Ecography **ECOG-04963**

Llopis-Belenguer, C., Blasco-Costa, I., Balbuena, J. A., Sarabeev, V. and Stouffer, D. B. 2019. Native and invasive hosts play different roles in host–parasite networks. – Ecography doi: 10.1111/ecog.04963

Appendix 1

Table A1. Fish sample sizes by host species, seasons and localities. (a) Sea of Azov; (b) Sea of Japan.

(a)		*Mugil cephalus*	*Planiliza haematocheilus*
Spring	Kerch Strait	32	28
	Molochny Estuary	0	25
	Obitochny Bay	0	22
	Sivash Lake	15	0
Summer	Kerch Strait	60	71
	Molochny Estuary	0	18
	Obitochny Bay	0	26
	Sivash Lake	0	84
	Utluksky Estuary	0	29
Autumn	Balaklava Bay	30	0
	Kerch Strait	0	31
	Molochny Estuary	0	14
	Sivash Lake	48	40
	Taganrog Bay, Mariupol	0	27
	Utluksky Estuary	0	12

(b)		*Mugil cephalus*	*Planiliza haematocheilus*
Spring	Artemovka Delta	0	24
	Kiyevka Bay	25	0
	Razdol'naya Delta	0	23
Summer	Artemovka Delta	0	6
	Kiyevka Bay	31	0
	Razdol'naya Delta	0	34
Autumn	Posiet Bay	0	59
	Razdol'naya Delta	0	58

Appendix 2

Table A1. Number of individuals of each species per role. Sea of Azov, whole parasite community, cz weighted analysis.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	377	42	8	0
Mugil cephalus	140	36	9	0

Table A2. Number of individuals of each species per role. Sea of Azov, actively transmitted parasite community, cz weighted analysis.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	395	4	7	0
Mugil cephalus	155	1	3	0

Table A3. Number of individuals of each species per role. Sea of Azov, trophically transmitted parasite community, cz weighted analysis.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	270	5	4	0
Mugil cephalus	136	32	15	0

Table A4. Number of individuals of each species per role. Sea of Azov, ectoparasite community, cz weighted analysis.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	403	0	5	0
Mugil cephalus	114	0	3	0

Table A5. Number of individuals of each species per role. Sea of Japan, whole parasite community, cz weighted analysis.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	186	12	5	1
Mugil cephalus	54	0	2	0

Table A6. Number of individuals of each species per role. Sea of Japan, actively transmitted parasite community, cz weighted analysis. Note: the original web contained 251 host individuals. However, only 250 hosts are included in this table because one host formed its own module. This host did not have z score (within-module links). Consequently, it could not be assigned to a role category.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	192	0	7	0
Mugil cephalus	47	0	4	0

Table A7. Number of individuals of each species per role. Sea of Japan, trophically transmitted parasite community, cz weighted analysis.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	187	6	3	0
Mugil cephalus	42	0	2	0

Table A8. Number of individuals of each species per role. Sea of Japan, ectoparasite community, cz weighted analysis. Note: the original web contained 241 host individuals. However, only 240 hosts are included in this table because one host formed its own module. This host did not have z score (within-module links). Consequently, it could not be assigned to a role category.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	165	20	8	1
Mugil cephalus	43	0	3	0

Appendix 3

We performed season-specific modularity and cz analyses of whole weighted databases to know if it exists a seasonal effect on species roles. As for the global analyses, we tested whether individuals of both fish species were similarly distributed within each of the four role categories for each season and sea, independently, by means of Fisher's exact test. Then, we tested by 10 000 replications: (a) if the number of peripherals of *P. haematocheilus* (Ph) differed from the number expected by chance in comparison to the observed number of peripherals of *M. cephalus* (Mc); (b) if the number of peripherals of *M. cephalus* differed from the number expected by chance in comparison to the observed number of peripherals of *P. haematocheilus*.

