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Ecology & Ethology of European Minnow

David Johnson – Hertfordshire's Living Rivers Officer

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European minnow

- Member of the carp family.
- Small (6-9 cm) fish.
- Form large shoals.
- Widespread across Eurasia.
- Found in small headwater streams to large lowland rivers and oxygen rich still waters.

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Panshanger Park Abundance

Observed abundance of European minnow from Environment Agency routine monitoring site "Panshanger Quarry"

Date	NGR	Area	Observed abundance
26/04/2007	TL2916612476	880	1 to 9 [Survey]
13/09/2007	TL2933812418	800	100 to 999 [Survey]
08/10/2008	TL2916912478	800	100 to 999 [Best Run]
04/09/2009	TL2916912478	800	1000 to 9999 [Best Run]
21/09/2010	TL2916912478	400	100 to 999 [Best Run]
21/09/2011	TL2916912478	610	100 to 999 [Best Run]
16/09/2012	TL2916912478	697.08	100 to 999 [Survey]
06/11/2013	TL2916912478	697.08	10 to 99 [Best Run]
07/10/2014	TL2916912478	703	10 to 99 [Survey]

Data from Freshwater Fish Counts for all Species, all Areas and all Years, published by Environment Agency. Licensed under Open Government Licence

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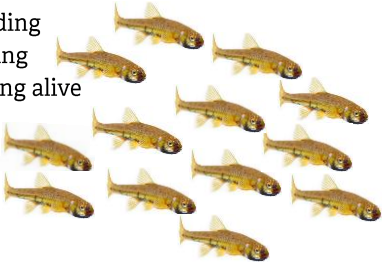
Life as a minnow

- Breeding
- Feeding
- Staying alive



Credit: Niall Benvie/2020VISION

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Staying alive!

Credit: Kletr/Shutterstock

Credit: Bertie Gregory/2020VISION

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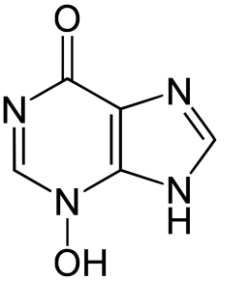
Schreckstoff – The smell of fear



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Alarm substance

- Only produced in physically fit fish.
- Metabolic cost of production.
- Lack of kin selection in shoal mate choice.
- Production of Schreckstoff is altruistic action.

Frisch, K.V. (1942) Uber einen Schreckstoff der Fischhaut und seine biologische Bedeutung. Zeitschrift für vergleichende Physiologie, 29(12) p. 46-145

Wisenden, B.W. and Smith, R.F.J. (1997) The effect of physical condition and shoalmate familiarity on proliferation of alarm substance cells in the epidermis of fathead minnows. Journal of Fish Biology, 50(4) p 799-808

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Don't poop where you eat!

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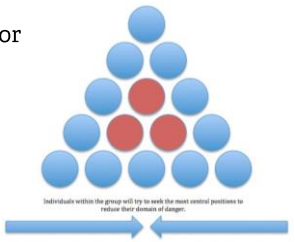
Selfish Herd

- In high "Schreckstoff"/predator environment minnow form tighter shoals.
- Safest in the middle!



Krause, J. (1993) The effect of 'Schreckstoff' on the shoaling behaviour of minnow: a test of Hamilton's selfish herd theory. Animal Behaviour, 45(5) p. 1019-1024

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Environmental influences

- Low habitat complexity = prefer shoaling
- High habitat complexity = prefer "hiding"

Orpwood, J.E., Magurran, A.E., Armstrong, J.D. and Griffiths, S.W. (2008) Minnows and the selfish herd: effects of predation risk on shoaling behaviour are dependent on habitat complexity. Animal Behaviour, 76(1) p. 143-152

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Predator Inspection

- Individual minnow will leave shoal to inspect potential predators.
- Leads to altered individual and shoal response to threat.
- Respond to predator behaviour not just presence.

Magurran, A.E. and Girling, S.L. (1986) Predator model recognition and response habituation in shoaling minnows. Animal Behaviour, 34(2), p. 510-518
Pitcher, T.J., Green, D.A., Magurran, A.E. (1986) Dicing with death: predator inspection behaviour in minnow shoals. Journal of Fish Biology, 28, p. 439-448

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Foraging

- Rate of food location increases with shoal size.
- Prefer shoal mates who are inefficient foragers.
- Can identify poor competitors even in absence of obvious cues e.g. fish size, aggressiveness.

Pitcher, T.J., Magurran, A.E. and Winfield, I.J. (1982) Fish in larger shoals find food faster. Behavioral Ecology and Sociobiology, 10(2), p. 149-151
Metcalfe, N.B. and Thomson, B.C. (1995) Fish recognize and prefer to shoal with poor competitors. Proceedings: Biological Sciences, 259(1355), p. 207-210

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Male breeding ornamentation


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Male breeding ornamentation

- Abdominal "redness" & tubercle numbers positively correlate with swimming performance, body length, gonadosomatic index and condition factor K.
- Potentially acts as an honest signal of health when attracting female mate.

Laie, Y.T., Kekäläinen, J. and Kortet, R. (2013) Male Ornamentation in the European Minnow (*Phoxinus phoxinus*) Signals Swimming Performance. Ethology, 119(12) p. 1077-1085

Protecting Wildlife for the Future

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