

# Are there latitudinal patterns in the life history traits of pumpkinseed (*Lepomis gibbosus*) in water bodies of Northern Europe?

## Introduction

Introduced from North America in the 19th century, the pumpkinseed is now established in at least 28 countries of Europe and western Asia Minor (Copp & Fox 2007). Except for England (e.g. Villeneuve *et al.*, 2005), all previous studies of pumpkinseed biology under natural thermal conditions have been in southern and central Europe. To understand how the invasive potential of pumpkinseed varies according to local climate across a latitudinal cline (Copp & Fox 2007), the present study examined pumpkinseed biological traits at sites spanning southern Norway to northern France.



Pumpkinseed from the Isle of Wight, England (site EAP, Figure 1)



Pumpkinseed from northern Netherlands (site HSP, Figure 1). Note that this is the first known case anywhere of a yellow operculum spot on this species

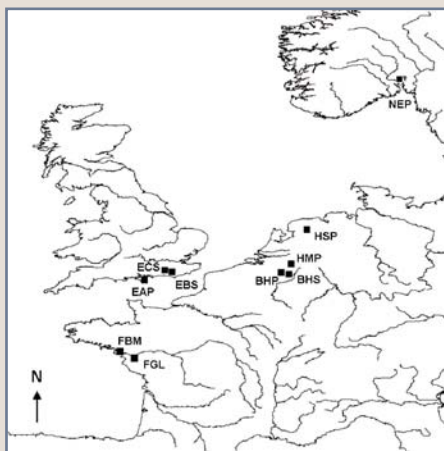


Figure 1: **Study sites:** Locations in northern Europe where pumpkinseed populations were sampled in the summers of 2005 and 2006.

## Related bibliography:

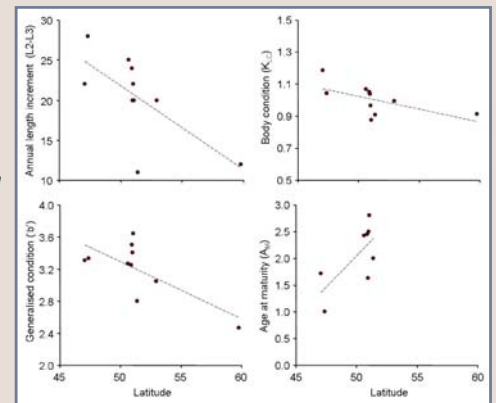
Copp, G.H. & Fox, M.G. 2007. Growth and life history traits of introduced pumpkinseed (*Lepomis gibbosus*) in Europe, and the relevance to invasiveness potential. pp289-306 In: Freshwater Bioinvaders: Profiles, Distribution, and Threats. (F. Gherardi ed.) Springer, Berlin.  
 Villeneuve, F., Copp, G.H., Fox, M.G. & Stakėnas, S. 2005. Interpopulation variation in the growth and life history traits of the introduced sunfish, pumpkinseed *Lepomis gibbosus*, in Southern England. *J. Appl. Ichthyol.* **21**, 275-281.

## Results

In 848 pumpkinseed captured from ten sites, decreases were observed in age 2 to 3 growth increment, generalised fish condition and mean body condition factor with increasing latitude; whereas mean age at maturity increased with increasing latitude.

As with elsewhere in Europe, mean age at maturity decreased significantly with increasing juvenile growth increment (TL at age 2).

Figure 2: **Latitudinal trends:** Relationships between latitude and biological traits of pumpkinseed populations in Northern Europe: TL increment age 2 to 3 ( $r = -0.68$ ;  $P < 0.05$ ), mean Le Cren condition factor ( $r = -0.60$ ;  $0.05 < P < 0.10$ ), generalised condition index, slope 'b' ( $r = -0.72$ ;  $P < 0.05$ ), age at maturity ( $r = 0.70$ ;  $0.05 < P < 0.10$ ).



## Conclusions

Using the relationship in Figure 3 as a potential predictive model of pumpkinseed invasive-ness, five of the ten populations could be provisionally categorized as 'non-invasive', one as 'transitional' and two as 'invasive'.

The present study considerably extends current knowledge of latitudinal variability in the biological traits of introduced pumpkinseed and, within a global warming context, provides new insights as regards pumpkinseed distribution and invasiveness in Europe.

Figure 3: **Potential predictor of pumpkinseed invasiveness:** Mean age at maturity (in years) as a function of mean juvenile growth (TL at age 2) for European pumpkinseed populations – redrawn Figure 6 from Copp & Fox (2007) with superimposed our new data indicated by site code given in Figure 1. The proposed physiological transition phase between non-invasive and invasive pumpkinseed populations is hypothesized as extending from the minimum age at maturity (the 45° line that traces from the intercept, at 'i') and the end of juvenile growth (which for many pumpkinseed populations is age 2; the 45° line that traces through the age 2 intercept with the regression slope, at 'ii').

