

# Identification of *Ichthyodinium chabelardi* – a lethal parasitic dinoflagellate infecting pelagic eggs of marine fishes



Alf Skovgaard<sup>I</sup>, Isabel Meneses<sup>II</sup> and Maria Manuel Angélico<sup>II</sup>

I: University of Copenhagen, Department of Biology, Denmark, [alfskovgaard@bi.ku.dk](mailto:alfskovgaard@bi.ku.dk)  
 II: IPIMAR, Instituto de Investigação das Pescas e do Mar, Lisboa, Portugal



## Background

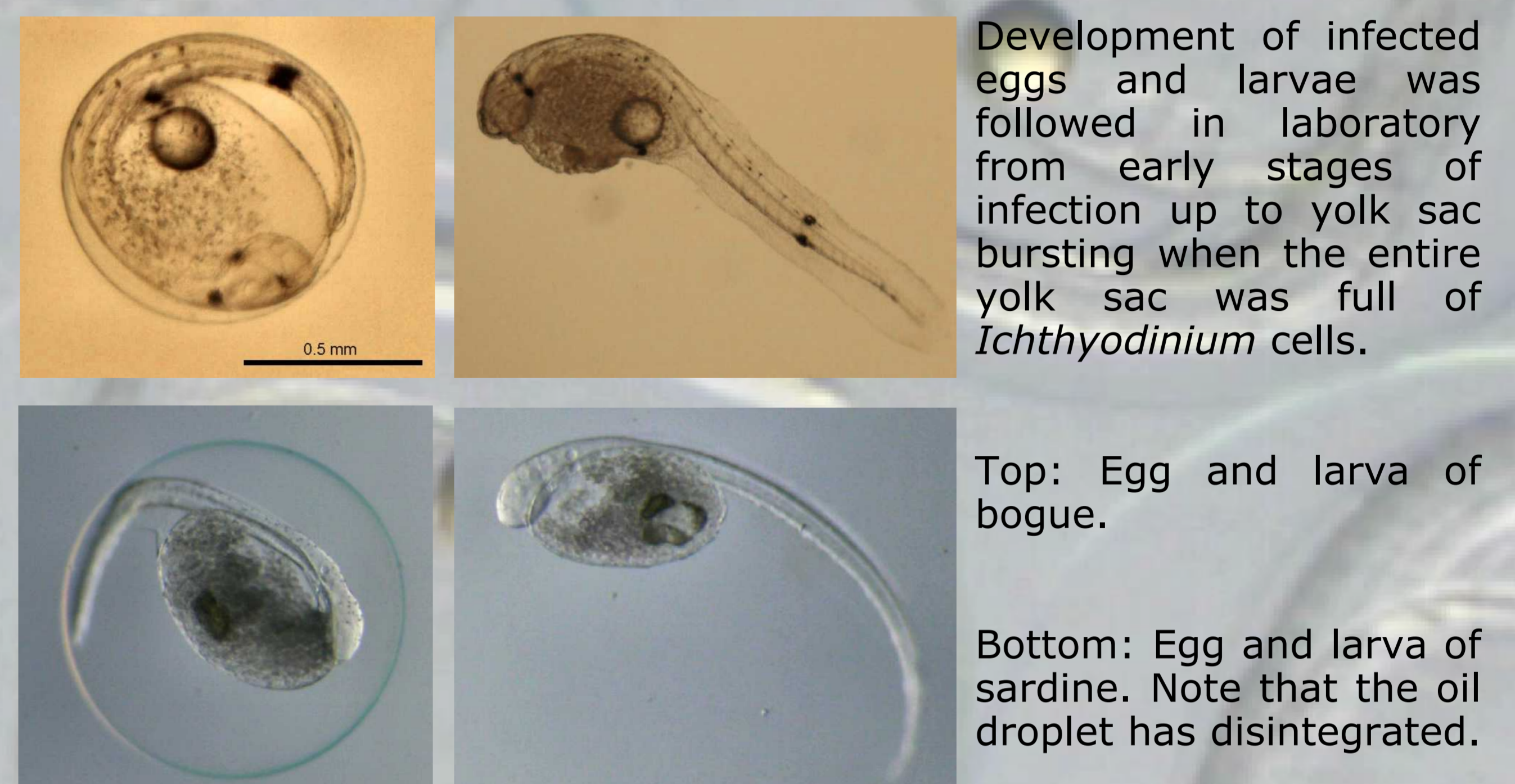
The protistan parasite *Ichthyodinium chabelardi* was first observed infecting eggs of the European sardine (*Sardina pilchardus*) and Pearlsides (*Maurollicus muelleri*)<sup>1,2</sup>. Recently, *Ichthyodinium* spp. have also been found in eggs of Atlantic mackerel (*Scomber scombrus*), horse-mackerel (*Trachurus trachurus*), yellowfin tuna (*Thunnus albacares*), and leopard coral grouper (*Plectropomus leopardus*)<sup>3,4,5,6</sup> in Europe and Asia, and similar parasites are known from eggs of other fish species<sup>7</sup>. *Ichthyodinium* is responsible for a substantial mortality of eggs of commercially important fish, yet our knowledge of its biology and distribution is scarce.

