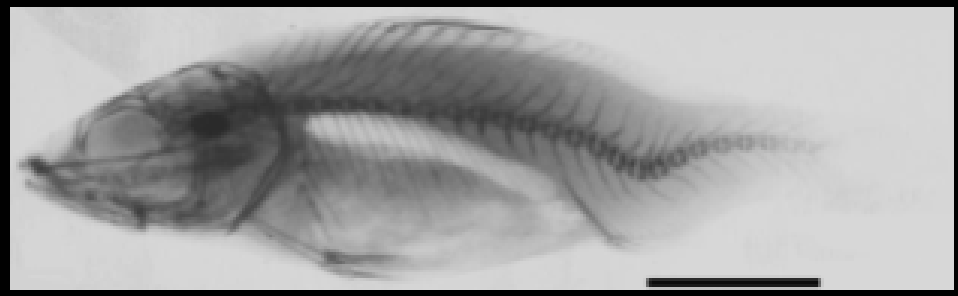
Abiotic causative factors of the hemal lordosis in sea bass



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Lordosis

Of the most severe and frequent skeletal deformities

Lordosis

Pre-Hemal

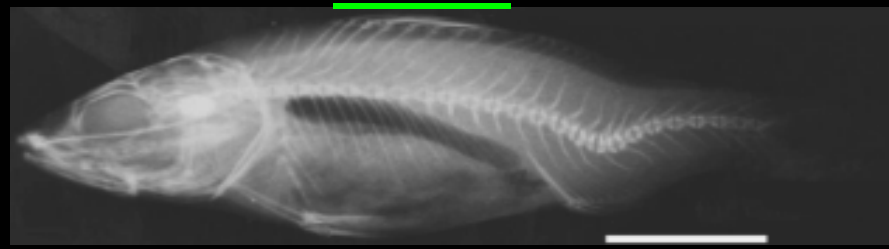
(Chatain 1986, 1987, 1994)

vertebra 11

Surface cleaning devices
Salinity floating test

VS

Hemal



(Divanach et al. 1997)

vertebra 15

Current decreasing devices

Even “solved”, lordosis continued to occur occasionally

Scientific Frame

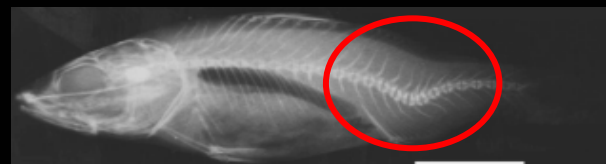
- Swimming effort is the real causative factor of lordosis (*Chatain 1994, Divanach et al. 1997*)
- The experimental removal of the caudal fin increases lordosis development (*Kihara et al. 2002*)

↓

* It is the muscle activity and not the loads by the caudal fin, that induce lordosis during swimming (Hypothesis A)

↓

* Lordosis is a consequence of muscle and bone interaction, which may be disturbed by the differential environmentally-induced ontogenetic plasticity of the 2 systems (Hypothesis B)
* Fish sensitivity to lordosis inducing factor (muscle activity) may be determined at early developmental stages, well before the action of the inducing factor (Hypothesis C)



Standardization of the swimming effort

Relative critical swimming speed (TL sec^{-1}) was selected for the approximation of prolonged swimming performance in sea bass