Sea of Azov – Spring

- Matrix size: 122 (individual hosts: 75 Ph; 47Mc) × 30 (parasite spp)
- Fisher test: p value = 0.1277. Individuals of both fish species are similarly distributed within each of the four role categories.
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Table A1. Number of individuals of each species per role.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	66	6	3	0
Mugil cephalus	46	0	1	0

- 10 000 replications:

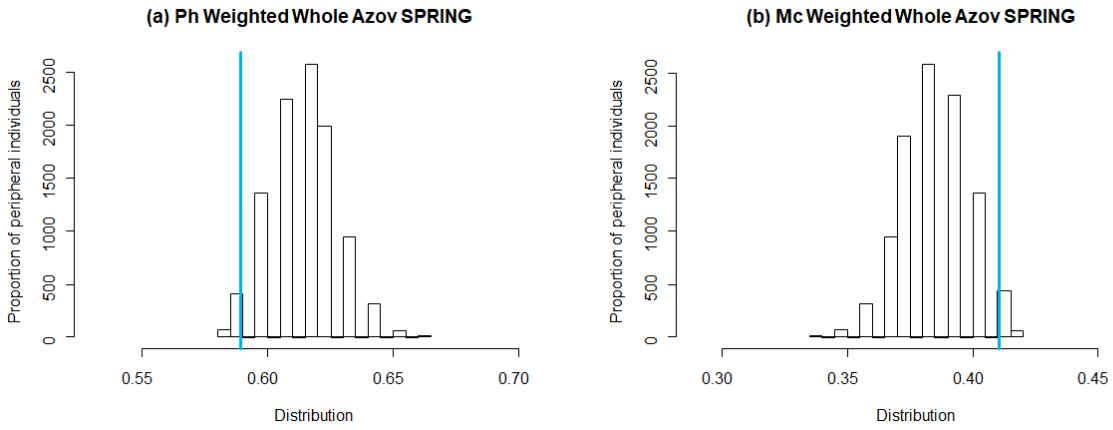

Figure A1. Observed proportion of peripheral individuals of (a) *Planiliza haematocheilus* (Ph) and (b) *Mugil cephalus* (Mc) as peripherals (blue lines, non-significant differences) and proportions found in 10 000 replications (white bars).

Sea of Azov - Summer

- Matrix size: 288 (individual hosts: 228Ph; 60 Mc) × 29 (parasite spp)
- Fisher test: p-value = 3.393×10^{-09}. Individuals of both fish species are NOT similarly distributed within the four role categories.

Table A2. Number of individuals of each species per role. Note: the original web contained 288 host individuals. However, only 286 hosts are included in this table because two hosts formed their own modules. These hosts did not have z scores (within-module links). Consequently, they could not be assigned to a role category.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	206	11	9	0
Mugil cephalus	37	21	1	1

- 10 000 replications:

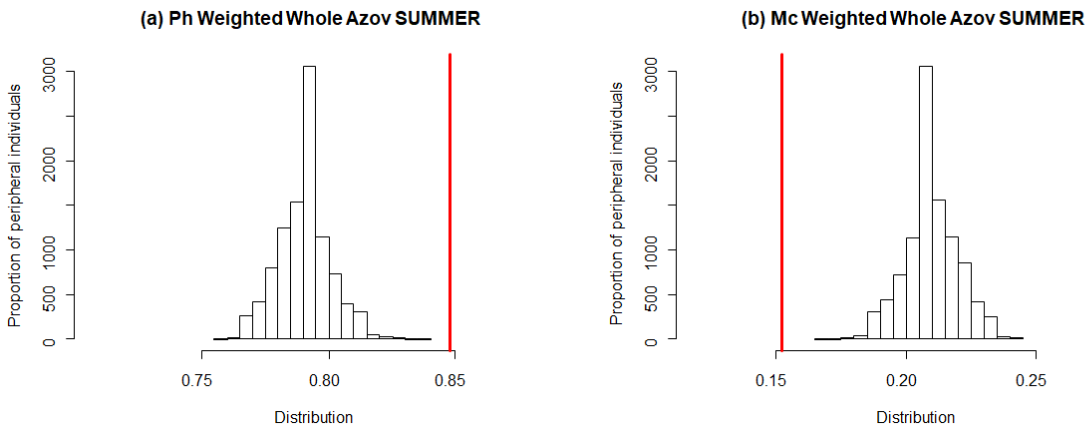

Figure A2. Observed proportion of peripheral individuals of (a) *Planiliza haematocheilus* (Ph) and (b) *Mugil cephalus* (Mc) as peripherals (red lines, significant differences) and proportions found in 10 000 replications (white bars).

