

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
Species 1 – <i>Elliptio complanata</i> (Eastern Elliptio)								
Harbold et al. 2014; LaRouche 2014; Lellis et al. 2013; Watters 1996	Migratory blockages for host fish		Freshwater					American eel (<i>Anguilla rostrata</i>), Brook trout (<i>Salvelinus fontinalis</i>), Lake trout (<i>S. namaycush</i>), Slimy sculpin (<i>Cottus cognatus</i>), and Mottled sculpin (<i>C. bairdii</i>)
van Snik Gray et al. 1999			Water temperature ~15°C			Number of juvenile mussels recovered from hosts varied by species, and ranged from 2-35, with timing of recovery from 16-30 days post-infestation		Laboratory only: white sucker (<i>Catostomus commersoni</i>), rock bass (<i>Ambloplites rupestris</i>), and pumpkinseed (<i>Lepomis gibbosus</i>); yellow perch (<i>Perca flavescens</i>) died during infection, but glochidia remained

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
								attached
Kat 1982		Clay, mud, sand, gravel						
Strayer and Malcolm 2012			Recruitment failure strongly associated with high interstitial concentrations of un-ionized ammonia (.02 $\mu\text{g N/L}$)					
Bogan and Proch 1997, Watters 1994								Banded killifish (<i>Fundulus diphanus</i>), green sunfish (<i>Lepomis cyanellus</i>), orangespotted sunfish (<i>L. humilis</i>), largemouth bass (<i>Micropterus salmoides</i>), white crappie (<i>Pomoxis annularis</i>), yellow perch (<i>Perca flavescens</i>)
Species 2 – <i>Pyganodon cataracta</i> (Eastern floater)								
Ashton 2009			pH, ~6.8-7.4;					Confirmed

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
			nitrite and TN <5mg/L; ammonia ~0.04-0.09 mg/L; MWW, 4-6m; % agriculture					hosts: Rock bass (<i>Ambloplites rupestris</i>), White sucker (<i>Catostomus commersoni</i>), Common carp (<i>Cyprinus carpio</i>), Pumpkinseed (<i>Lepomis gibbosus</i>), Bluegill (<i>L. macrochirus</i>), Yellow perch (<i>Perca flavescens</i>)
Bogan and Proch 1997, Watters 1994								Common carp (<i>Cyprinus carpio</i>), pumpkinseed (<i>Lepomis gibbosus</i>), threespine stickleback (<i>Gasterosteus aculeatus</i>), white sucker (<i>Catostomus commersoni</i>)
Taxon 3 - "Selected anodontine species": Dwarf Wedgemussel (<i>Alasmidonta heterodon</i>), Green Floater (<i>Lasmigona subviridis</i>), Brook Floater (<i>Alasmidonta varicosa</i>)								

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
Michaelson and Neves 1995 (dwarf wedgemussel)		Gravel, sand, or mud	Water temperature (°C) (tessellated darter, 19.0-21.5; Johnny darter, 21.0-22.0; mottled sculpin, 15.0-20.0)			Glochidial metamorphosis and peak encystment (tessellated darter, 12-26 days [16d]; Johnny darter, 10-22 days [18d]; mottled sculpin, 16-38 days [30d])		Tessellated darter (<i>Etheostoma olmsteadi</i>), Johnny darter (<i>E. nigrum</i>), mottled sculpin (<i>Cottus bairdi</i>)
Strayer and Ralley 1993 (dwarf wedgemussel, brook floater)		Fine to medium sands (0.1-1.0 mm)						
Species 4 – <i>Micropterus dolomieu</i> (Smallmouth bass)								
(Brown et al. 2009; Edwards et al. 1983; Scott and Crossman 1973)		Firm sand, mud, gravel < 2.5 cm		Clean substrate	4-10 days			
(Jenkins and Burkhead 1994)							Micro-crustaceans, insects, small fishes	
(Brown et al. 2009; Scott and Crossman 1973)			~15° C (onset of spawning); DO > 7mg l ⁻¹ ;					
(Blazer et al. 2012)	Endocrine disruptors							
Species 5 – <i>Micropterus salmoides</i> (Largemouth bass)								
(Sackett et al. 2013)	Hg transfer;							