Factors under test

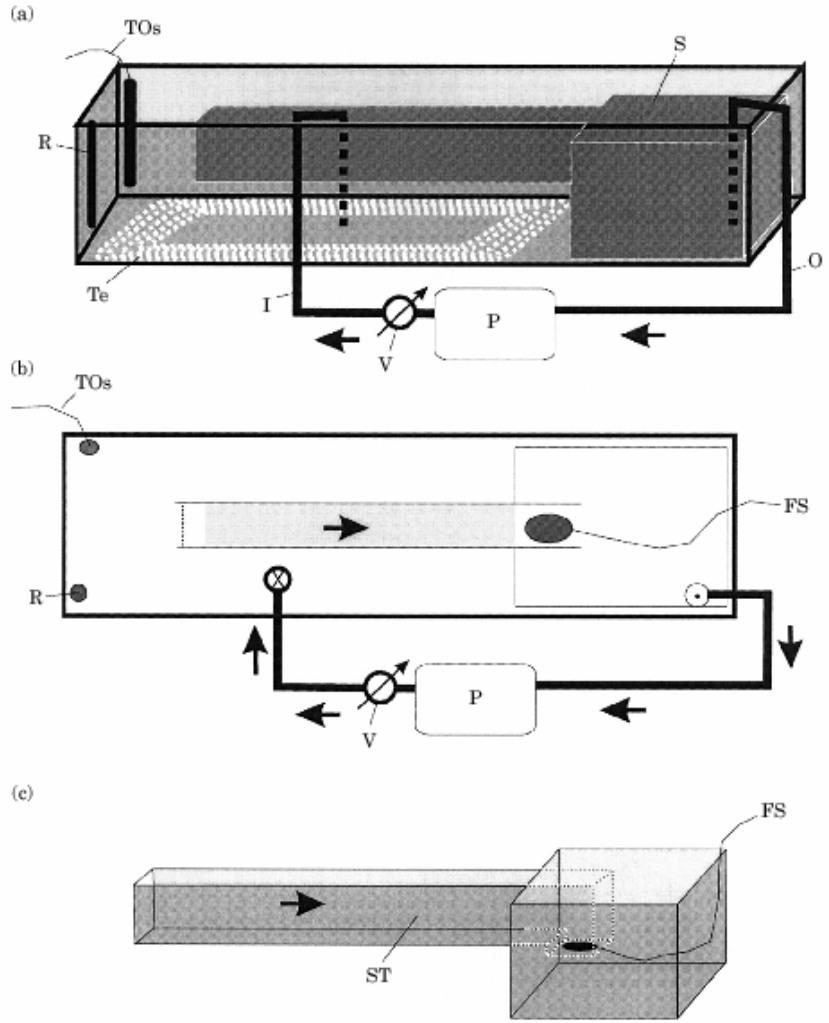
Body size: 22 - 45 mm TL

Water temperature: 15 - 28 ^{o}C

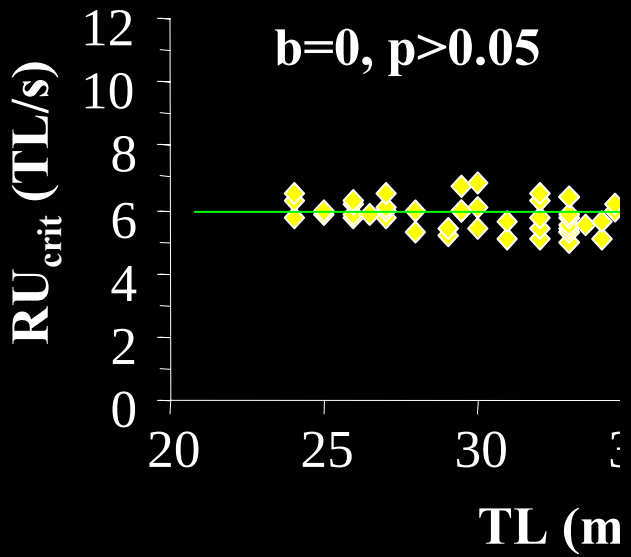
Fish origin

Reared juveniles

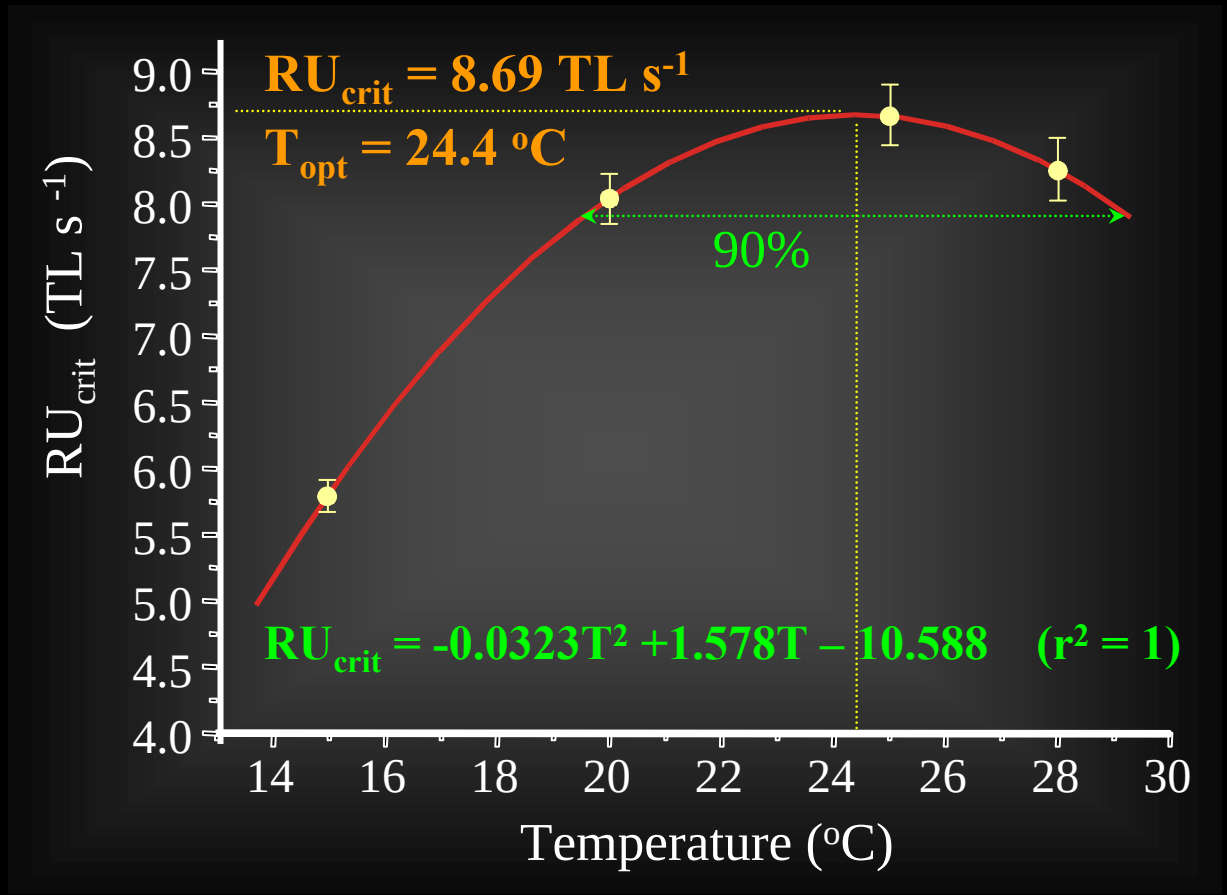
Deformed fish were excluded



Standardization of the swimming effort



Isometric increase of U_{crit} with TL



RU$_{crit}$: Relative critical swimming speed (TL sec^{-1})

