Supplementary Material

1. Supplementary Tables and Figures

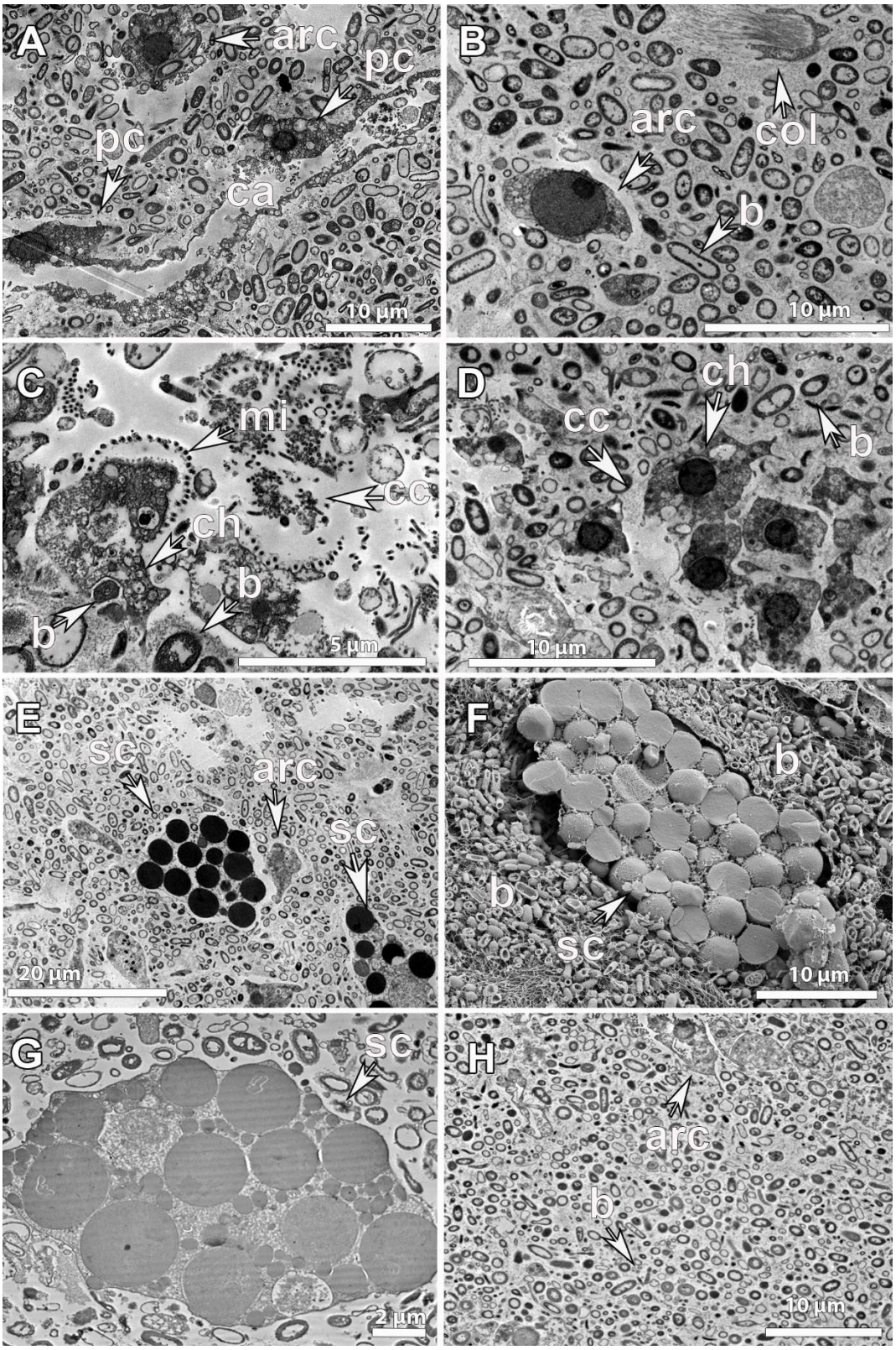
Table S1. Number of specimens with gametes collected from each species, indicating their reproductive status, the collection date, Research vessel, location and depth.