## Identification of hosts and parasites



*Ichthyodinium* was found in eggs of sardine and bogue (*Boops boops*) from coastal waters off Lisbon. Sardine eggs were identified from their morphology. Bogue eggs were identified from their cytochrome b gene sequence. The small subunit (SSU) rRNA gene of *Ichthyodinium* cells was sequenced, and they were identical in *Ichthyodinium* from sardines and bogue. These sequences were, in turn, 97% similar to corresponding sequences from yellowfin tuna and leopard coral grouper from Asia.

## *Ichthyodinium* in sardine and bogue



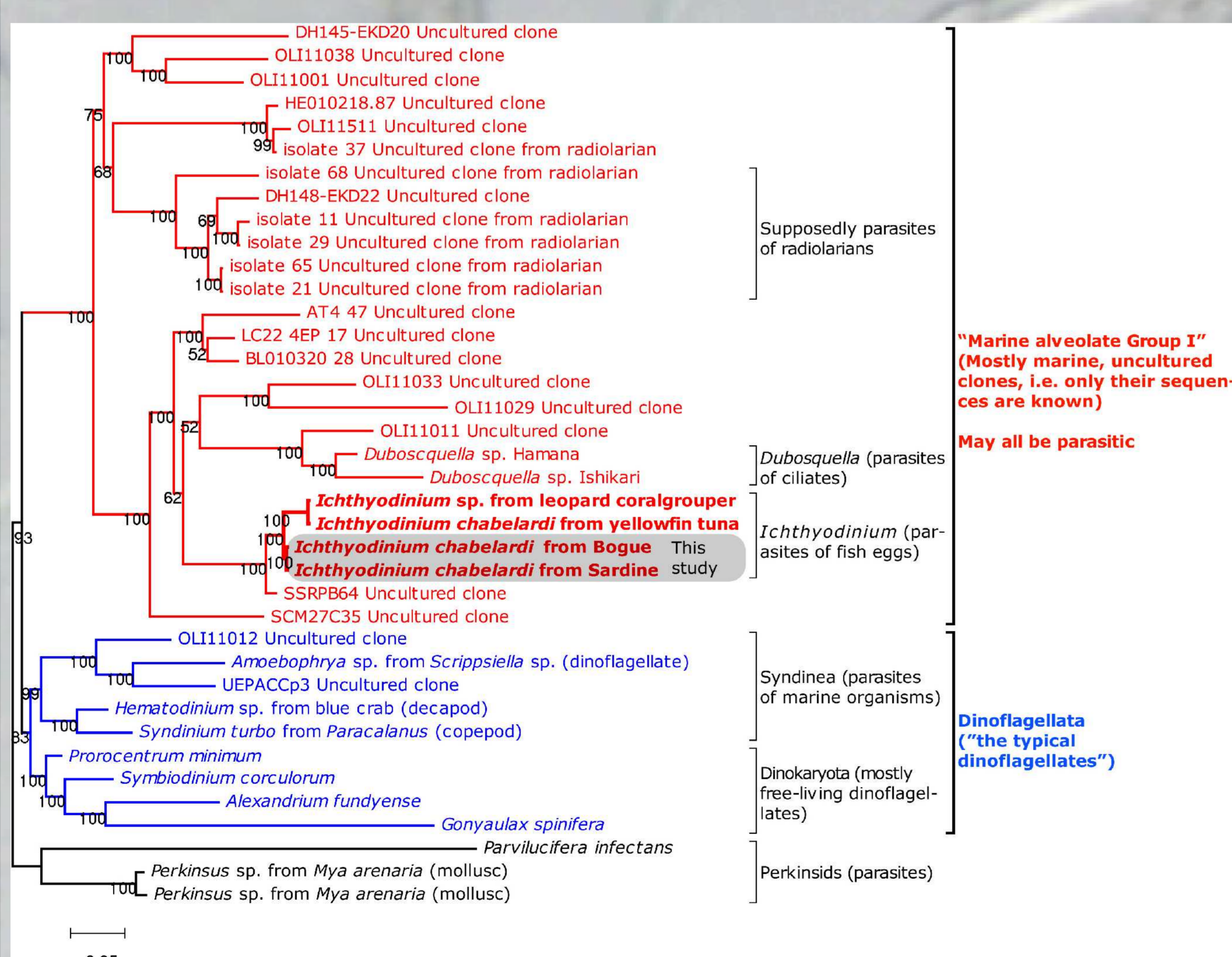
Development of infected eggs and larvae was followed in laboratory from early stages of infection up to yolk sac bursting when the entire yolk sac was full of *Ichthyodinium* cells.