Temperature and current effects

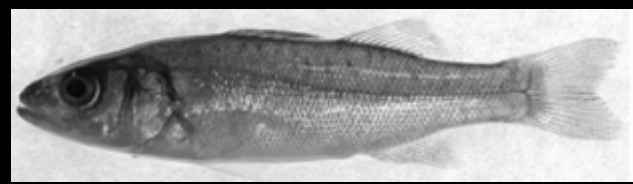
Basic experimental setup

20 °C

- 0% RU_{crit}
- 25% RU_{crit}
- 50% RU_{crit}
- 75% RU_{crit}

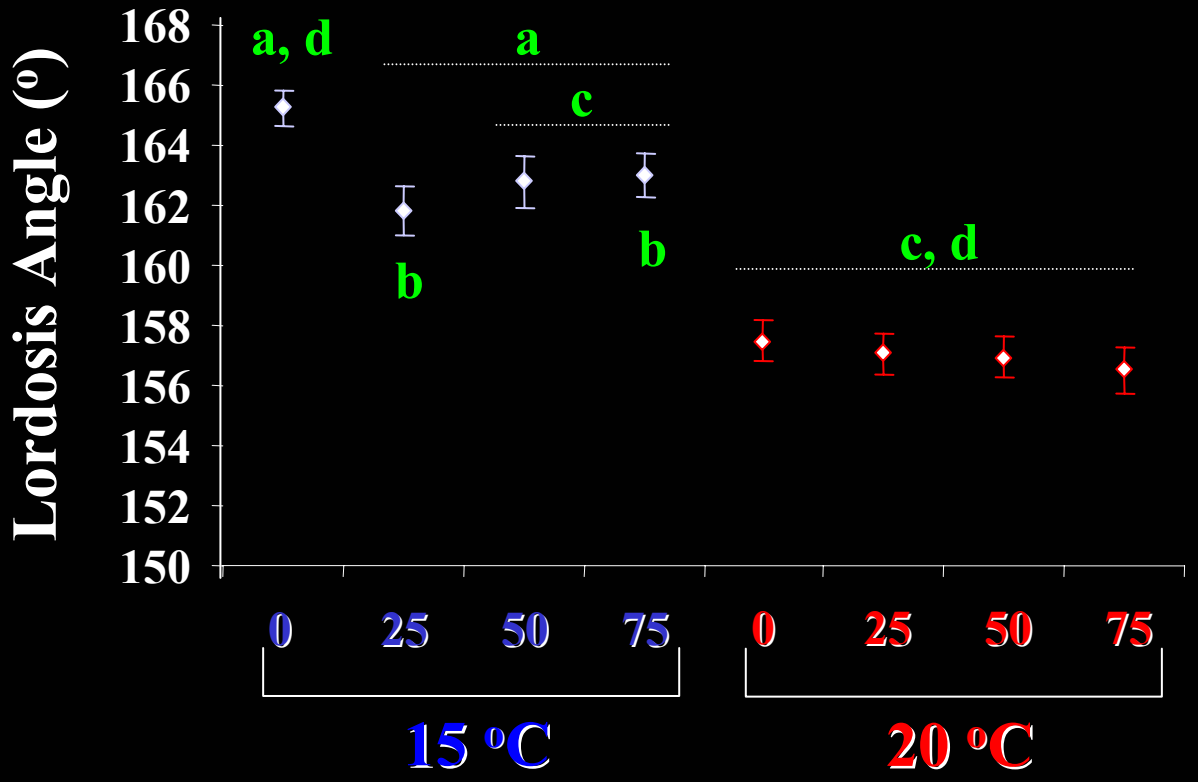
15 °C

- 0% RU_{crit}
- 25% RU_{crit}
- 50% RU_{crit}
- 75% RU_{crit}



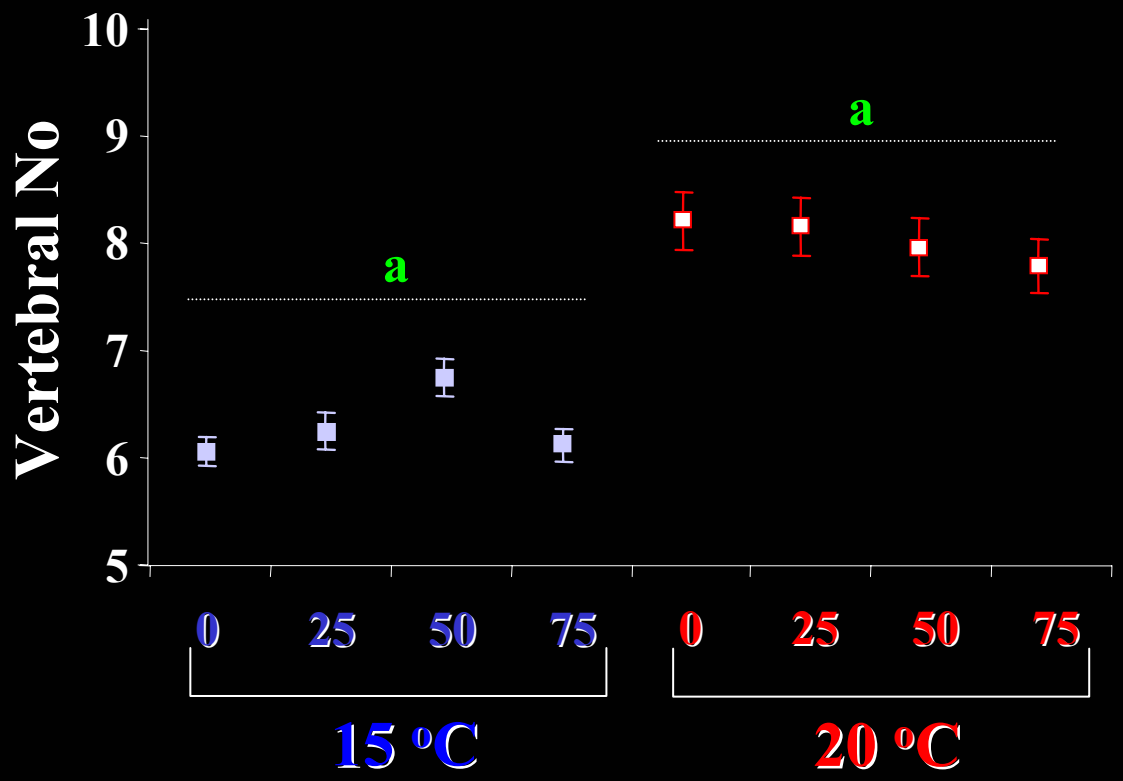
The different water-current conditions were applied at 20 mm TL and adjusted according to the previous results at 25, 30, 35 and 40 mm TL.

