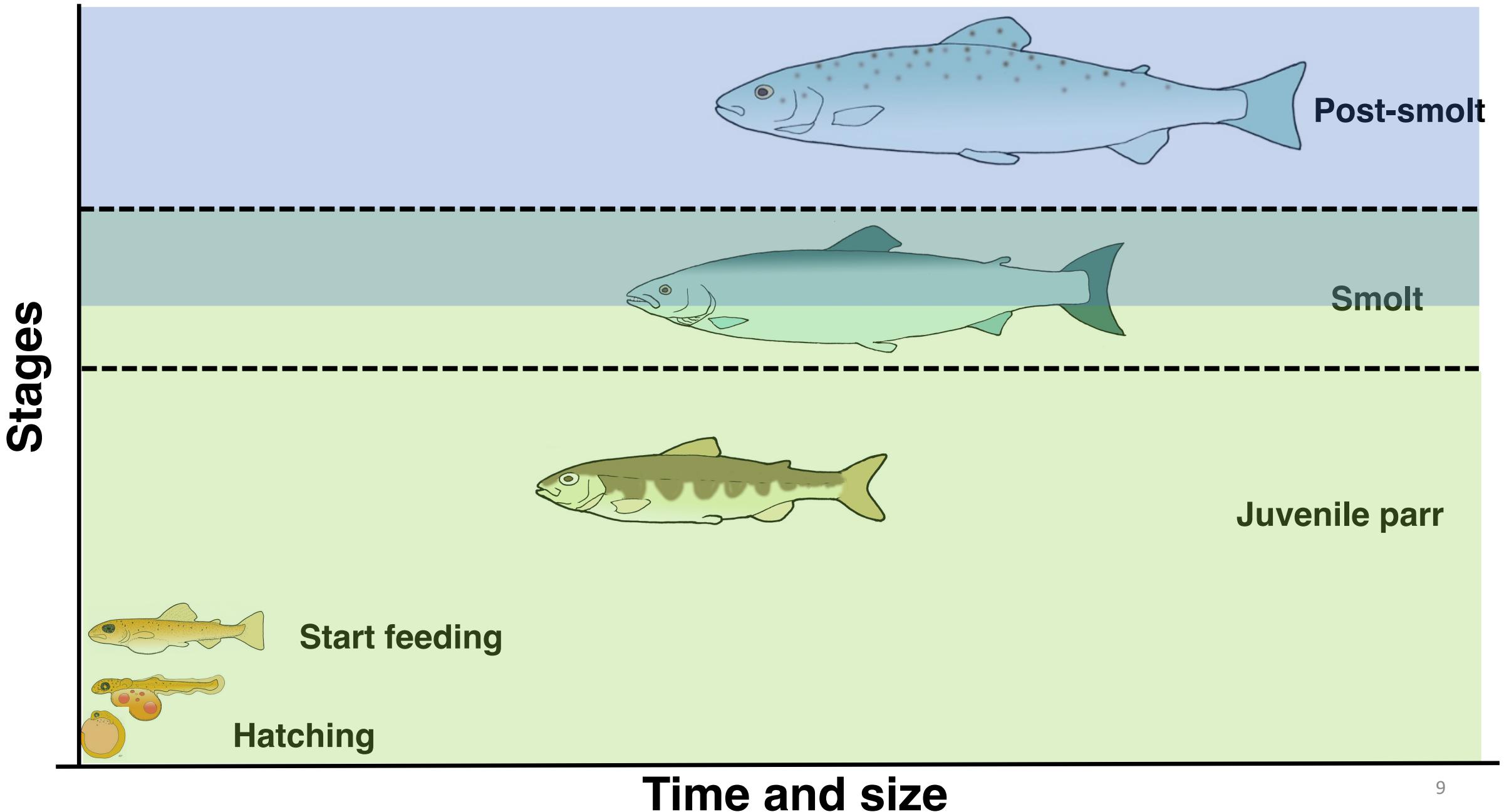
# Gill NKA activity - winter signal (WS) and smolt size



