Changes in Body Composition and Fatty Acid Profile During Quillback Rockfish (*Sebastes maliger*) Embryogenesis

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Background

Survival during the larval phase can be vital in determining the eventual strength of year classes that recruit to fished stocks. Larval survival often depends on having energy stores sufficient to ensure survival to first feeding. Differences in the amounts and use of endogenous lipid and protein sources during embryonic development may influence the survival rates of early planktonic rockfish larvae.

Little is known regarding biochemical and energetic changes during the early development of quillback rockfish (*Sebastes maliger*). This commercially important species has internal development of embryos and gives birth to free-swimming larvae.

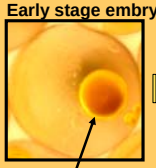
Adult quillback rockfish

Sampling area near Chichagof Island in southeast Alaska

Objectives

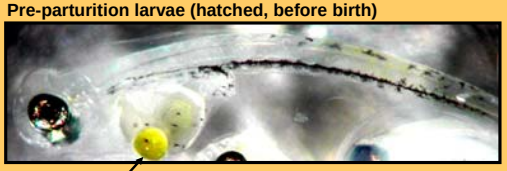
- To describe the amount and sources of energy consumed during quillback rockfish embryogenesis, from early stage embryos to pre-parturition larvae
- To assess how well changes in oil globule volume indicate changes in total lipid content
- To determine whether all fatty acids (FAs) are used at the same rate as the total lipid during embryonic development, or whether some are conserved

Early stage embryo



Oil globule

Pre-parturition larvae (hatched, before birth)



Oil globule

Summary of Findings

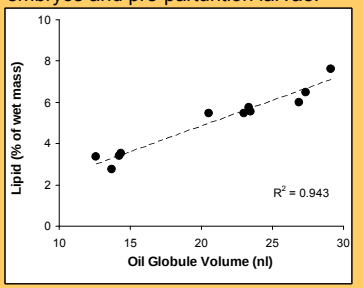
Key finding: more of the energy consumed during embryonic development was contributed by lipid (60%) than by protein (40%).

Comparisons of proximate composition data from early-stage embryos versus hatched, pre-parturition larvae taken from wild-caught gravid females indicated:

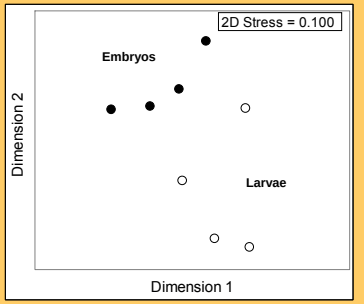
- Embryos took on water to gain size while they consumed their stored lipids and proteins for energy, gaining over one-third their weight in moisture while losing ~20% of their dry tissue mass as they developed into larvae. Gaining size may allow feeding on a greater variety of prey, and reduce risk of predation once they are released as larvae.
- While both lipid and protein were consumed in significant amounts during embryonic development, lipid was lost at a greater rate as a proportion of initial lipid mass than was protein
- During the course of development, an embryo consumed a minimum of 0.88 J of energy, on average, with approximately 0.53 J coming from lipid and 0.35 J from protein
- Lipids contributed a larger portion of total energy expended, indicating a protein-sparing effect. This is consistent with other studies of rockfish, and underscores the importance of measuring lipid levels when assessing larval condition

	Embryos	Larvae	% Change
Wet mass per individual (µg)	649 ± 60	884 ± 72	36.2
Moisture (%)	78.5 ± 1.7	87.3 ± 0.8	11.3
Dry mass per individual (µg)	140 ± 13	112 ± 15	-19.5
Protein mass per individual (µg)	**90.3 ± 9.9**	**73.0 ± 12.1**	**-19.2**
Lipid mass per individual (µg)	**43.5 ± 6.8**	**28.9 ± 4.7**	**-33.6**
Protein (% wet mass)	13.9 ± 1.08	8.22 ± 0.74	-41.0
Lipid (% wet mass)	6.70 ± 0.85	3.25 ± 0.35	-51.4
Oil globule volume (nL)	27.8 ± 1.2	13.7 ± 0.8	-50.6
Total energy content per individual (J)	**3.40 ± 0.44**	**2.52 ± 0.40**	**-25.9**
Energy density (J/mg wet mass)	5.24 ± 0.52	2.84 ± 0.24	-45.9
Energy density (J/mg dry mass)	24.3 ± 0.9	22.4 ± 0.8	-7.9

Oil globule volume was strongly correlated with lipid levels, affirming its utility as an indicator of the condition of embryos and pre-parturition larvae.



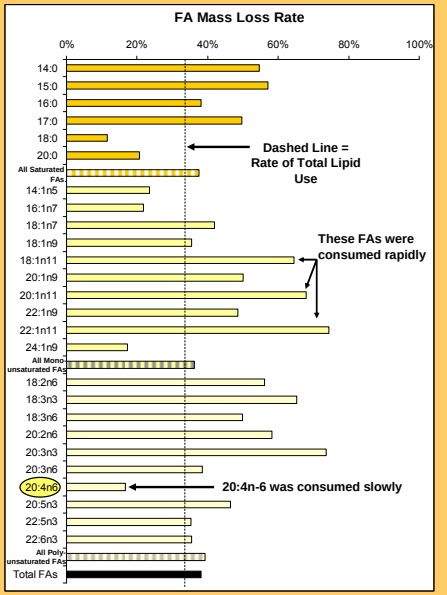
FA profiles (the relative proportions of 28 FAs) of embryos (●) differed distinctly from those of hatched larvae (○), indicating FAs are consumed at different rates as embryos develop into larvae.



The FA 20:4n-6 showed a much slower rate of use than total lipids (graph below), despite being the most abundant n-6 polyunsaturated FA.

Embryos of quillback rockfish, like other marine fishes, likely cannot synthesize this metabolically important FA, either entirely or at a rate which will meet their needs for growth and survival.

The conservation of 20:4n-6 suggests that this essential FA may well reflect the quality of maternal nutrient provisioning, and be a useful indicator of condition.



See: Sewall, F. F. and Rodgveller, C. J. (in press) Changes in body composition and fatty acid profile during quillback rockfish (*Sebastes maliger*) embryogenesis. Fishery Bulletin 107(2): xxx.

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Acknowledgements: We thank Ron Heintz, Marie Larsen, Robert Bradshaw, Jacek Maselko, Chris Lunsford, John Heifetz, Darcie Neff, and Lawrence Schaufler for assistance with this project.