Effect of developmental temperature and swimming intensity on lordosis angle



± 1SE
n=149-193
Same letters: p<0.05

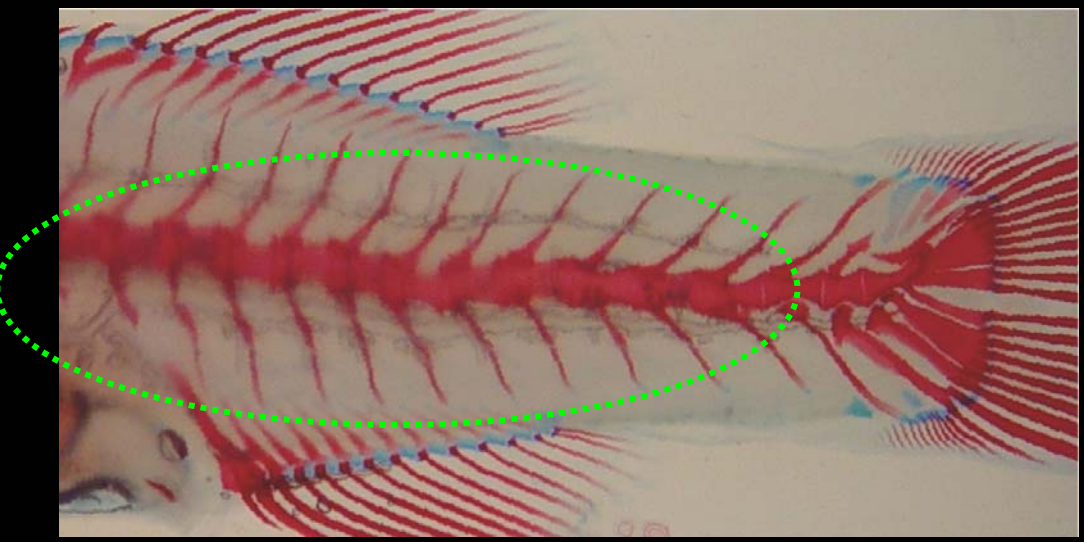
Effect of developmental temperature and swimming intensity on the number of "lordotic" vertebrae