Species	Reproductive status	Specimens with gametes	Collection date	Location (expedition Name)	Coordinates	Depth
G. phlegraei	Female	0	September, 2011	North of Svaldbard	80° 32.3115'N, 15° 21.69708'E	215 m
	Male	0				
	Female	1	May, 2017	Hordaland coast (RV "K. Bonnevie")	59° 52.797' N, 4° 42.311'E	224-230m
	Male	3				
	Female	0	June, 2017	Korsfjiord		80 m
	Male	0				
	Female	1	July, 2017	Sula reef (RV "G.O. Sars")	64° 4.494'N, 08° 1.62 'E	267-293m
	Male	1				
	Female	1	August, 2017	Tromsøflaket, western Barents Sea (RV "G.O. Sars")	71° 35.22'N, 21° 22.5'E	333 m
	Male	3				
	TOTAL	**10**				
G. macandrewii	Female	1	September, 2011	North of Svaldbard	80° 32.3115'N, 15° 21.69708'E	215 m
	Male	0				
	Female	1	September, 2016	Skorpeodden, Korsfjord, Norway (RV "Hans Brattstrøm")	59° 58.8790'N, 05° 22.4371´E	97-332m
	Male	0				
	Female	0	September, 2016	W Rosemary Bank Seamount (RV "Scotia")	59°25′N, 10°15′W	1304m
	Male	0				
	Female	6	May, 2017	Hordaland coast (RV "K. Bonnevie")	59° 52.797' N, 4° 42.311'E	224-230m
	Male	3				
	Female	0	June, 2017	Korsfjiord (RV "Hans Brattstrøm")		80 m
	Male	0				
	Female	1	July, 2017	Sula reef (RV "G.O. Sars")	64° 4.494'N, 08° 1.62 'E	267-293 m
	Male	1				
	Female	0	August, 2017	Tromsøflaket, western Barents Sea (RV "G.O. Sars")	71° 35.22'N, 21° 22.5'E	333 m
	Male	0				
	TOTAL	**13**				
G. barretti	Female	0	September, 2016	Skorpeodden and Langenuen , Korsfjord, Norway (RV "Hans Brattstrøm")	59° 58.8790'N, 05° 22.4371´E / 59° 52.3700'N - 05° 32.9939´E	97-332m
	Male	0				
	Female	5	September, 2016	W Rosemary Bank Seamount (RV "Scotia")	59°25′N, 10°15′W	1304m
	Male	6				
	Female	0	May, 2016			

	Male	0		Kosterfjord,West of Yttre Vantenholmen (RV "Nereus")	58° 52.574'N, 11° 06.089'E	88-94 m
	Female Male	1 0	May, 2017	Hordaland coast (RV "K. Bonnevie")	59° 52.797' N, 4° 42.311'E	224-230m
	Female Male	0 1	June, 2017	Korsfjiord (RV "Hans Brattstrøm")		80 m
	Female Male	1 0	July, 2017	Sula reef (RV "G.O. Sars")	64° 4.494'N, 08° 1.62 'E	267-293 m
	Female Male	1 2	August, 2017	Tromsøflaket, western Barents Sea (RV "G.O. Sars")	71° 35.22'N, 21° 22.5'E	332-333 m
	Female Male	0 0	April, 2019	Krugglöbranten (RV "Nereus")	58° 53.10'N, 11° 06.04'E	89-90m
	TOTAL	**17**				
G. hentschheli	Female Male	3 1	June, 2016	Schulz Bank (RV "G.O. Sars")	73° 58.959'N, 07° 31.422'E 73° 58.959'N, 07° 31.422'E	640 m
	Female Male	3 1	August, 2017		73° 47.43'N, 06° 51.19'E 73° 47.43'N, 06° 51.19'E	1652-2959m
	TOTAL	**8**				
G. atlantica	Female Male	4 0	September, 2011/2012/ 2015/2016	W Rosemary Bank Seamount (RV "Scotia")	59°25′N, 10°15′W	660-1304m
	Female Male	2 2	September, 2016	Skorpeodden and Langenuen , Korsfjord, Norway (RV "Hans Brattstrøm")	59° 58.8790'N, 05° 22.4371´E / 59° 52.3700'N - 05° 32.9939´E	97-332m
	Female Male	0 1	May, 2017	Hordaland coast (RV "K. Bonnevie")	59° 52.797' N, 4° 42.311'E	224-230m
	Female Male	1 0	June, 2017	Korsfjiord (RV "Hans Brattstrøm")		80 m
	Female Male	0 1	July, 2017	Sula reef (RV "G.O. Sars")	64° 4.494'N, 08° 1.62 'E	267-293m
	TOTAL	**11**				

