

There's something about ... starving sprat!

By H. Baumann

Every year in August, a little nature spectacle unfolds along Germany's Baltic Sea shores. The shallow beach waters are suddenly teeming with billions of little fish – some of them still translucent and so small that they'd easily fit into a match box. The bigger ones may already sport silvery looks ... they're about to metamorphose into juveniles. In Strande, a popular hang-out for hobby sailors near Kiel, yacht owners have known for long what happens in their marina on a calm summer night. The waters around boats and lamp posts seem to be boiling from the innumerable fish trying to feed just below the surface.

"It's quite a sight", one proprietor admits, "but they're so tiny and not worth catching."

In summer 2003, boat owners thus looked quizzically at scientists from the Institute of Hydrobiology and Fisheries Science, who had come all the way from Hamburg to do exactly that. Catch some of these little fish. The biologists seemed very excited. Equipped with a large, strange-looking dip-net and a variety of water buckets they weren't so much interested in dinner but in collecting the tiny critters live.

"The idea was to bring them in our laboratory", explains Myron Peck from the IHF, "we need to find out how they grow under different temperatures and various amounts of food. That's never been done before."

The billions of fish are sprat, scientifically *Sprattus sprattus*. As adults, they probably wouldn't be offended when called 'small herrings', which are in fact their closest relatives. Sprat are pretty common in most European seas, but only in the Baltic they play such an outstanding role for the ecosystem. They're important, both as predators and prey. Cumulatively, sprat eat a lot of zooplankton, mostly small crustaceans known as copepods, and because the fish are so numerous, some researchers suspect them to be capable of significantly reducing their otherwise ubiquitous food source ("top-down control"). Other marine organisms rely on sprat for prey, most of all Baltic cod, but also birds and sea mammals. Humans? Sure. Baltic fishermen catch about 400,000 tons of sprat every year.

One of the things that researchers find most intriguing about Baltic sprat is called recruitment variability. Each fall those fish – the 'recruits' – that survived their initial 3-5 months and reached a size of about 6-9 cm are joining the adult schools. Their number varies, naturally, yet in the case of sprat that can mean everything between 20 and close to 300 billions of fish.

'It depends', scientists like to say.



Early sprat juveniles schooling in the shallow waters of the Strande marina in August 2003. The fish were 25-40 mm in length. (Photo: D.Stepputtis)

Basically, it depends on how many sprat eggs are produced and how many of the eggs and larvae then die along the way. But it's mostly the latter that is so variable and so poorly understood, and new sprat year classes thus regularly turn out to be either much stronger or weaker than expected. Imagine a school director who has no clue whether there will be 20 or 300 first-graders at the beginning of the new term ... Clearly, a lot of knowledge has still to be gathered before the Baltic ecosystem and its variable sprat year classes will be sufficiently understood to become what researchers often refer to as the 'ultimate goal': predictable.

Nowadays, fisheries scientists seem to have an ever growing interest in the little sprat that periodically roam the Baltic beach waters and marinas in such vast numbers. Unbeknownst to them, these fish could be the key to quite some progress in the recruitment question. Simply put, this is because they are in a very interesting but rarely studied stage of their development. They just outgrew what researchers call "the larval phase" but without completing yet their metamorphosis into juveniles that look like small versions of the adult fish. Within this transition, the little youngsters need to grow very fast – about 1 mm every day – and thus critically depend on favourable conditions, most importantly sufficient food and high enough water temperatures. Scientists are also toying with the idea that it matters how densely these sprat schools are actually occurring in the shallow waters. Too many, and the food may soon become scarce ...

“We are still at the very beginning to explore what’s going on in the shallow waters”, says Jens-Peter Herrmann from the IHF, “Research was long focussed on the Baltic basins, for example the Bornholm Basin, where the spawning grounds of sprat are. We’ve never found these sprat juveniles there. Seems like we just looked at the wrong places ...”