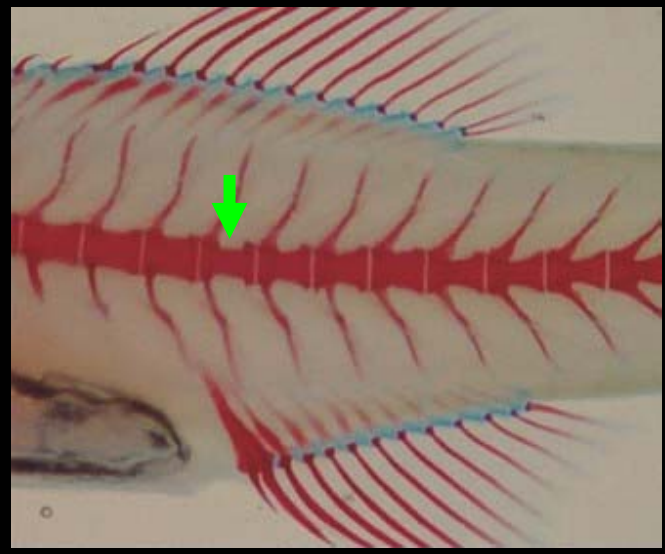


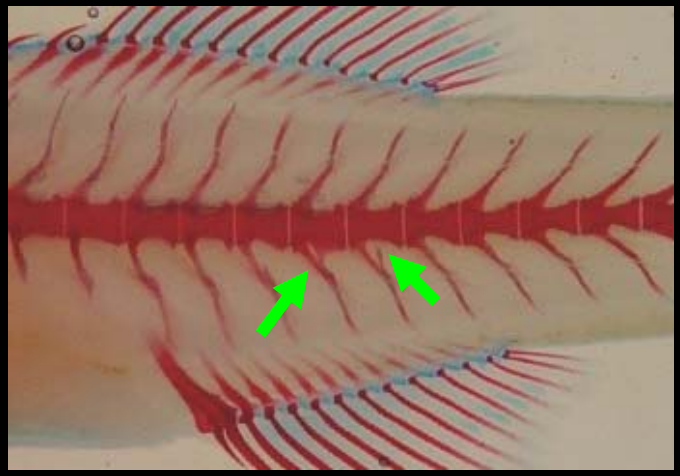
± 1SE
n=149-193
a: p<0.05

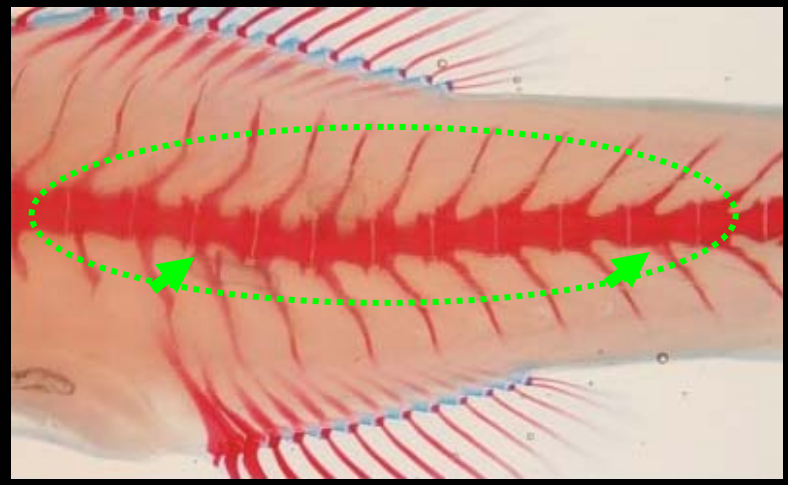
Anatomical predisposition of lordosis

One week after the water-currents' application