Table S2. Measurements of volume and area for each of the *Geodia* spp. based on published or observed dimensions (diameter, thickness) (Cárdenas et al., 2013; Rapp, personal communication; personal observations from photos of the collected material) for *Geodia* spp. (these values are indicated in red). The four *Geodia* spp. were considered to have a spherical shape, except for *G. atlantica* which was considered to have a hollow cone shape.

		Shape of sphere				***Shape of cone***
		G. phlegraei	***G. macandrewii***	***G. barretti***	***G. hentscheli***	***G. atlantica***
average diameter (cm)		15	20	16.02	10	-
r (cm)		15/2	20/2	16.02/2	10/2	-
r (cm)		7.5	10	8	5	-
volume (cm^3)	$4/3 \times \pi \times r^3$	**1767**	**4189**	**2159**	**524**	-
area (cm^2)	$4 \times \pi \times r^2$	**707**	**1256**	**806**	**314**	
external diameter (cm)		-	-	-	-	70
thickness (cm)		-	-	-	-	3
internal diameter (cm)		-	-	-	-	(70-2x3)
external r (cm)		-	-	-	-	70/2
internal r (cm)		-	-	-	-	64/2
hight (cm)		-	-	-	-	40
volume (cm^3)	$\pi \times r^2 \times h / 3$	-	-	-	-	**8419**
area (cm^2)	$\pi \times r \times s$					**5841**
$s = \sqrt{r^2 + h^2}$	r, external r	-	-	-	-	


A
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H
arc
b
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Figure S1. General description of the cells in the mesohyl of *Geodia* spp. (A), pinacocytes (pc) (~10 µm) around the canals (ca) and archaeocytes within the mesohyl of *G. barretti* from Sula reef in July. **(B),** colenocytes (col) producing collagen and archaeocytes (5-7 µm) in the mesohyl full of bacteria from the same specimen. **(C),** choanocyte chamber, with projections of the collar microvilli (mi) of the choanocytes. A choanocyte (ch) phagocytizing a bacterium (b) from the same specimen. **(D),** the total choanocyte chamber (cc) had a length of ~10 µm and each choanocyte measured ~5 µm in *G. macandrewii* from Korsfjord in September. **(E),** Spherulous cells (sc) 18-20 µm, with electrodense spherules in the mesohyl. **(F),** a close-up of a spherulous cell taken with a scanning electron microscope (SEM), and surrounded by bacteria (b) in the mesohyl of *G. barretti* from Korsfjord, in September**. (G),** a spherulous cell of *G. atlantica* collected in Korsfjord in September. **(H),** the mesohyl with few sponge cells and numerous bacterial symbionts (b), in *G. barretti* from Tromsøflaket, western Barents Sea in August**.**

