DSSG25: Parasites in the deep

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Introduction:

Even though parasites are often neglected, they thrive in almost every environment and they contribute a major part to the marine biodiversity. Parasites can be crucial players in food webs and ecosystem functioning. Parasitological studies link the life cycle biology of the parasites with the ecology of their fish host, which is dependent on the habitat the host lives in. So far life cycles, host relationships, distribution and zoogeography of parasites in the deep-sea have not been studied in detail (Bray 2005).

Around 10-15% (~3200 – 4800 species) of the global fish fauna occur in the deep-sea and quite a diverse range of parasites has been described for deep-sea fishes. A total of 671 parasite species is known from 421 fish species (Klimpel et al. 2009). Comprehensive studies on deep-sea fishes in the southern hemisphere are rare, as most of these studies have been carried out in the northern hemisphere. The most species-rich parasite fauna occurs between 200 and 1000m, predominated by Digenea, Cestoda, Nematoda and Crustacea and their diversity and abundance decrease from 1000 to 3000m. Only a few parasite records are available below 3000m and the lowest depth a parasite was recorded from is 5340m to date (Klimpel et al. 2009).

Parasites in the deep-sea must adapt to an environment where contact between successive hosts in a life cycle is supposedly very rare. The successful parasite transmission depends on the temporal and spatial distribution of their invertebrate and vertebrate hosts. Parasitological studies of deep-sea fishes are already scarce, but virtually nothing is known about deep-sea invertebrates. There is still no real understanding of the variances in diversity in different habitats and zoogeographical regions. Its accessibility remains one of the main hurdles of the deep-sea.

The species of interest here was the deep-sea eel *Simenchelys parasitica* Gill, 1879. This fish species is distributed in the Western Pacific as well as the Eastern and Western Atlantic and its depth range extents from 136 to 2620m. *Simenchelys parasitica* feed on invertebrates and fishes, but are also reported to be parasitic on other fishes (Froese & Pauly 2015). The only known parasite infecting *S. parasitica* is the Digenea *Hypertrema ambovatum* (Manter 1960), occurring between 200 and 2567m (Klimpel et al. 2009). The aim of this study was to determine the parasite fauna of *S. parasitica* in the Kermadec Trench, New Zealand.

Material and Methods:

Specimens of *S. parasitica* were caught with traps between 1000 and 1500m in the Kermadec Trench, New Zealand in 2013. On board of RV Kaharoa the gastro-intestinal tracts of 60 fish were removed and stored in ethanol (70%) for later dissection. The intestinal tracts were dissected and parasites were isolated in the labs at Edinburgh Napier University. Isolated parasites were fixed in AFA (alcohol, formalin, acetic acid) and stored in 70% EtOH until further identification. So far the parasites have been studied by means of light microscopy and molecular techniques. Parasites were stained after standard protocols for Digenea and Cestoda (Rueckert et al. 2008), while Nematoda were cleared using the methods by Riemann (1988).

DNA was isolated from pieces of nematode worms using the MasterPure complete DNA and RNA purification kit (EPICENTRE). Target genes were amplified by PCR using puReTaq Ready to go PCR beads (GE Healthcare).

PCR products corresponding to the expected size were gel isolated and cloned into the pSC-A-amp/kan vector using the StrataClone PCR cloning kit (Agilent Technologies). Up to eight cloned plasmids for each PCR product were digested with *Eco* R1 and inserts were screened for size with gel electrophoresis. Two clones were sequenced with ABI Big-Dye reaction mixture using vector primers orientated in both directions. The gene sequences were identified by BLAST analysis.

Results and Discussion:

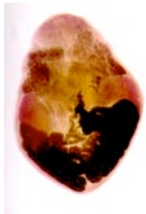
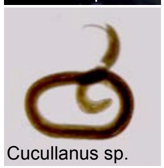
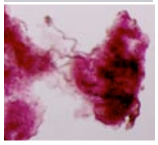
Three parasite taxa were isolated from 60 *S. parasitica*. In addition to the known Digenea, I was able to isolate three cestode species and probably four nematode species from this fish, all of which represent new host records apart from the digenean (Table 1). The molecular species identification is still ongoing. Most abundant in *S. parasitica* was the Digenea *Hypertrema ambovatum*, with 17 infected fish and an intensity of up to 29 per fish. The least abundant was the larval Cestoda *Scolex pleuronectis*, infecting only one fish with one specimen.

Simenchelys parasitica acts mostly as intermediate, but also as final host for the parasites found. Only the Digenea *H. ambovatum* was found in an adult life-stage, all other parasites were larval-stages. Utilizing the life cycles of parasites, one can infer the position of the host within the food web. The first intermediate host of *Anisakis simplex* for example is a planktonic crustacean and the final host is a marine mammal, so *S. parasitica* acts as the second intermediate host. This means that for a successful transmission of *A. simplex* crustaceans as well as mammals must at least temporarily inhabit the Kermadec Trench.

Funds spent and future directions:

This grant enabled me to by some of the consumables for the molecular work (e.g. *Eco* R1, StrataClone PCR cloning kit, DNA purification kit). Unfortunately, the trials for the molecular identification have not been successful yet, but I am still trying to amplify the genes for a more in depth identification and possibly molecular phyologenetic analyses. Depending on the outcome of this I am planning to publish these data in collaboration with Alan Jamieson and Thomas Linley.

Table 1: Prevalence (%), mean intensity, intensity and images of parasites infecting *S. parasitica.*

		Simenchelys parasitica (n=60)		
Parasite taxa	n infected	Prevalence (%)	Mean intensity (intensity)	Images
DIGENEA (*Hypertrema ambovatum*)	17	28.3	7 (1-29)	
NEMATODA (e.g. *Anisakis*, *Cucullanus*)	10	16.7	1.5 (1-3)	 
CESTODA *Scolex pleuronectis*	1	1.7	2 (2)	
CESTODA Trypanorhyncha (*Hepatoxylon*, Tentaculariidae)	5	8.3	1 (1)	 

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