

**How does parental contribution affect offspring
performance in anadromous and resident brown trout,
Salmo trutta L.?**

Submitted by

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ABSTRACT

The brown trout, *Salmo trutta* L., displays one of the most variable and polymorphic life-history strategies of all the salmonids. In some populations, individuals spend their whole life-cycle in the river (freshwater-resident) whereas in others, a varying proportion migrates to sea for variable amounts of time to better feeding conditions before returning to spawn (anadromous). The 'decision' if an individual will migrate or not will be determined by the balance of the costs and benefits of following a particular life-history strategy. The balance of these, which do not affect males and females equally, will determine the future success (measured by fitness) of each strategy. This research addresses the influences of parental contribution, mainly maternal effect, of anadromous and freshwater-resident brown trout on offspring performance and subsequent life-history.

A partial migratory population of brown trout was studied in the Tadnoll Brook, one of the seven major tributaries on the River Frome. The tributary is classified as a circum-neutral chalk stream, 9.9 km long with a catchment approximately 50 km². Carbon and nitrogen stable isotope analysis (SIA) was used to quantify maternal reproductive contribution of anadromous and freshwater-resident brown trout to offspring and determine the future success (measured by fitness) in terms of size and time of emergence. A panel of 12 microsatellite loci was used to assign parentage to 0+ parr. Using field data collected over 1.5 years on individual fish, this study tested parental influence on offspring performance in terms of size and growth rate and calculate the reproductive contribution of maternal/paternal anadromous and freshwater-residents. Adult life-history strategy was identified using a combination of results from SIA, PIT tag data and ecological data (body size, temperature). Parr life-history strategy (1+) was inferred using PIT tag detection data.

The results of the SIA indicated fry of anadromous females emerged earlier and at a larger size than fry of freshwater-resident females. Parentage assignment of parr was low (28%), with 8 parr assigned to both parents and 43 assigned to only a single parent. There was no detectable effect of parental life-history on parr size and growth rate, however the raw data may suggest offspring of anadromous parents have an early size advantage but a slower growth compared to offspring of freshwater-resident parents during the first year of the parr stage. Twenty-four percent of the offspring were identified as putative smolts at 2+ and both forms interbred and could produce offspring of each life-history. Estimates of reproductive

contribution (SIA and growth) show a higher proportion of anadromous females and males (growth only) contributed to offspring production.

The results of this research indicate that the maternal anadromous contribution is higher in the Tadnoll Brook population, affording fitness benefits to their offspring during early ontogeny such as size advantages and emerging at a more profitable time to establish feeding territories. Adult life-history does not appear to influence juvenile (0+ parr) life-history but may have an effect on offspring performance. The presence of both forms in the population suggests the anadromous fitness benefits to offspring may only have an affect during ontogeny and early stages of growth. Then after juveniles reach a size threshold environmental factors influence offspring life-history, resulting in the largest parr with the fastest growth adopting an anadromous life-history.

LIST OF CONTENTS

ABSTRACT	2
LIST OF FIGURES	5
LIST OF TABLES	7
ACKNOWLEDGEMENTS	7
CHAPTER 1: INTRODUCTION	9
1.1 BROWN TROUT, <i>SALMO TRUTTA</i> L.	9
1.1.1 GEOGRAPHICAL DISTRIBUTION	9
1.1.2 LIFE-HISTORY	10
1.1.3 LIFE-HISTORY STRATEGY	11
1.1.4 SMOLTIFICATION	12
1.1.5 HOMING	15
1.1.6 MATURATION VS. SMOLTING AND MIGRATION	15
1.1.7 MIGRATION VS RESIDENCY	16
1.2 FACTORS AFFECTING LIFE-HISTORY STRATEGIES	17
1.2.1 PARENTAL EFFECT	17
1.2.2 PARENTAL INVESTMENT AND CARE.....	18
1.2.2.1 MATING STRATEGIES.....	20
1.3 PARENTAL INFLUENCE IN FISH.....	20
1.3.1 PARENTAL CARE	20
1.3.2 PARENTAL EFFECT AND INVESTMENT	21
1.4 PARENTAL INFLUENCE IN BROWN TROUT	22
1.4.1 PARENTAL INVESTMENT AND MATERNAL EFFECTS.....	22
1.4.2 IS LIFE-HISTORY STRATEGY CONTROLLED BY ENVIRONMENT OR GENETICS?	23
1.5 OFFSPRING PERFORMANCE	25