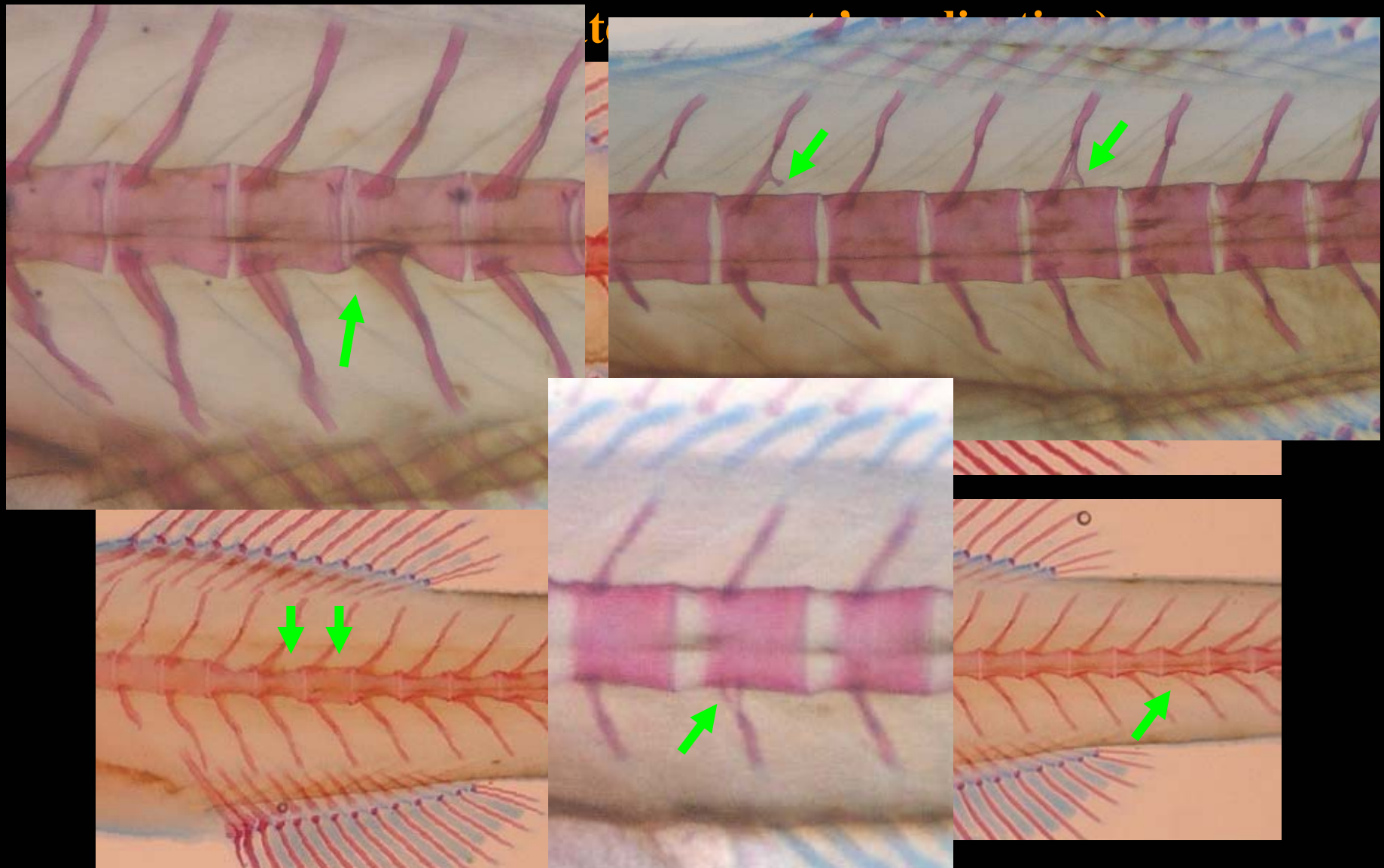






Anatomical predisposition of lordosis

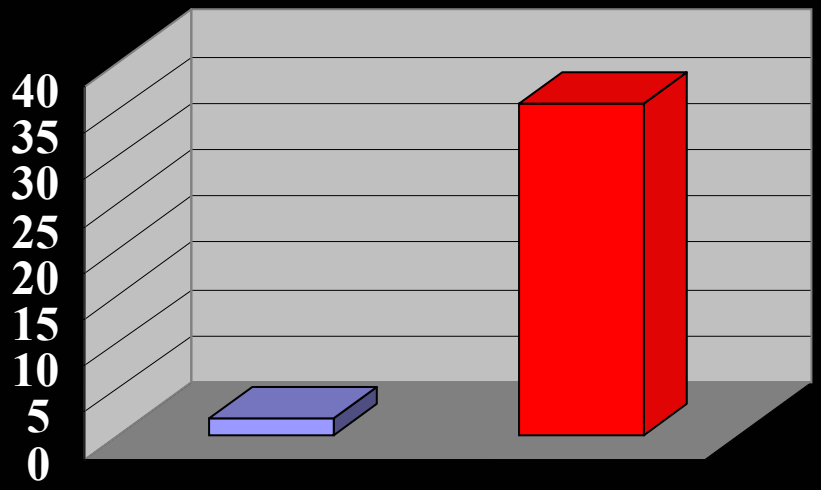
At the end of thermal treatments



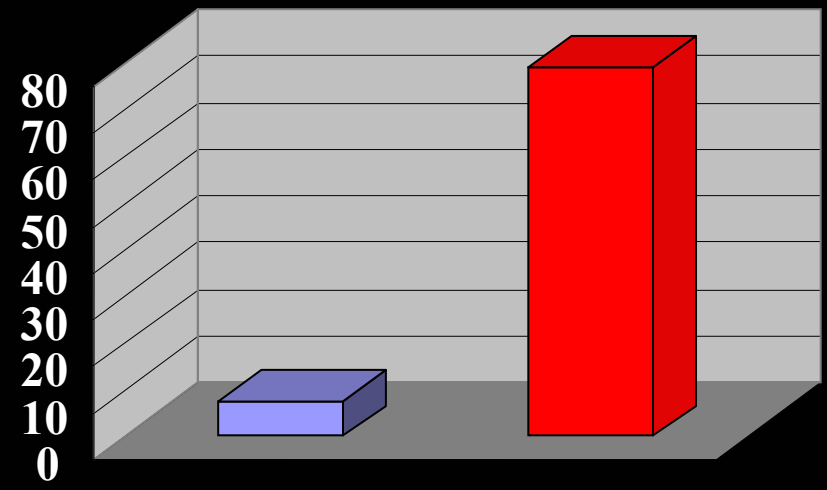
Frequency of the deformity types in 15 and 20° C