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
(Jenkins and Burkhead 1994)			Commences at 12°-15.5° C;					
(Rintamaki 1986; Stuber et al. 1982)		Gravel (optimal); vegetation, roots, sand, mud also suitable	pH between 5-10	Clean gravel with low siltation	2-7 days		Micro-crustaceans, insects,	
Species 6 – <i>Esox niger</i> (Chain pickerel)								
(Coffie 1998; Jenkins and Burkhead 1994)		Spawning in vegetation (no nests)	2 – 22° C, peak spawning ~ 12°C				Zooplankton, then invertebrates	
(Coffie 1998; Underhill 1949)				Vegetation (adhesive)	6-12 days			
Species 7 - <i>Morone americana</i> (White perch)								
(Able and Fahay 1998; Morgan and Rasin 1982; Setzler-Hamilton 1991)		Fine gravel, sand (no nesting)	12 – 20° C; salinity 0-1.5 ppt; pH 6.5-8.5; DO > 5 mgL ⁻¹	Water column over fine gravel or sand	2-6 days	~ 6 weeks	Rotifers, juvenile copepods;	
(Monosson et al. 1994; Morgan and Prince 1977)	Chlorine toxicity; PCB, TCB							
Species 8 – <i>Anchoa mitchilli</i> (Bay anchovy)								
(Able and Fahay 1998; Morton 1989; Olney 1983)		Pelagic (no nesting)	Prefer salinities > 8 ppt; >17° C;	Pelagic, near surface	24h			
(Morgan and Prince 1977)	Chlorine toxicity							

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
(Delancey 1989; Fives et al. 1986; Houde and Lovdal 1984)						~45 days	Copepods, tintinnids, bivalve larvae	
Species 9 – <i>Leiostomus xanthurus</i> (Spot)								
(Flores-Coto and Warlen 1993; Hildebrand and Cable 1930; Homer and Mihursky 1991)	Copper (reduced hatching)	Continental shelf spawners; no nesting	~ 19°C for hatching;	Deep pelagic water	1-4 days	Mean 82 days	Copepods and ostracods	
Species 10 – <i>Macoma balthica</i> (Baltic clam)								
(Lammens 1967; Pekkarinen 1986; Van Colen et al. 2012)	CO2	None (broadcast spawners)	> 10° C;	Pelagic	~20h	1-6 months		
Species 11 – <i>Menidia menidia</i> (Atlantic silverside)								
(Able and Fahay 1998; Balouskus and Targett 2012; Fay et al. 1983; Gilmurray and Daborn 1981; Martin and Drewry 1978; Middaugh 1981)		Benthic eggs, not in nests but within intertidal marshes	>13° C;	<i>Spartina alterniflora</i> marsh surface; attached by filaments	~8 days (temperature dependent)	27-35 days	<i>Eurytemora herdmani</i>	
(Morgan and Prince 1977)	Chlorine							
Species 12 – <i>Paralichthys dentatus</i> (Summer flounder)								
(Able and Fahay 1998; Grover 1998; Madenjian et al. 2016; Martinez and Bolker 2003; Packer	Possible PCB	No nesting; pelagic eggs	9.1°-22.9° C;	Open ocean areas over continental shelf	2-9 days	18-31 days	Tintinnids, copepod nauplii, calanoid copepods,	

Study Reference	Fecundity Parameters			Egg Dynamics		Larval dynamics		Intermediate Host
	Stressors	Nesting habitat	Water quality requirements	Egg habitat	Duration	Duration	Prey	
et al. 1999; Packer and Hoff 1999; Smith 1973)							appendicularians	
Species 13 – <i>Centropristis striata</i> (Black sea bass)								
(Able and Fahay 1998; Edwards et al. 2008; Steimle et al. 1999; Tucker 1989)		No nesting: pelagic on continental shelf	12-24° C; marine	Inner shelf waters 15-51m depth	35-75 hours	20-35 days	Zooplankton	