There are more individuals of *P. haematocheilus* (invader) playing a peripheral role than expected by chance.

Sea of Azov – Autumn

- Matrix size: 202 (individual hosts: 124; 78Mc) × 30 (parasite spp)
- Fisher test: p-value = 0.008613. Individuals of both fish species are NOT similarly distributed within each of the four role categories.

Table A3. Number of individuals of each species per role.

	Peripheral	Connector	Module hub	Netork hub
Planiliza haematocheilus	110	10	4	0
Mugil cephalus	56	16	6	0

- 10 000 replications:

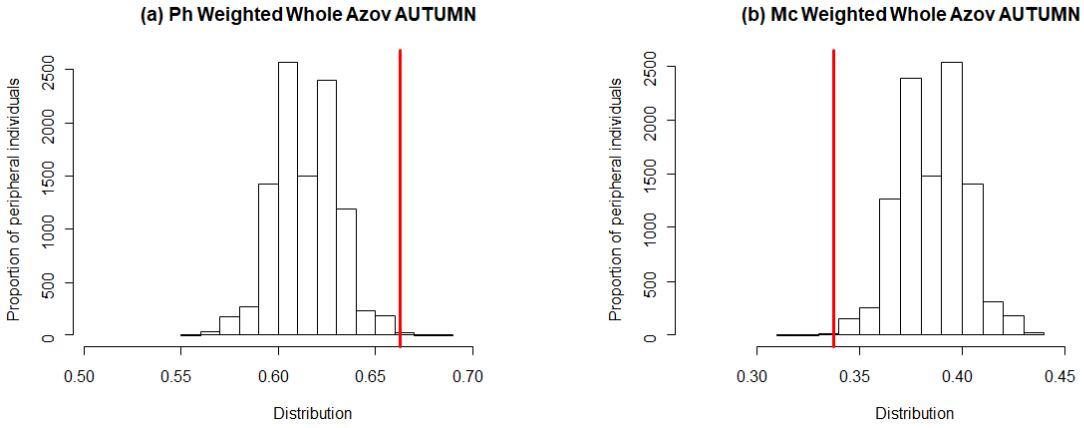

Figure A3. Observed proportion of peripheral individuals of (a) *Planiliza haematocheilus* (Ph) and (b) *Mugil cephalus* (Mc) as peripherals (red lines, significant differences) and proportions found in 10,000 replications (white bars).

There are more individuals of *P. haematocheilus* (invader) playing a peripheral role than expected by chance.

Sea of Japan – Spring

- Matrix size: 72 (individual hosts: 47 Ph; 25 Mc) × 24 (parasite spp).
- Fisher test: p-value = 0.4781. Individuals of both fish species are similarly distributed within each of the four role categories.

Table A4. Number of individuals of each species per role.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	40	6	1	0
Mugil cephalus	23	1	1	0

- 10 000 replications:

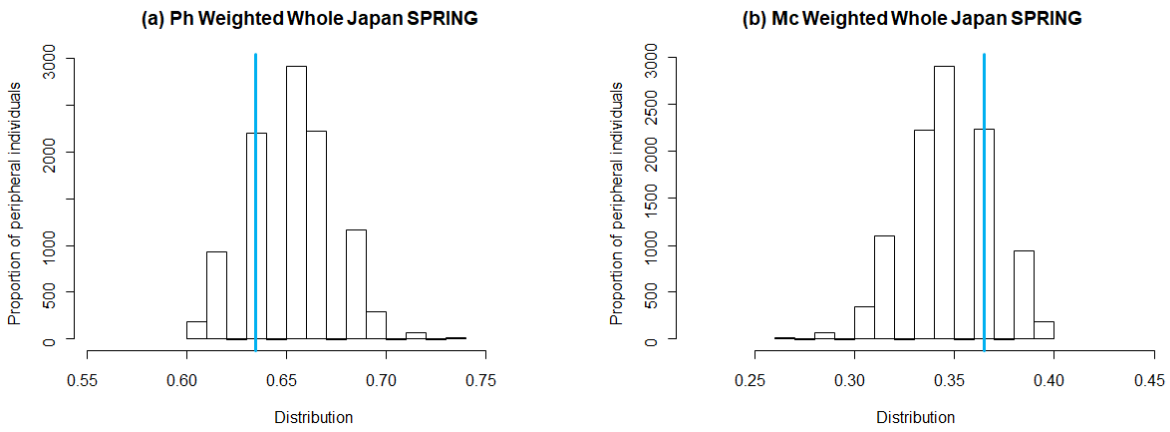

Figure A4. Observed proportion of peripheral individuals of (a) *Planiliza haematocheilus* (Ph) and (b) *Mugil cephalus* (Mc) as peripherals (blue lines, non-significant differences) and proportions found in 10,000 replications (white bars).

Sea of Japan – Summer

- Matrix size: 71 (individual hosts: 40 Ph; 31 Mc) × 25 (parasite spp)
- Fisher test: p-value = 0.1277. Individuals of both fish species are similarly distributed in the four categories.

Table A5. Number of individuals of each species per role.

	Peripheral	Connector	Module hub	Network hub
Planiliza haematocheilus	33	5	2	0
Mugil cephalus	30	0	1	0

- 10 000 replications:

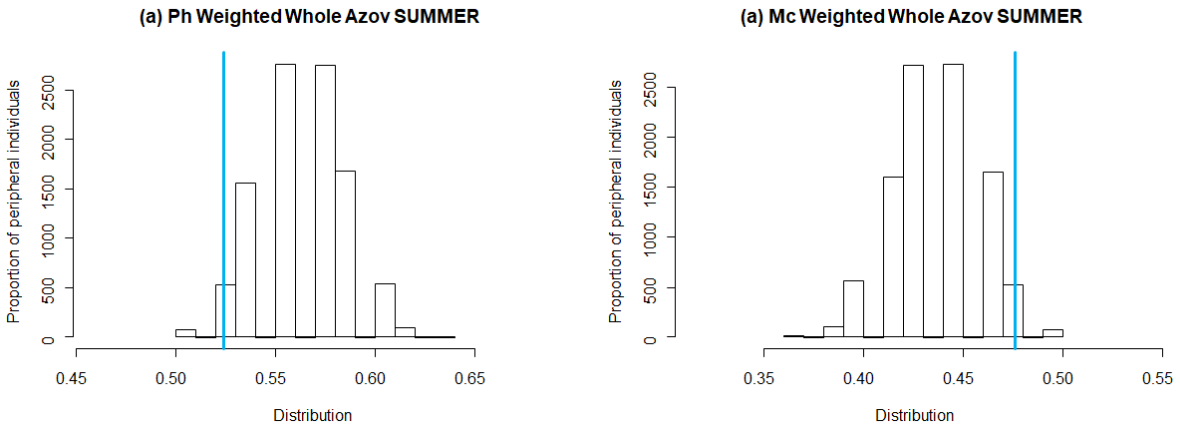

Figure A5. Observed proportion of peripheral individuals of (a) *Planiliza haematocheilus* (Ph) and (b) *Mugil cephalus* (Mc) as peripherals (blue lines, non-significant differences) and proportions found in 10,000 replications (white bars).

Sea of Japan – Autumn

We could not do these analyses for autumn because this sample only contains individuals of *Planiliza haematocheilus*.