at the end of thermal treatments

Pre-hemal Vertebral Centra

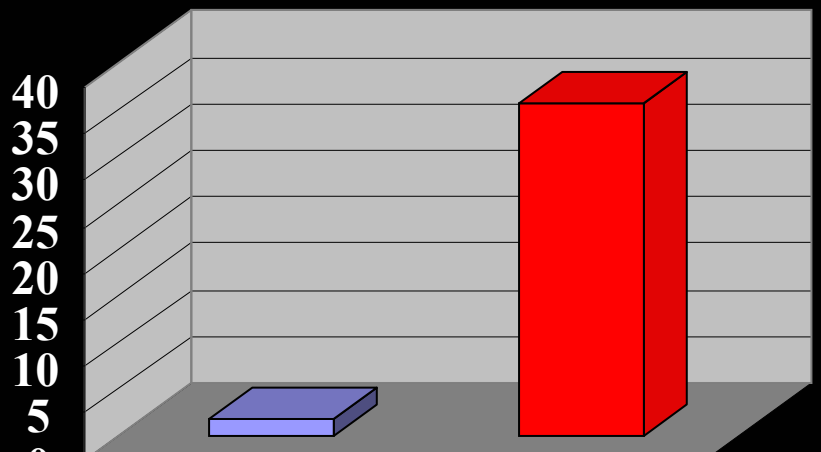


Hemal Vertebral Centra

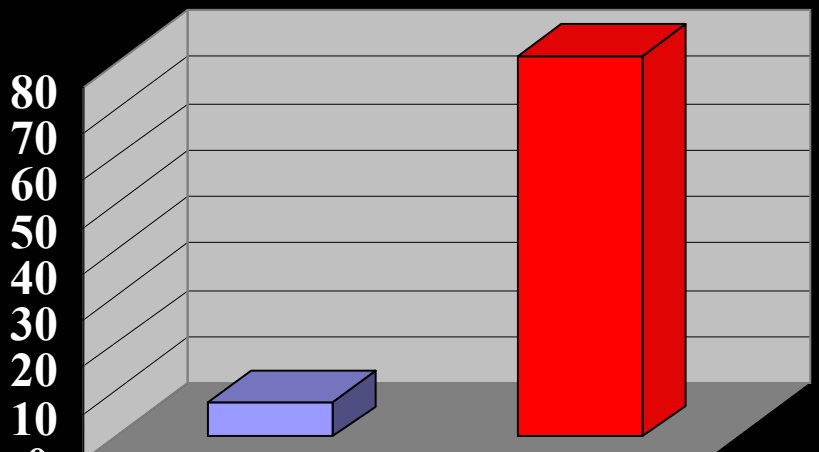


one week after the water-currents' application

Pre-hemal Vertebral Centra



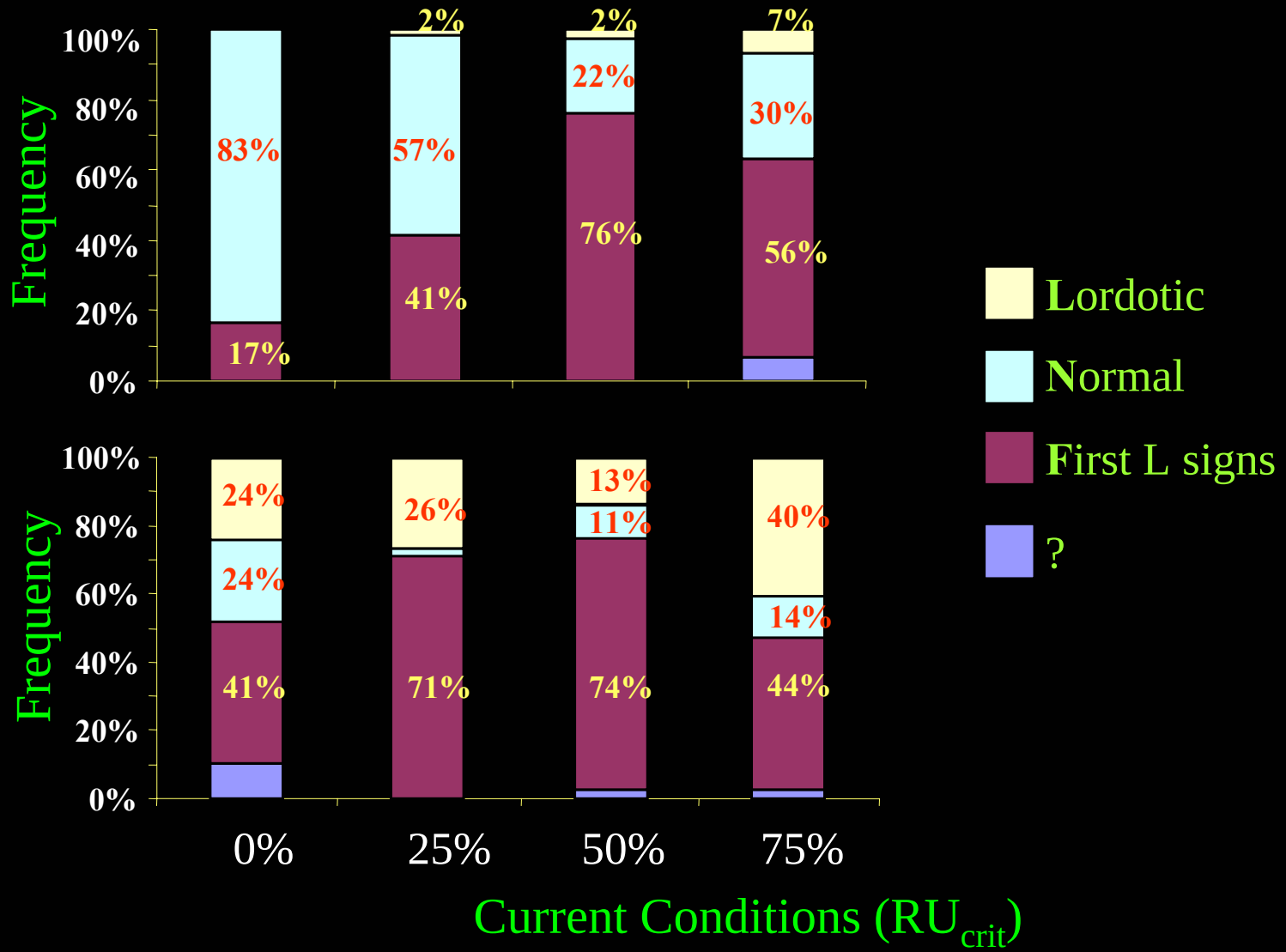
Hemal Vertebral Centra



Frequency of Lordosis
2 weeks after the currents' application

15 °C

20 °C



Temperature and current effects

Conclusions

- **Rearing temperature during the larval phase significantly affects the lordosis development in the following developmental stages (15^{o} C << 20^{o} C)**
- **Rearing temperature during the larval phase is a more significant factor than water-currents for the induction of lordosis**
- **The anatomical predisposition to lordosis can be determined well before the development of lordosis**

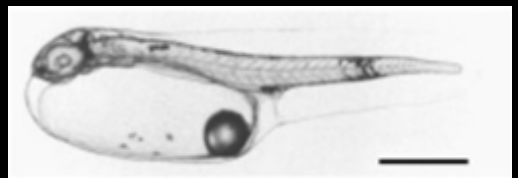
What about the rest of the Skeletal deformities ?

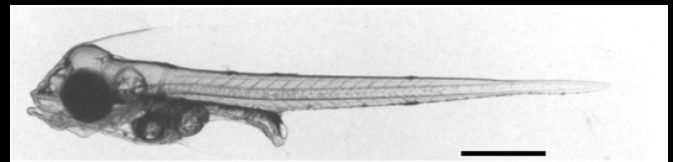
Skeletal deformities

- **Insufficient knowledge of optimum rearing conditions, specific for each**
  - **species and**
  - **developmental period**

e.g. Salmon vs Bream at hatching & first feeding

Dev. state of bones
Size
Importance of yolk
Rotifers vs inert diet
Abiotic vs biotic factors