Literature Cited

- Able, K.W., and M.P. Fahay. 1998. *The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight*. New Brunswick, New Jersey: Rutgers University Press.
- Ashton, M.J. 2009. *Freshwater Mussel Records Collected by the Maryland Department of Natural Resources' Monitoring and Non-Tidal Assessment Division (1995-2009): Investigating Environmental Conditions and Host Fishes of Select Species.*, 71. Annapolis, MD: Maryland Department of Natural Resources, Resource Assessment Service, Monitoring and Non-Tidal Assessment Division.
- Balouskus, R.G., and T.E. Targett. 2012. Egg Deposition by Atlantic Silverside, *Menidia menidia*: Substrate Utilization and Comparison of Natural and Altered Shoreline Type. *Estuaries and Coasts* 35: 1100-1109.
- Blazer, V.S., L.R. Iwanowicz, H. Henderson, P.M. Mazik, J.A. Jenkins, D.A. Alvarez, and J.A. Young. 2012. Reproductive endocrine disruption in smallmouth bass (*Micropterus dolomieu*) in the Potomac River basin: spatial and temporal comparisons of biological effects. *Environmental Monitoring and Assessment* 184: 4309-4334.
- Bogan, A., and T. Proch. 1997. *Manual of the Freshwater Bivalves of Maryland*. CBWP-MANTA- EA-96-03. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division, 580 Taylor Avenue, Annapolis, Maryland.
- Brown, T.G., B. Runciman, S. Pollard, A.D.A. Grant, and M.J. Bradford. 2009. Biological Synopsis of Smallmouth Bass (*Micropterus dolomieu*), 50. British Columbia, Canada: Fisheries and Oceans Canada, Science Branch, Pacific Region.
- Coffie, P.A. 1998. Status of the Chain pickerel, *Esox niger*, in Canada. . *Canadian Field-Naturalist* 112: 133-140.