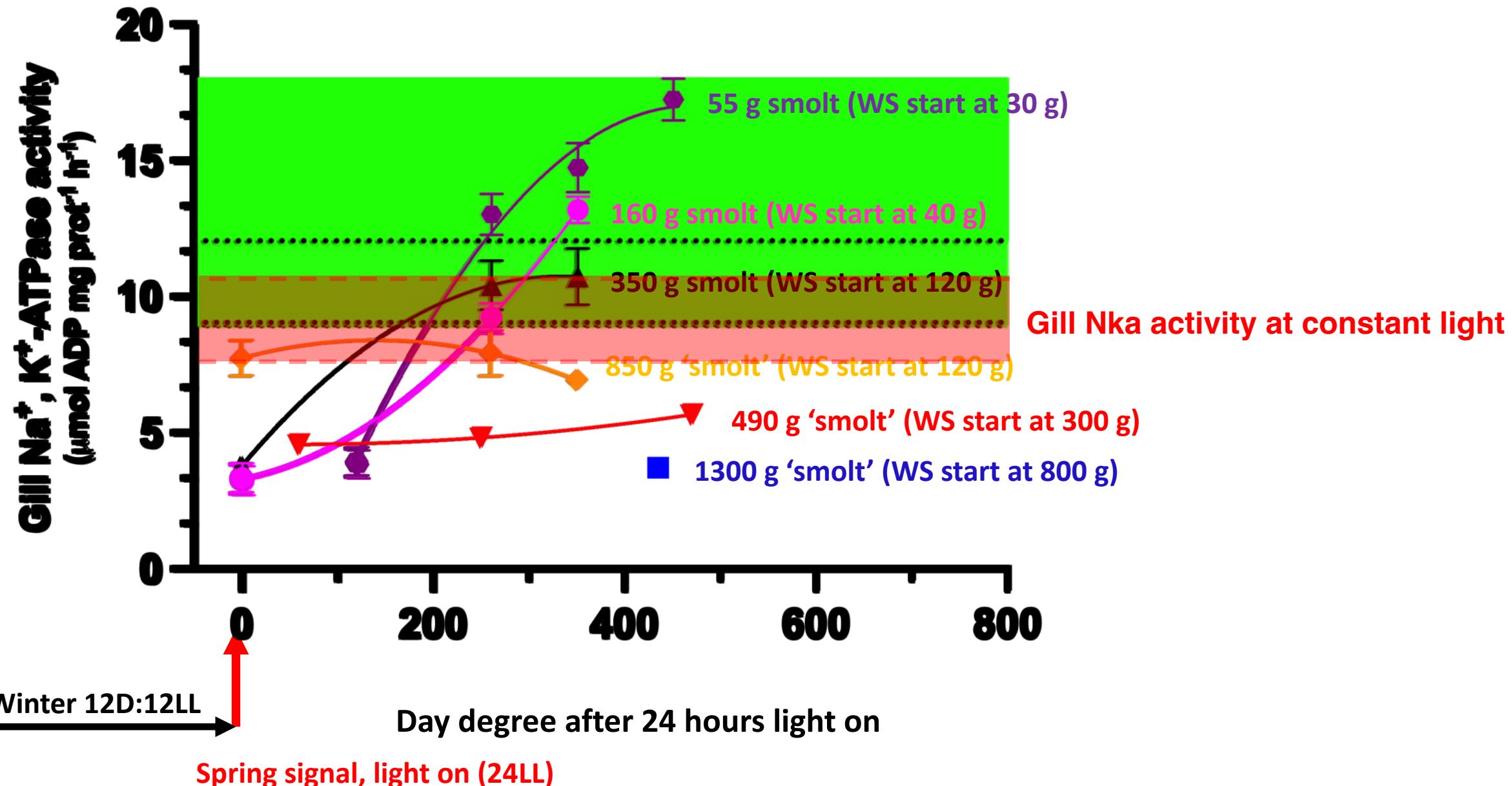
# Smoltification protocols functions well for ‘normal’ sized smolts