Top: Egg and larva of bogue.

Bottom: Egg and larva of sardine. Note that the oil droplet has disintegrated.

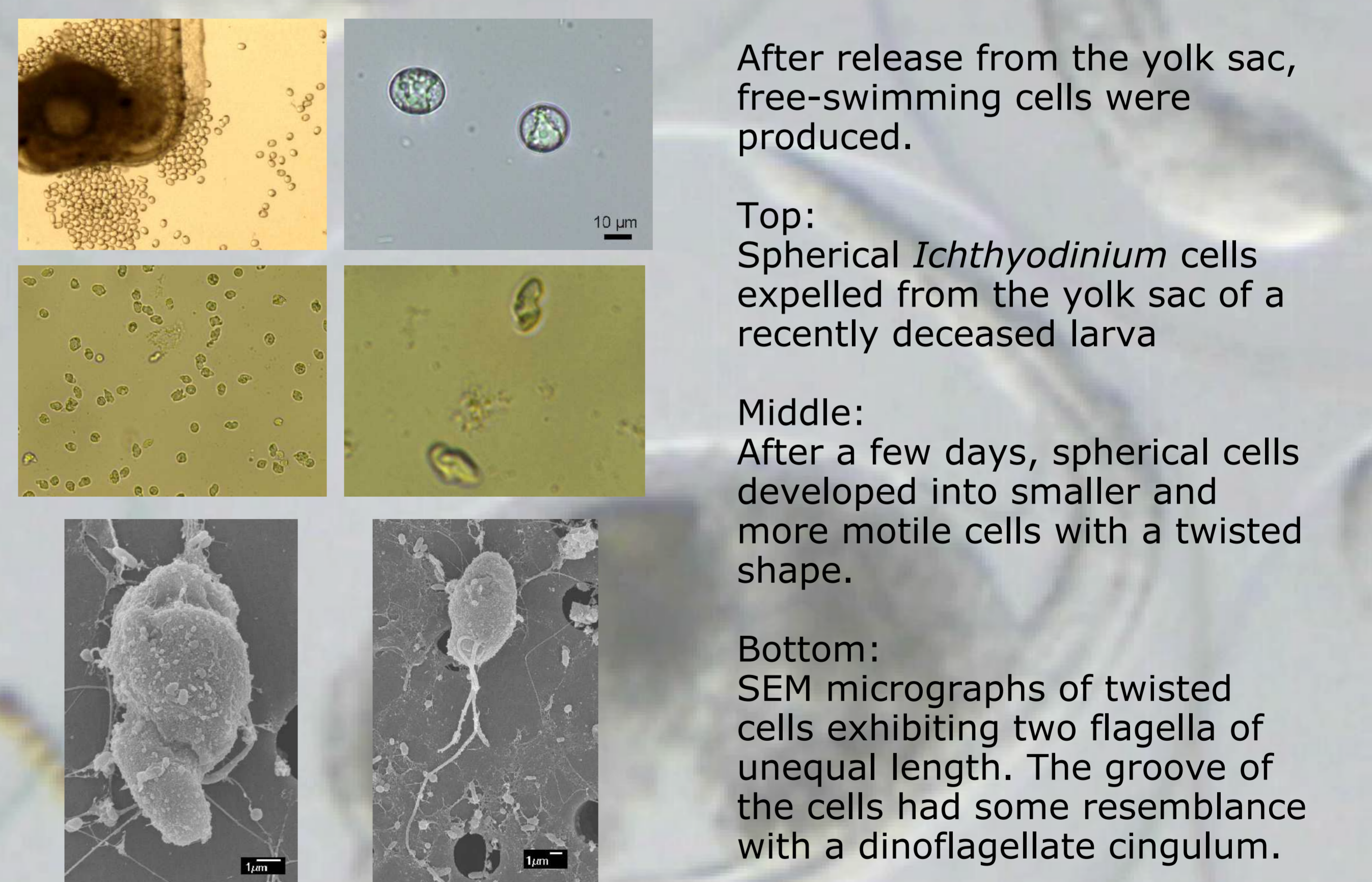
## What is *Ichthyodinium*?