- Delancey, L.B. 1989. Trophic relationship in the surf zone during the summer at Folly Beach, South Carolina. *Journal of Coastal Research* 5: 477-488.
- Edwards, E.A., G. Gebhart, and O.E. Maughan. 1983. Habitat Sustainability Information: Smallmouth Bass, 47. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service, Research and Development, Division of Biological Services, Western Energy and Land Use Team.
- Edwards, K.P., J.A. Hare, and F.E. Werner. 2008. Dispersal of black sea bass (*Centropristis striata*) larvae on the southeast US continental shelf: results of a coupled vertical larval behavior - 3D circulation model. *Fisheries Oceanography* 17: 299-315.
- Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) -- Atlantic silverside, 15: U.S. Fish and Wildlife Service, Division of Biological Services.
- Fives, J.M., S.M. Warlen, and D.E. Hoss. 1986. Aging and growth of larval bay anchovy *Anchoa mitchilli*, from the Newport River estuary, North Carolina. *Estuaries* 9: 362-367.
- Flores-Coto, C., and S.M. Warlen. 1993. Spawning time, growth, and recruitment of larval spot *Leiostomus xanthurus* into a North Carolina estuary. *U S National Marine Fisheries Service Fishery Bulletin* 91: 8-22.
- Gilmurray, M.C., and G.R. Daborn. 1981. Feeding relations of the Atlantic silverside *Menidia menidia* in the Minas Basin, Bay of Fundy. *Marine Ecology Progress Series* 6: 231-235.
- Grover, J.J. 1998. Feeding habits of pelagic summer flounder, *Paralichthys dentatus*, larvae in oceanic and estuarine habitats. *Fishery Bulletin* 96: 248-257.
- Harbold, W., J.V. Kilian, G. Mack, J. Zimmerman, and M.J. Ashton. 2014. First evidence of *Elliptio complanata* (Bivalvia: Unionidae) from the Patapsco River, Maryland. *Northeastern Naturalist* 21: N35-N40.
- Hildebrand, S.F., and L.-E.E. Cable. 1930. Development and life history of fourteen teleostean fishes at Beaufort, North Carolina. *Bull U S Bur Fisheries* 46: 383-488.
- Homer, M.L., and J.A. Mihursky. 1991. Spot. In *Habitat requirements for Chesapeake Bay living resources*, ed. S.L. Funderburk, J.A. Mihursky, S.J. Jordan and D. Riley, 11-11 - 11-19. Annapolis, MD: Chesapeake Bay Program.
- Houde, E.D., and J.A. Lovdal. 1984. Seasonality of occurrence, foods and food preferences of ichthyoplankton in Biscayne Bay, Florida. *Estuarine Coastal and Shelf Science* 18: 403-419.
- Jenkins, R.E., and N.M. Burkhead. 1994. *Freshwater fishes of Virginia*. Bethesda, MD: American Fisheries Society.
- Kat, P.W. 1982. Effects of population density and substratum type on growth and migration of *Elliptio complanata* (Bivalvia: Unionidae). *Malacological Review* 15: 119-127.
- Lammens, J.J. 1967. Growth and reproduction in a tidal flat population of *Macoma balthica* (L.) *Netherlands Journal of Sea Research* 3: 315-382.
- LaRouche, G. 2014. Finding Cooperative Solutions to Environmental Concerns with the Conowingo Dam to Improve the Health of the Chesapeake Bay. Testimony of Genevieve LaRouche, Field Office Supervisor, Chesapeake Bay Field Office, U. S. Fish and Wildlife Service, U. S. Department of the Interior. In The Senate Environment and Public Works Subcommittee on Water and Wildlife. Conowingo, MD.
- Lellis, W.A., B.S.J. White, J.C. Cole, C.S. Johnson, J.L. Devers, E.v.S. Gray, and H.S. Galbraith. 2013. Newly Documented Host Fishes for the Eastern Elliptio Mussel *Elliptio complanata*. *Journal of Fish and Wildlife Management* 4: 75-85.