# Smoltification a bit more challenging when fish are larger

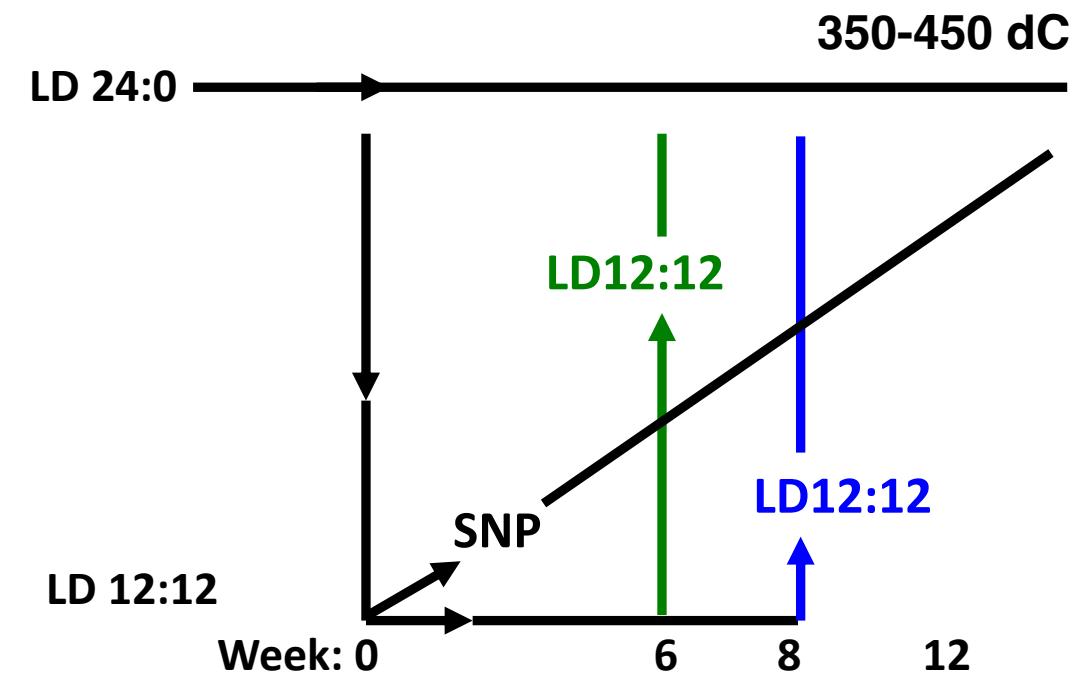
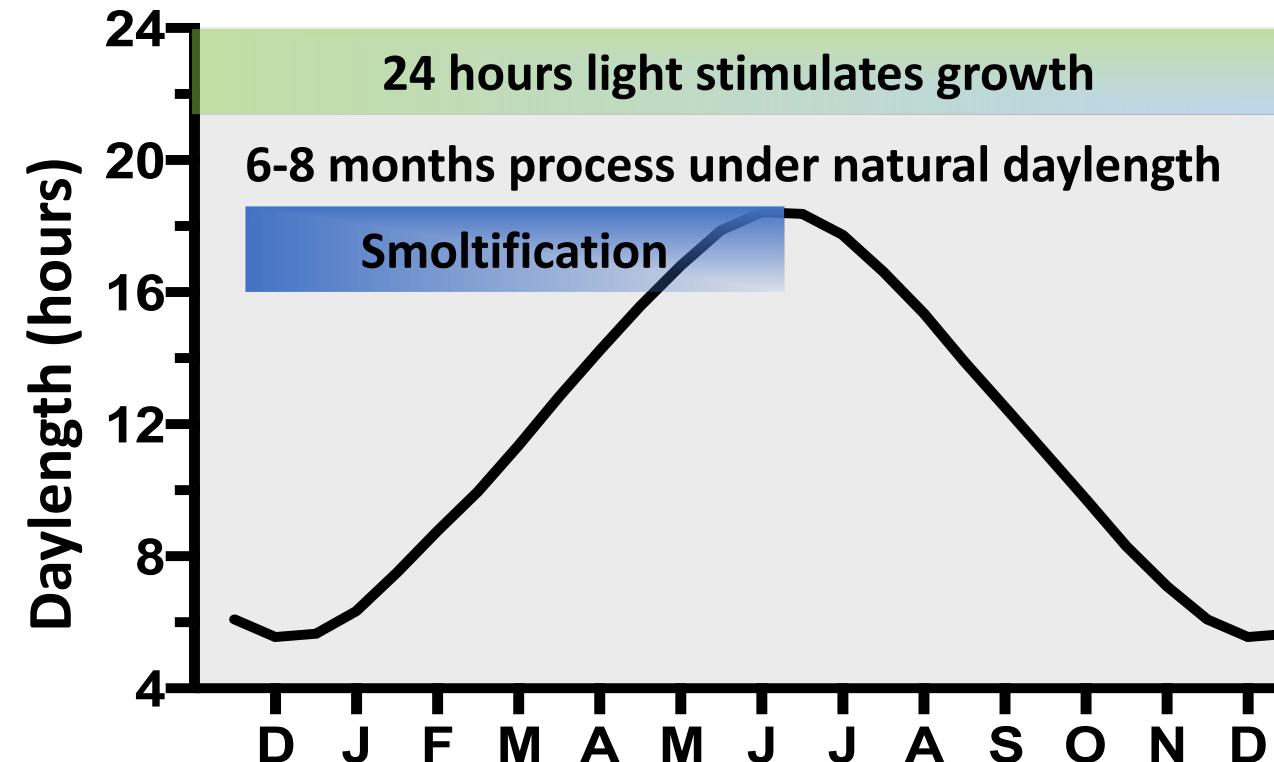