1.6 TOOLS FOR ANALYSIS OF LIFE-HISTORY	25
1.6.1 STABLE ISOTOPE ANALYSIS (SIA)	26
1.6.2 MICROSATELLITES	28
1.7 OBJECTIVES AND HYPOTHESES	30
1.7.1 CHAPTER 3	30
1.7.2 CHAPTER 4 & 5	30
CHAPTER 2: METHODS	32
2.1 STUDY SITE.....	32
2.1.1 CATCHMENT HYDROLOGY AND GEOLOGY	32
2.1.2 FISH POPULATION.....	32
2.1.3 LAND USE AND ANTHROPOGENIC ACTIVITY	33
2.1.4 RECREATION.....	33
2.2 SAMPLE COLLECTION.....	33
2.2.1 SPAWNING ADULTS.....	33
2.2.2 EMERGING FRY.....	34
2.3 PIT TAGGING	34
2.4 PIT TELEMETRY	35
2.4.1 TADNOLL MILL.....	36
2.4.2 RIVER FROME.....	36
2.4.3 FLUVARIUM.....	38
2.4.4 MILLSTREAM WEIR	38
2.5 MANAGEMENT OF DATA	38
CHAPTER 3: BROWN TROUT OFFSPRING FITNESS: A CONSEQUENCE OF MATERNAL LIFE-HISTORY STRATEGY	39
3.1 INTRODUCTION	40
3.2 MATERIALS AND METHODS.....	43
3.2.1 STUDY SITE.....	43

3.2.2 SAMPLE COLLECTION.....	43
3.2.3 SAMPLE PROCESSING	44
3.2.4 SAMPLE PRESERVATION.....	45
3.2.5 ISOTOPE MIXING MODEL.....	45
3.2.6 STATISTICS	46
3.3 RESULTS	47
3.3.1 REDD PRODUCTION.....	47
3.3.2 IDENTIFICATION OF MATERNAL LIFE-HISTORY.....	47
3.3.3 SIZE AT EMERGENCE	49
3.3.4 TIME OF EMERGENCE	50
3.3.5 MATERNAL REPRODUCTIVE CONTRIBUTION.....	51
3.4 DISCUSSION.....	53
3.4.1 IDENTIFICATION OF MATERNAL LIFE-HISTORY.....	53
3.4.2 IDENTIFICATION OF FRY LIFE-HISTORY.....	53
3.4.3 SIZE AND TIME AT EMERGENCE.....	55
3.4.4 BENEFITS AND COSTS OF EARLY EMERGENCE.....	55
3.4.5 BENEFITS AND COSTS OF A LARGER BODY SIZE.....	56
3.4.6 REPRODUCTIVE CONTRIBUTION.....	56
3.4.7 CONCLUSIONS.....	57
CHAPTER 4: PARENTAGE AND RELATEDNESS OF A BROWN TROUT POPULATION.....	59
4.1 INTRODUCTION	60
4.1.1 MOLECULAR MARKERS	60
4.1.2 APPROACHES OF PARENTAGE ASSIGNMENT METHODS.....	60
4.1.2.1 EXCLUSION.....	61
4.1.2.2 CATEGORICAL ALLOCATION.....	61
4.1.2.3 FRACTIONAL ALLOCATION	61

