
Contents

Preface	ix
Introduction	xi
Chapter 1. Reproductive Behavior: Spawners	1
1.1. The preparatory phase of pre-spawning: the preliminaries.	5
1.1.1. Selection of sexual partners	5
1.1.2. Seducers	5
1.1.3. Courtiers	18
1.1.4. Reversal of roles	22
1.1.5. Forbidden love	24
1.1.6. Spawning aggregations	28
1.1.7. Practicing polygamy*	31
1.1.8. Homosexuals	33
1.1.9. Sexual disabilities.	34
1.1.10. More or less aberrant sexuality.	37
1.2. The phase of realization: couplings and spawning	39
1.2.1. Alternative mating strategies.	39
1.2.2. Freely consensual couplings	45
1.2.3. Harassers.	47
1.2.4. Violent couplings	49
1.2.5. Hybrids	53
1.2.6. Fleeting loves	56
1.2.7. Discreet love	57
1.2.8. Cuckolds and cuckolders.	58
1.2.9. Hermaphrodites	59
1.2.10. Transsexuals	61
1.2.11. Unisex populations	

1.2.12. Fatherless fish by parthenogenesis	68
1.2.13. Posthumous paternity	70
Chapter 2. Reproductive Behavior: Parents	73
2.1. The post-spawning phase: the future of the offspring	73
2.1.1. Nest builders	73
2.1.2. Incubating clutches in the mouth	85
2.1.3. Deserters	88
2.1.4. Gestation	90
2.2. Parental care	96
2.2.1. Providing parental care	96
2.2.2. Having good parents	107
2.2.3. Larval recruitment	113
2.2.4. Metamorphoses	116
2.2.5. Miniaturized fish	118
Chapter 3. Remarkable Capabilities	119
3.1. Aces of ballistics	119
3.1.1. Stronger than William Tell?	119
3.1.2. Using a stream of water to hunt	120
3.2. Possession of a black box	120
3.2.1. An inviolable personal identity card	120
3.2.2. Traveling leaves traces, like a real passport	121
3.2.3. A birth certificate	122
3.2.4. Proof of diet	122
3.2.5. Belonging to a stock	123
3.2.6. Parasites used as biological markers	124
3.3. Using tools	124
3.3.1. A form of intelligence from which fish are not excluded	124
3.3.2. Using an anvil	125
3.3.3. Capabilities related to the size of their brains?	125
3.4. Capacity to play	126
3.4.1. Expression of a certain well-being	126
3.4.2. A toy in an aquarium	126
3.5. Artists	127
3.6. Counting	128
3.6.1. Quantitative knowledge of their environment	128
3.6.2. Innate quantitative knowledge which is perfected	130
3.6.3. Clever fish	130
3.6.4. Inter-individual variability	131
3.7. Having a personality	132

3.7.1. Not all fish are identical	132
3.7.2. Individual and inter-sexual differences	132
3.7.3. Customized food preferences	134
3.7.4. Differences in risk-taking	134
3.7.5. Personality changes related to age and parental life	136
3.7.6. Personality traits varying according to environmental factors	136
3.7.7. Differences in migratory behavior.	137
3.7.8. Personalized mutual relations	137
3.7.9. Complex motivations.	138
3.7.10. Different brain potential	138
3.7.11. Higher metabolic potential	139
3.7.12. Influence of the genome	140
3.7.13. Early expression of personality.	140
3.7.14. Social influence	141
3.8. Disguise	142
3.8.1. Offensive mimicry for feeding.	142
3.8.2. Offensive mimicry for reproductive purposes	143
3.8.3. Defensive mimicry	145
3.8.4. A dual strategy, both offensive and defensive	146
3.8.5. Deceiving one's sex partner: the height of dishonesty?	146
3.8.6. Fooling rivals	148
3.8.7. Counter-adaptation to flush out cheaters	148
3.8.8. Fooling customers	149
3.9. Having a very precise biological clock	150
3.9.1. The day-night "circadian" cycle.	150
3.9.2. The lunar or semi-lunar cycle of tides or tidal rhythm*	152
3.9.3. Fish showing original qualities	155
3.9.4. Additional role of melatonin in health and fitness	155
Chapter 4. Neurological and Neuroendocrine Conditioning Requirements	157
4.1. Experience of stress and suffering	157
4.1.1. Sensitivity to stress	157
4.1.2. Actual suffering?	159
4.1.3. Neuropsychological data compared and a mental construct of pain in fish	160
4.1.4. Safeguarding well-being	161
4.2. A question asked about their period of inactivity: are they able to sleep?	163
4.2.1. Do fish really sleep?	163
4.2.2. Experimental sleep deprivation generating anomalies in cognitive performance	164
4.2.3. Insomniac populations	164
4.3. The complexity of their brains: their cognitive abilities	165
4.3.1. A primitive brain in a lower vertebrate?	165

4.3.2. Physiological basis of stress common to all vertebrates	168
4.3.3. Memorization skills.	169
4.3.4. Brain differences between the two sexes	169
4.3.5. Brain differences related to the physical and social environment.	171
4.3.6. Brain activity stimulated during the reproductive period	173
4.3.7. Morpho-anatomo-physiological lateralization	174
4.3.8. Lateralization of the brain	176
4.3.9. Differences between selachians and teleosts	179
4.3.10. Cerebral sexual dimorphism	180
4.3.11. Forms of training	180
4.3.12. Really intelligent fish?	181
4.3.13. Remarkable cognitive skills in sharks	183
4.3.14. Fish as victims of optical illusions	184
4.3.15. Recognition of human faces	184
4.3.16. Sensitivity to music	186
4.3.17. Active embryonic and/or larval ontogenesis* or neurogenesis	187
4.3.18. The certain existence of collective intelligence.	187
Conclusion	189
Glossary	193
Species Index	217
Summary of Volume 1	223