*Ichthyodinium* is traditionally classified as a dinoflagellate. Phylogenetic analyses show that *Ichthyodinium* is an alveolate (together with dinoflagellates, ciliates, apicomplexans, and perkinsids). It clusters with "Marine alveolate Group I" - a group comprising mainly environmental sequences of unknown morphology (= uncultured clones). This group forms a sister group to the typical dinoflagellates.



Phylogenetic tree based on Bayesian inference of 38 SSU rRNA gene sequences of selected alveolates and alveolate-like environmental sequences. Numbers below nodes represent posterior probabilities. The tree is rooted with 3 sequences from perkinsids.

## Free-swimming *Ichthyodinium* cells



After release from the yolk sac, free-swimming cells were produced.

Top: Spherical *Ichthyodinium* cells expelled from the yolk sac of a recently deceased larva

Middle: After a few days, spherical cells developed into smaller and more motile cells with a twisted shape.

Bottom: SEM micrographs of twisted cells exhibiting two flagella of unequal length. The groove of the cells had some resemblance with a dinoflagellate cingulum.

## Conclusions

- Bogue (*Boops boops*) eggs were for the first time reported as hosts for *Ichthyodinium*.
- *Ichthyodinium* spp. have been reported from eggs of around a dozen of marine fishes and it is probable that more hosts will be identified in the future.
- SSU rDNA sequences from *Ichthyodinium* of different host species from Europe were identical. A slight difference was found between *Ichthyodinium* from Europe and Asia.
- *Ichthyodinium* is not a typical dinoflagellate, but it is genetically related to the dinoflagellates.

### References:

- 1 Holland & Cachon (1952) CR Acad Sci III 235:976–977
- 2 Holland & Cachon (1953) Bull Trav Pub Stat A. 4:321–331
- 3 Stratoudakis et al. (2000) J Fish Biol. 57:476–82
- 4 Meneses et al. (2003) J Plank Res. 25:1177–81
- 5 Yuasa et al. (2007) Fish Pathology. 42:59–66
- 6 Mori et al. (2007) Fish Pathology. 42:49–57
- 7 Pedersen & Køie (1994) Dis Aquat Orgs. 19:39–46