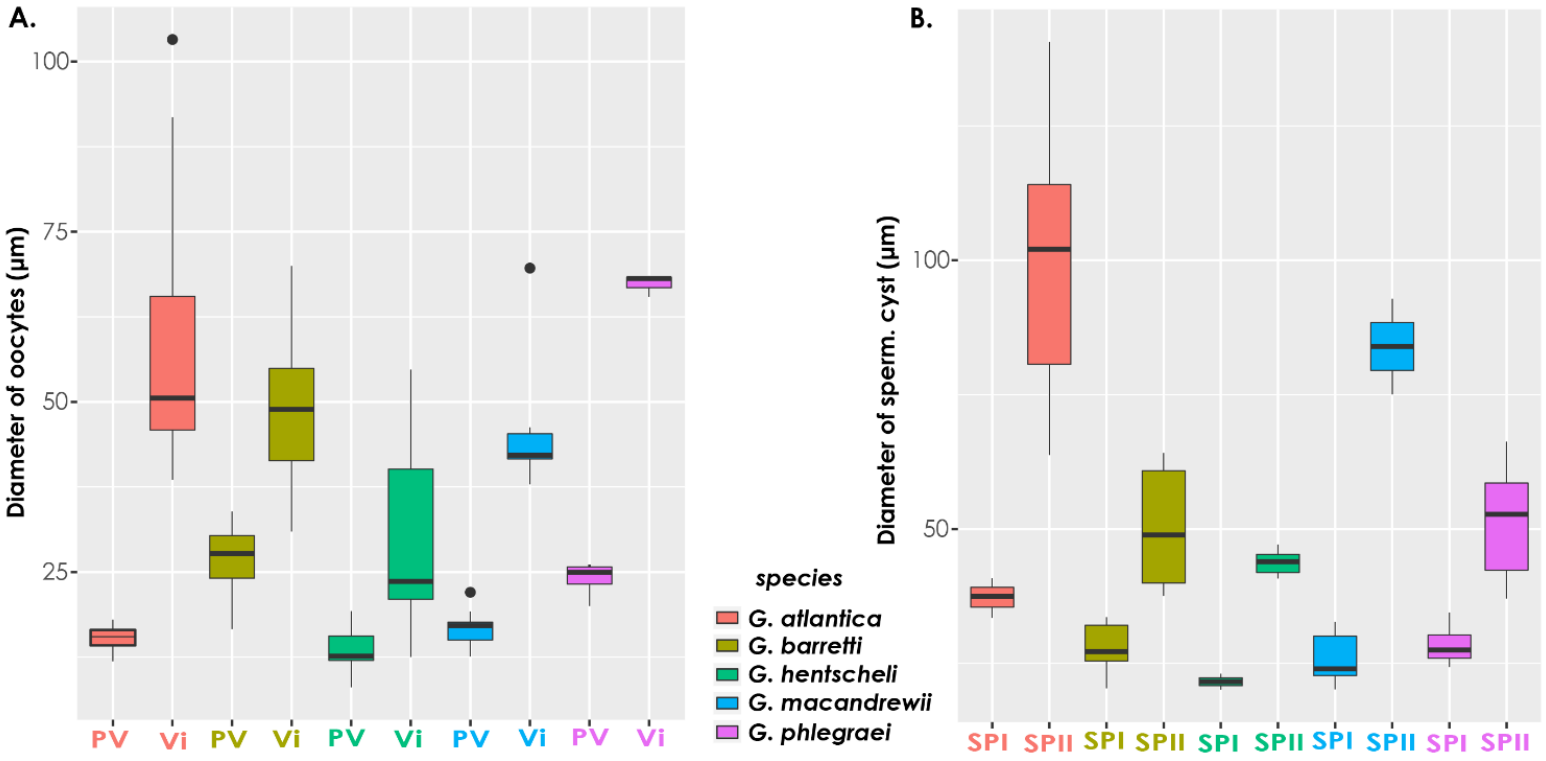

Figure S2. (A), average size of previtellogenic and vitellogenic oocytes in each species. **(B),** average size of spermatic cysts in early (SP_I) and late development (SP_II) in each species.

