



## ***Spraguea* (Microsporida: Spraguidae) infections in the nervous system of the Japanese anglerfish, *Lophius litulon* (Jordan), with comments on transmission routes and host pathology**

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\* On 11<sup>th</sup> March 2011, Japan experienced a powerful earthquake and devastating tsunami. Fukushima Prefecture was badly affected, many people lost their lives with many more currently unaccounted for. Mr Akira Osada, who was Head of Fukushima Prefectural Fisheries Experimental Station during this study, is among those missing since the events of that day. This manuscript is dedicated to him, and to acknowledge the significant contributions he made to Japanese fisheries research.

### **Abstract**

Anglerfish from the genus *Lophius* are a globally important commercial fishery. The microsporidian *Spraguea* infects the nervous system of these fish resulting in the formation of large, visible parasitic xenomas. *Lophius litulon* from Japan were investigated to evaluate the intensity and distribution of *Spraguea* xenomas throughout the nervous system and to assess pathogenicity to the host and possible transmission routes of the parasite. *Spraguea* infections in *L. litulon* had a high prevalence; all fish over 403 mm in standard length being infected, with larger fish usually more heavily infected than smaller fish. Seventy percent of all fish examined had some gross visible sign of infection. The initial site of development is the supramedullary cells on the dorsal surface of the medulla oblongata, where all infected fish have parasitic xenomas. As the disease progresses, a number of secondary sites typically become infected such as the spinal, trigeminal and vagus nerves. Fish with infection in the vagus nerve bundles often have simultaneous sites of

infection, in particular the spinal nerves and along the ventral nerve towards the urinary bladder. Advanced vagus nerve infections sometimes form xenomas adjacent to kidney tissue. *Spraguea* DNA was amplified from the contents of the urinary bladders of two fish, suggesting that microsporidian spores may be excreted in the urine. We conclude that supramedullary cells on the hindbrain are the primary site of infection, which is probably initiated at the cutaneous mucous glands where supramedullary cells are known to extend their peripheral axons. The prevalence of *Spraguea* infections in *L. litulon* was very high, and infections often extremely heavy; however, no associated pathogenicity was observed, and heavily infected fish were otherwise normal.

**Keywords:** *Lophius*, microsporidia, *Spraguea*, supramedullary cells, transmission, xenoma.

### **Introduction**

Microsporidian parasites that form large aggregations of xenomas in the nervous system of anglerfish from the genus *Lophius* were first reported by Thélohan (1895), who described an infection of the

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