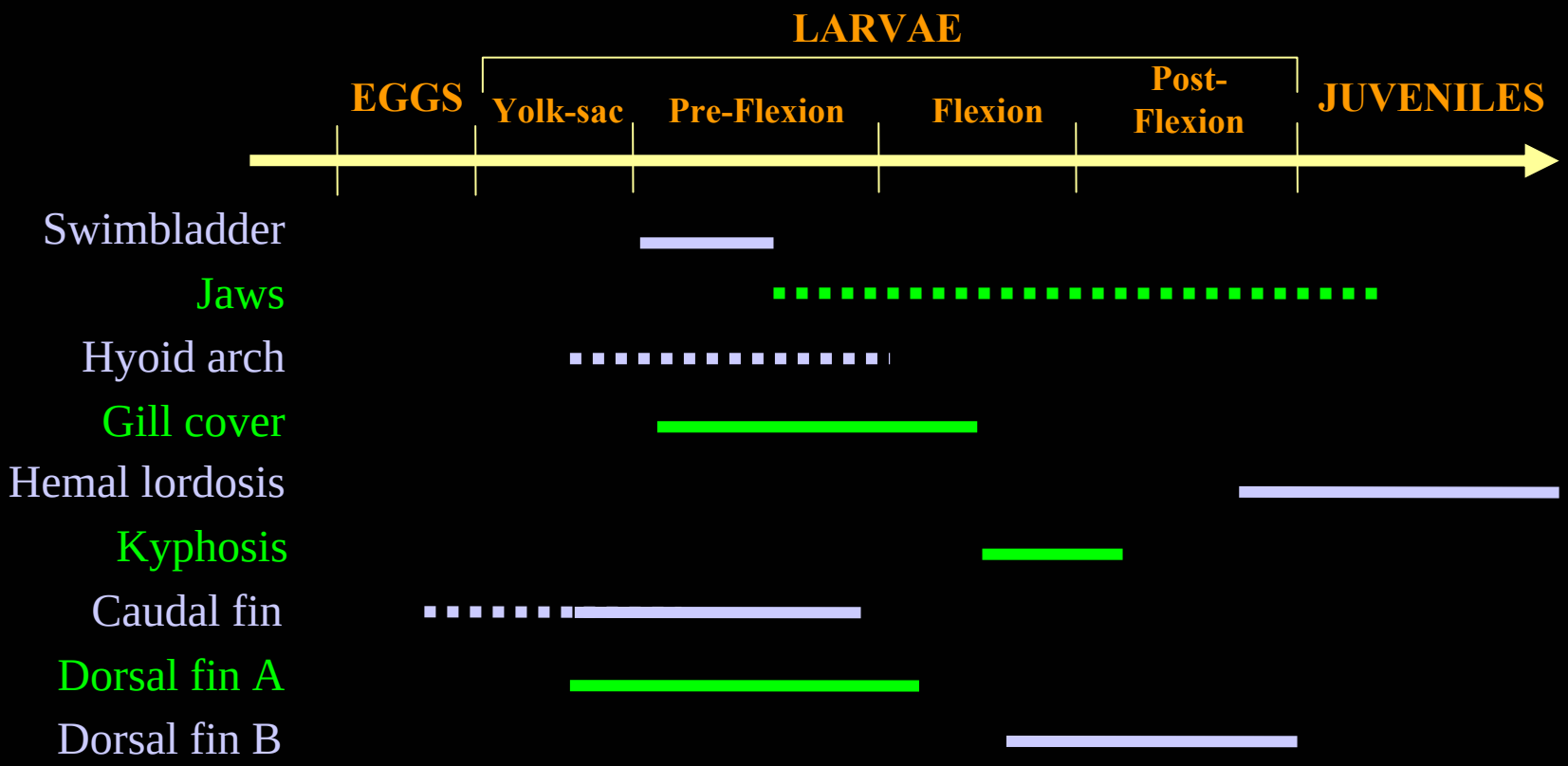


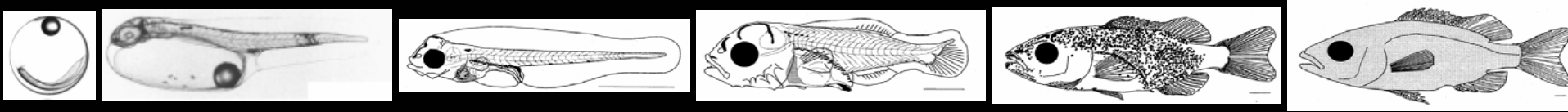


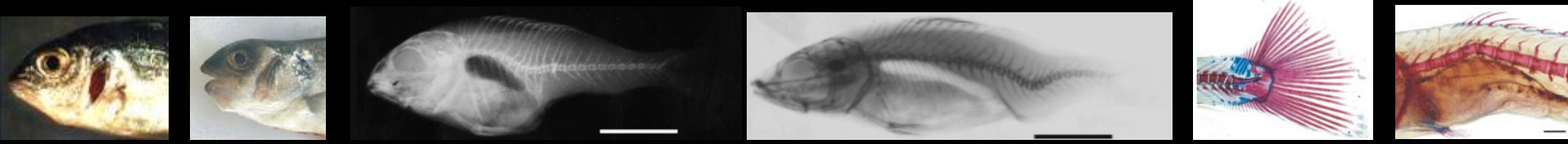
Ontogenetic phases of skeletal deformities

- **Stage of development: the most significant question in the last decade**

  The most important causes change with developmental stage

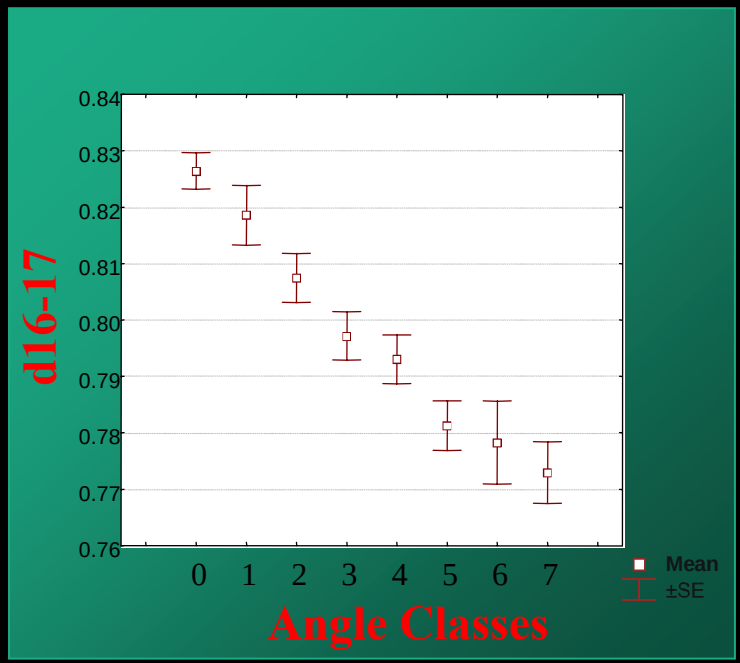


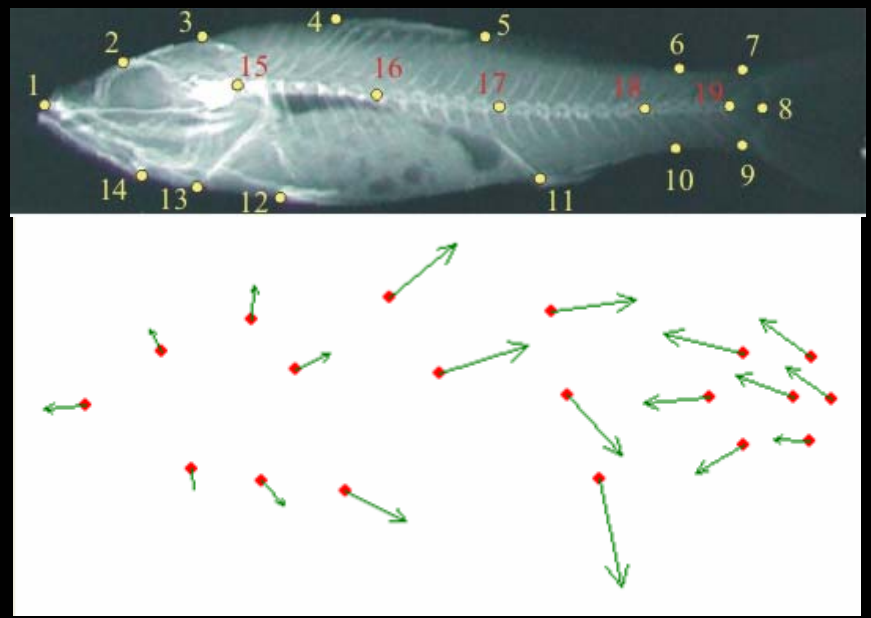




Research Targets

- Causative factors
- Mass selection
- Quality control and Scale of severity





Acknowledgements

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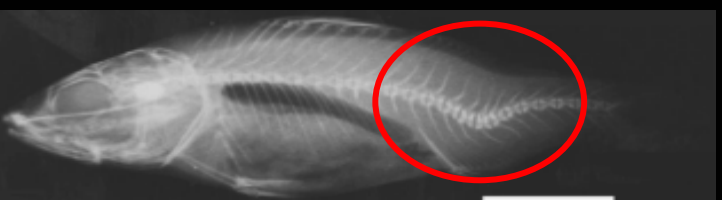

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crd: Prof. N. Stickland