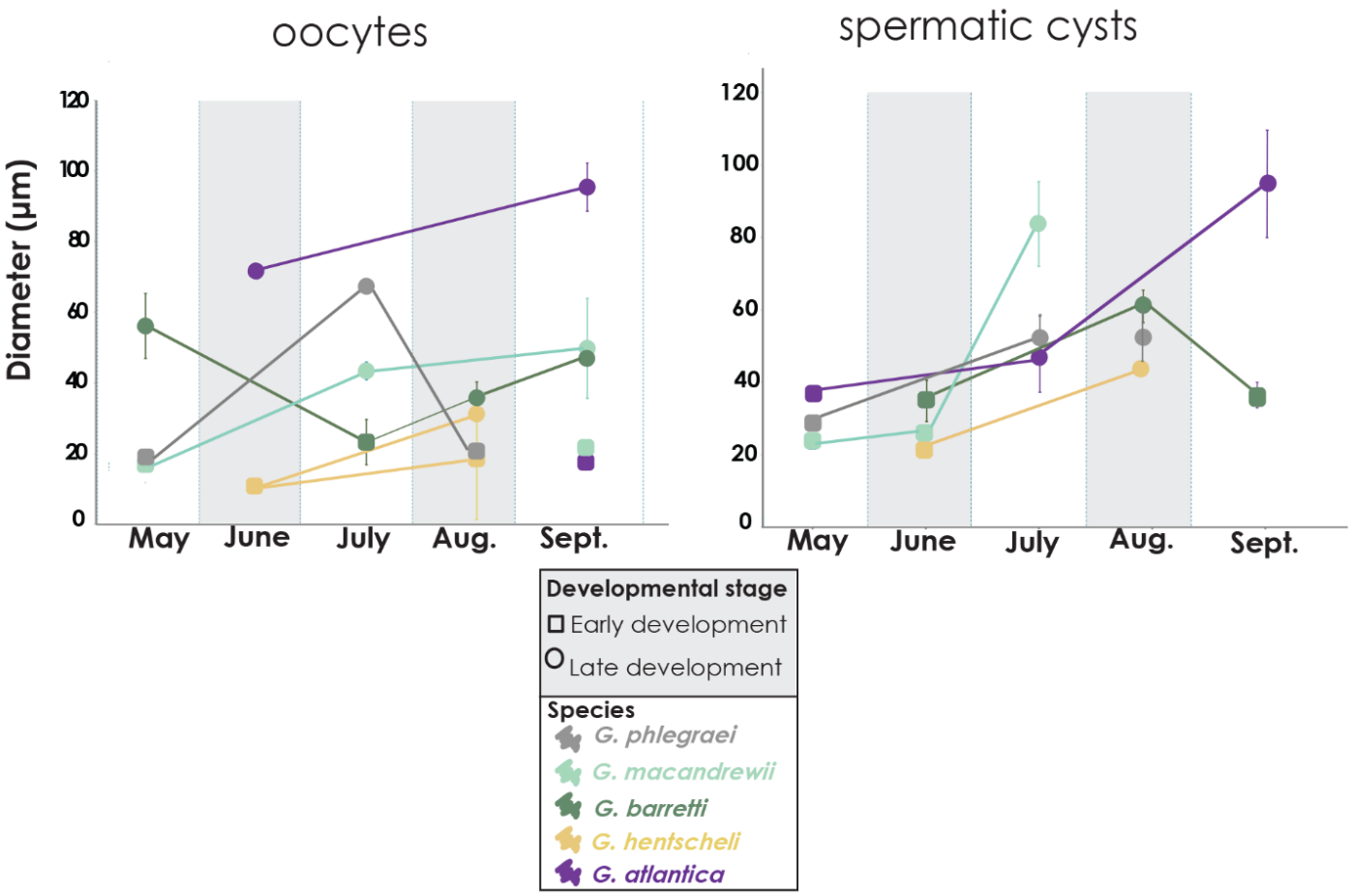

Figure S3. Average size and standard deviation of female previtellogenic and vitellogenic oocytes and male early and late spermatic cysts for all the studied species and months collected.

