

Appendix A from S. Fischer et al., “Rearing-Group Size Determines Social Competence and Brain Structure in a Cooperatively Breeding Cichlid”

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Supplementary Tables

Table A1: Size range, mean size, and sex of breeders and helpers of large and small family groups

Rank	Large group			Small group		
	Range (mm)	Mean (mm)	Sex	Range (mm)	Mean (mm)	Sex
Breeder male	56–75	64	Male	60–75	64	Male
Breeder female	47–66	58	Female	53–61	56	Female
Helper 1	45–62	52	Female/male	19–23	21	Unknown
Helper 2	45–59	50	Female/male			
Helper 3	41–57	47	Female/male			
Helper 4	34–54	43	Female/male			
Helpers 5–10	18–36	26	Unknown			
Helpers 11–13	15–23	18	Unknown			

Table A2: Mixed models analyzed in this study

Dependent variable	Factors	Covariates	Random factors	Transformation	Interactions
Submission, exp. phase (iso. days 0–50)	Treat.	Iso. day, obs. day	Group ID, observer	Log	Treat. × iso. day
Aggression, exp. phase (iso. days 0–50)	Treat.	Iso. day, obs. day	Group ID, observer	Log	Treat. × iso. day
Submission, exp. phase (iso. day 0 and 60)	Treat., iso. day	Obs. day	Group ID, observer	Square root	Treat. × iso. day
Aggression, exp. phase (iso. day 0 and 60)	Treat., iso. day	Obs. day	Group ID, observer	Log	Treat. × iso. day
SGR in family groups	Treat.	Day of meas., SL at meas. day 1, no. of siblings in tank	Group ID	None	Treat. × day of meas.
Submission, social-challenge test	Treat.	Iso. day, rec. aggr.	Group ID, observer	Square root	Treat. × iso. day, treat. × rec. aggr., rec. aggr. × iso. day, treat. × iso. day × rec. aggr.
Submission, social-challenge test (iso. days 0 and 60)	Treat., iso. day	Rec. aggr.	Group ID, observer	Square root	Treat. × iso. day, treat. × rec. aggr., rec. aggr. × iso. day, treat. × iso. day × rec. aggr.
Aggression, social-challenge test	Treat.	Iso. day, rec. aggr.	Group ID, observer	Square root	Treat. × iso. day, treat. × rec. aggr., rec. aggr. × iso. day, treat. × iso. day × rec. aggr.
Aggression, social-challenge test (iso. days 0 and 60)	Treat., iso. day	Rec. aggr.	Group ID, observer	Square root	Treat. × iso. day, treat. × rec. aggr., rec. aggr. × iso. day, treat. × iso. day × rec. aggr.
Size of test fish during the social-challenge test	Treat.	Iso. day	Group ID	None	Treat. × iso. day
Acceptance, social-challenge test (iso. days 0–60)	Treat.	Iso. day, rec. aggr.	Group ID	Logit link (GLMM)	Treat. × iso. day, treat. × rec. aggr.
Aggression, exp. phase (iso. days 0–20 and iso. day 60)	Treat.	Iso. day, obs. day	Group ID, observer	Log	Treat. × iso. day, iso. day × obs. day
Submission, exp. phase (iso. days 0–20 and iso. day 60)	Treat.	Iso. day, obs. day	Group ID, observer	Log	Iso. day × treat., iso. day × obs. day
MDS score, dimension 1	Treat., iso. day	Brain mass	Group ID	None	Treat. × iso. day
MDS score, dimension 2	Treat., iso. day	Brain mass	Group ID	None	Treat. × iso. day
Volume fraction of brain structures (separate model for each structure)	Treat., iso. day	Brain mass	Group ID	None	Treat. × iso. day
Total brain mass	Treat., iso. day	Body weight	Group ID	Log	Treat. × iso. day
Body length of test fish at day 200	Treat., iso. day	None	Group ID	Log	Treat. × iso. day

Note: Information on the mixed models analyzed during this study, including the respective dependent variables, fixed factors, covariates, and random factors, eventual data transformations performed to obtain normally distributed residuals (or the link function for generalized linear mixed models [GLMM]), and any interaction terms included in the initial, full models. To obtain final models, nonsignificant interactions were stepwise removed. Behaviors (aggression, submission) are always expressed as frequencies of occurrence during the respective observation times (5 min in the experience phase, 10 min during the social-challenge trials). Acceptance: whether at the end of the social-challenge test a fish was evicted or accepted by the dominant conspecific (see “Methods” for details). Treat. (treatment): small- or large-group rearing of test fish; iso. (isolation) day: day when a juvenile was isolated from its family group; obs. (observation) day: age of test fish when observations were performed; rec. aggr. (received aggression): aggression the test fish received from the larger conspecific in the social-challenge test. Exp. phase = experience phase; group ID = group identity; MDS = multidimensional scaling; meas. = measurement; SGR = specific growth rate; SL = standard length.

Table A3: Specific growth rates of test fish reared within small or within large family groups until day 71

Factors	Estimate \pm SE	<i>t</i>	<i>P</i>
Intercept	-1.390 \pm 2.209	-.629	.533
Treatment	.313 \pm .446	.700	.458
Measurement day	.042 \pm .025	1.710	.095
Number of siblings	-.006 \pm .024	-.256	.785
Size on first day	.276 \pm 1.25	.221	.814

Note: Measurements were taken on days 40, 50, and 60 (i.e., during the experience phase) and on day 71. Treatment: small- or large-group rearing of juveniles; size on first day: sizes of test fish on their first day of measurement; measurement day: age of test fish when measurement was performed; number of siblings: group size of juveniles present in the tank. Reference category for the estimate treatment: small groups. $N = 18$ family groups and 271 test fish (43 specific growth rates in 16 family groups). Italics indicate $.05 < P < .1$.