- Madenjian, C.P., O.P. Jensen, R.R. Rediske, J.P. O'Keefe, A.R. Vastano, and S.A. Pothoven. 2016. Differences in Energy Expenditures and Growth Dilution Explain Higher PCB Concentrations in Male Summer Flounder. *Plos One* 11.
- Martin, F.D., and G.E. Drewry. 1978. Development of fishes of the Mid-Atlantic bight: U.S. Fish & Wildlife Service.
- Martinez, G.M., and J.A. Bolker. 2003. Embryonic and larval staging of summer flounder (*Paralichthys dentatus*). *Journal of Morphology* 255: 162-176.
- Michaelson, D.L., and R.J. Neves. 1995. Life history and habitat of the endangered Dwarf Wedgemussel *Alasmidonta heterodon* (Bivalvia: Unionidae). *Journal of the North American Benthological Society* 14: 324-340.
- Middaugh, D.P. 1981. Reproductive ecology and spawning periodicity of the Atlantic silverside *Menidia menidia* (Pisces, Atherinidae). *Copeia*: 766-776.
- Monosson, E., W.J. Fleming, and C.V. Sullivan. 1994. Effects of the planar PCB 3,3',4,4'-tetrachlorobiphenyl (TCB) on ovarian development, plasma levels of sex steroid hormones and vitellogenin, and progeny survival in the white perch (*Morone americana*). *Aquatic Toxicology (Amsterdam)* 29: 1-19.
- Morgan, R.P., II, and R.D. Prince. 1977. Chlorine toxicity to eggs and larvae of five Chesapeake Bay fishes. *Transactions of the American Fisheries Society* 106: 380-385.
- Morgan, R.P., and V.J. Rasin. 1982. Influence of temperature and salinity on development of white perch eggs. *Transactions of the American Fisheries Society* 111: 396-398.
- Morton, T. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) -- Bay anchovy, 13: U.S. Fish and Wildlife Service.
- Olney, J.E. 1983. Eggs and early larvae of the bay anchovy, *Anchoa mitchilli*, and the weakfish, *Cynoscion regalis*, in lower Chesapeake Bay with notes on associated ichthyoplankton. *Estuaries* 6: 20-35.
- Packer, D.B., S.J. Griesbach, P.L. Berrien, C.A. Zetlin, D.L. Johnson, and W.W. Morse. 1999. Summer flounder, *Paralichthys dentatus*, life history and habitat characteristics. In NOAA Technical Memorandum, 88. Woods Hole, MA: NOAA NMFS.
- Packer, D.B., and T. Hoff. 1999. Life history, habitat parameters, and essential fish habitat of Mid-Atlantic summer flounder. *American Fisheries Society Symposium* 22: 76-92.
- Pekkarinen, M. 1986. Notes on the spawning, egg cleavage and early development of the bivalve *Macoma balthica*. *Annales Zoologici Fennici* 23: 71-75.
- Rintamaki, R. 1986. Largemouth Bass: Biology Note 307. In Technical Notes, 4: USDA Soil Conservation Service.
- Sackett, D.K., D.D. Aday, J.A. Rice, and W.G. Cope. 2013. Maternally transferred mercury in wild largemouth bass, *Micropterus salmoides*. *Environmental Pollution* 178: 493-497.
- Scott, W.B., and E.J. Crossman. 1973. *Freshwater fishes of Canada*: Fisheries Research Board of Canada Bulletin 184.
- Setzler-Hamilton, E. 1991. White Perch. In *Habitat requirements for Chesapeake Bay living resources*, ed. S.L. Funderburk, J.A. Mihurski, S.J. Jordan and D. Riley, 12.11-12.20. Annapolis, MD: Chesapeake Bay Program.
- Smith, W.G. 1973. Distribution of summer flounder, *Paralichthys dentatus*, eggs and larvae on continental shelf between Cape Cod and Cape Lookout, 1965-66. *Fishery Bulletin* 71: 527-548.

- Steimle, F.W., C.A. Zetlin, P.L. Berrien, and S. Chang. 1999. Black sea bass, *Centropristis striata*, life history and habitat characteristics, 42. Woods Hole, MA: NOAA NMFS.
- Strayer, D.L., and H.M. Malcolm. 2012. Causes of recruitment failure in freshwater mussel populations in southeastern New York. *Ecological Applications* 22(6): 1780–1790.
- Strayer, D.L., and J. Ralley. 1993. Microhabitat use by an assemblage of stream-dwelling unionaceans (Bivalvia), including two rare species of *Alasmidonta*. *Journal of the North American Benthological Society* 12(3): 247-258.
- Stuber, R.J., G. Gebhardt, and O.E. Maughan. 1982. Habitat suitability index models: Largemouth bass, 33: FWS/OBS-82/10.16.
- Tucker, J.W., Jr. 1989. Energy utilization in the bay anchovy, *Anchoa mitchilli*, and black sea bass, *Centropristis striata striata*, eggs and larvae. *U S Fish and Wildlife Service Fishery Bulletin* 87: 279-293.
- Underhill, A.H. 1949. Studies on the development, growth and maturity of the chain pickerel, *Esox niger* Lesueur. *The Journal of Wildlife Management* 13: 377-391.
- Van Colen, C., E. Debusschere, U. Braeckman, D.V. Gansbeke, and M. Vincx. 2012. The early life history of the clam *Macoma balthica* in a high CO2 world. *Plos One* 7: 1-8.
- Watters, G.T. 1994. An annotated bibliography of the reproduction and propagation of the Unionoidea (primarily of North America). *Ohio Biological Survey, Miscellaneous Monograph No. 1*. 158 pp.
- Watters, G.T. 1996. Small dams as barriers to freshwater mussels (Bivalvia, Unionoidea) and their hosts. *Biological Conservation* 75: 79-85.