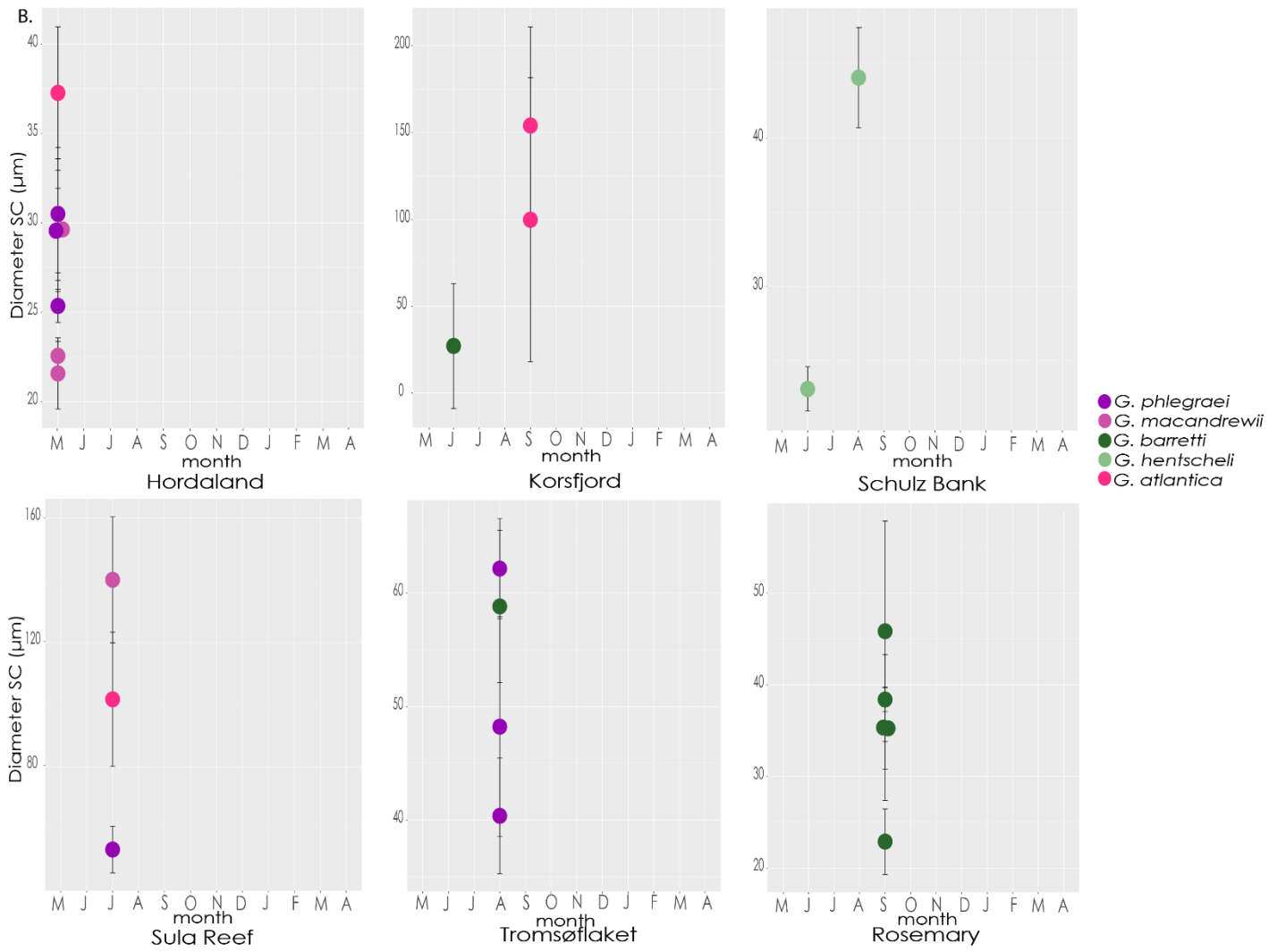

Figure S4. Average diameter and standard deviation of spermatic cysts (SC) from each specimen of each species collected throughout the different months and locations.