4.1.2.4 PARENTAL RECONSTRUCTION.....	61
4.1.2.5 SIBSHIP RECONSTRUCTION.....	62
4.1.3 CERVUS.....	62
4.1.4 RELATENESS AMONG SAMPLES	62
4.1.5 AIMS.....	63
4.2 METHODS	64
4.2.1 STUDY SITE AND SAMPLE COLLECTION	64
4.2.2 SAMPLE PRIORITISATION	64
4.2.3 DNA EXTRACTION	65
4.2.4 MULTIPLEX DESIGN	65
4.2.5 PRIMER OPTIMISATION	66
4.2.6 POLYMERASE CHAIN REACTION (PCR).....	66
4.2.7 AGAROSE GEL ELECTROPHORESIS.....	68
4.2.8 GENOTYPING.....	68
4.2.9 MATCHING SAMPLES	69
4.2.10 STATISTICAL ANALYSIS	69
4.2.11 PARENTAGE ANALYSIS	69
4.2.12 RELATEDNESS ANALYSIS.....	70
4.3 RESULTS	71
4.3.1 STATISTICAL ANALYSIS	71
4.3.2 PARENTAGE ANALYSIS	72
4.3.3 RELATEDNESS ANALYSIS	75
4.4 DISCUSSION	79
CHAPTER 5: PARENTAL INFLUENCE ON OFFSPRING PERFORMANCE AND LIFE-HISTORY STRATEGY IN BROWN TROUT	82
5.1 INTRODUCTION	83
5.1.1 POLYMORPHISM IN BROWN TROUT	83

5.1.2 PARENTAL INVESTMENT	83
5.1.3 THE ONSET OF SMOLTIFICATION	84
5.1.4 ENVIRONMENT OR GENETICS INFLUENCES THE DECISION TO MIGRATE	85
5.1.5 AIMS.....	85
5.2 METHODS	86
5.2.1 STUDY SITE.....	86
5.2.2 SAMPLING AND TAGGING	86
5.2.3 TEMPERATURE DATA	87
5.2.4 PIT TELEMETRY	88
5.2.5 DATA DOWNLOAD	88
5.2.6 DATA ACQUISITION FOR LIFE-HISTORY STRATEGY	88
5.2.7 SCALIMETRY AND GROWTH.....	89
5.2.7.1 COLLECTION AND MOUNTING	89
5.2.7.2 READING OF SCALES.....	90
5.2.7.3 AGE NOTATION.....	91
5.2.8 ANALYSIS.....	91
5.2.8.1 SIZE	91
5.2.8.2 GROWTH.....	92
5.2.8.3 REPRODUCTIVE CONTRIBUTION AND OFFSPRING LIFE-HISTORY	92
5.3 RESULTS	96
5.3.1 ADULT LIFE-HISTORY IDENTIFICATION	96
5.3.2 ADULT SIZE.....	96
5.3.2.1 FEMALE ANADROMOUS AND FRESHWATER-RESIDENTS.....	96
5.3.2.2 MALE ANADROMOUS AND FRESHWATER-RESIDENTS	96
5.3.3 SAMPLE SIZE AND ANALYSIS	99
5.3.4 PARR SIZE.....	99

5.3.4.1 OFFSPRING OF ANADROMOUS AND FRESHWATER-RESIDENT FEMALES	99
5.3.4.2 OFFSPRING OF ANADROMOUS AND FRESHWATER-RESIDENT MALES	99
5.3.5 0+ GROWTH RATE	100
5.3.5.1 OFFSPRING OF ANADROMOUS AND FRESHWATER-RESIDENT FEMALES	100
5.3.5.2 OFFSPRING OF ANADROMOUS AND FRESHWATER-RESIDENT MALES	101
5.3.6 TEMPERATURE	102
5.3.6.1 2007/8	102
5.3.7 REPRODUCTIVE CONTRIBUTION	103
5.3.7.1 MATERNAL	103
5.3.7.2 PATERNAL.....	103
5.3.8 OFFSPRING LIFE-HISTORY STRATEGY	104
5.4 DISCUSSION	106
5.4.1 OFFSPRING SIZE AND GROWTH RATE.....	107
5.4.2 REPRODUCTIVE CONTRIBUTION	108
5.4.3 OFFSPRING LIFE-HISTORY STRATEGY	109
5.4.4 FUTURE WORK.....	109
5.4.5 CONCLUSION.....	110
CHAPTER 6: GENERAL DISCUSSION	111
REFERENCES.....	119
APPENDIX ONE	137