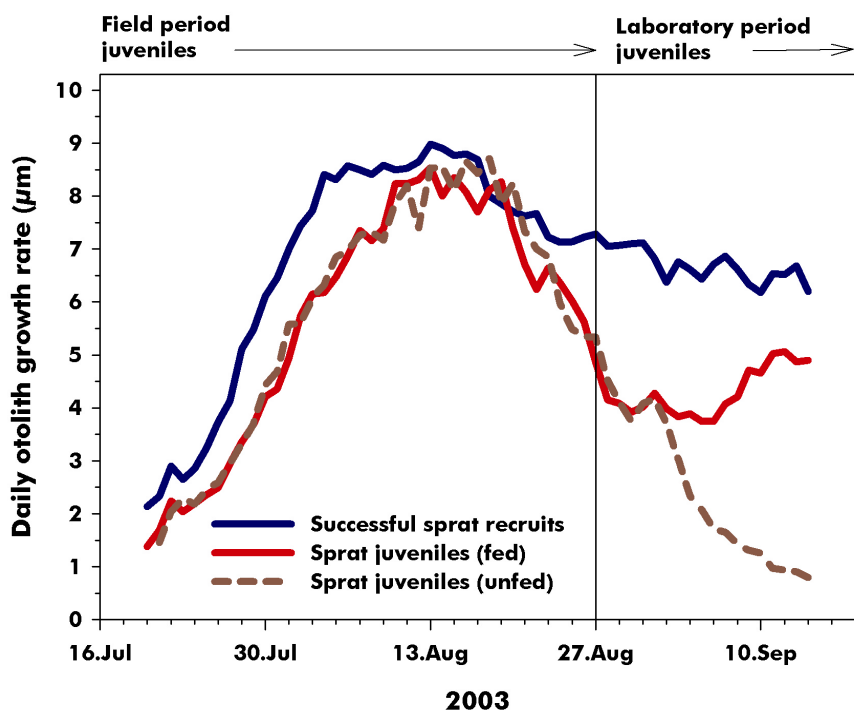
One of the first studies on these little sprat has now been published in the *Journal of Fish Biology* (Baumann et al., 2007), and according to the authors, it contains indeed a surprising message. In 2003, these fish likely suffered from severe food depletion, also known as starvation. The scientists had analysed the microscopic structures in the fishes ear bones, the otoliths, which allow to reconstruct how good or bad the animals had grown just before they were collected in the marina. In contrast to the ‘successful sprat recruits’, which were sampled more than a month later, the fish from the shallow waters showed a dramatic decline in their growth rates, which could not be attributed to anything but food scarcity. The laboratory experiments at the IHF in Hamburg further supported

this conclusion, because the fed sprat juveniles quickly responded with increasing growth rates. Such a starvation event of juvenile fish hasn’t been documented in the scientific literature before, but the scientists argue that it could be a more widespread phenomenon – at least for Baltic sprat – than previously assumed. While the authors also cautiously add that the magnitude and the year-to-year variability of such starvation events is totally unknown, this and other findings of recent studies have identified the need to continue and broaden research in the shallow waters of Baltic Sea shores.

Looks like beach people better get used to the sight of fish-chasing beach scientists ...

References

Baumann, H., Peck, M.A., Götze, H.-E., & Temming A. 2007. Starving early juvenile sprat, *Sprattus sprattus* L., in Western Baltic coastal waters: evidence from combined field and laboratory observations in August/September 2003. *Journal of Fish Biology* 70: 853-866.



Growth histories reconstructed from otolith analysis of sprat juveniles sampled in the Strande marina (red, dark red) and successful sprat recruits sampled in October 2003 in the Western Baltic Sea (blue). A rapid growth decline prior to sampling was apparent only in the juveniles. Re-feeding in the lab elicited increasing growth rates (solid line), while growth declined further and as rapidly in the unfed control group (dashed line).