# Gill Nka activity - winter signal (WS) and smolt size



# Lysstyring og smoltifisering - er det egentlig så vanskelig?

- Nei, ikke for ‘tradisjonell’ smolt størrelser
- Ja, litt mer komplisert ved produksjon av stor smolt (post-smolt)



LD24:0 or LL = 24 hours light  
LD12:12 = 12 hours light:12 hours dark  
SNP = Simulated Natural Photoperiod



# Takk for oppmerksomheten

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**Nofima**

Kunnskapskartlegging-  
produksjon av stor laksesmolt

Faglig sluttrapport

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**REVIEW**

**New wine in old bottles: Modification of the  $\text{Na}^+/\text{K}^+$ -ATPase enzyme activity assay and its application in salmonid aquaculture**

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**Abstract:** The  $\text{Na}^+, \text{K}^+$ -ATPase (NKA) enzyme is important to generate the transmembrane ion gradient in the gills, intestine, and kidneys, hence, is vital for secondary transport of fluids and different solutes in teleosts. Gill NKA enzyme activity is often used as a proxy for parr-smolt transformation (PST) during which anadromous salmonids prepare for seawater (SW). Increased intensification and production of larger smolts in modern salmonid aquaculture has resulted in reports of gill NKA activity being less reliable as a proxy for smolt quality. Consequently, changes in mRNA  $nka-\alpha 1b/\alpha 1a$  ratios in gills are increasingly used as indicators of PST. However, nka isoform mRNA abundance may not reflect translation into the functional protein, nor the activity of the mature enzyme. This may limit the predictive power of molecular markers under certain environmental conditions, rearing regimes, and biological scenarios. During PST, the osmoregulatory transformations necessary for SW tolerance and survival does not only occur in the gills. Equally important are the changes in ion transporting activities, including NKA activity, in the intestine and kidneys. However, to our knowledge, there are no previous studies addressing the timing and concurrent changes in NKA activity in the three osmoregulatory tissue during PST. Here we present modifications and optimization of the NKA enzyme activity protocols for gill, intestinal and kidney tissue and outline how to best utilize NKA activity measurements as part of a more holistic approach to evaluate overall smolt quality in modern aquaculture.

**KEY WORDS:** aquaculture, fish,  $\text{Na}^+/\text{K}^+$ -ATPase, osmoregulation, parr-smolt transformation, seawater tolerance

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