Table 3. A summary of published information on relations between relative fecundity (f') and maternal age or size in exploited populations of north temperate and arctic marine fishes.
(Information for this analysis were taken from the text or tables, or digitized from figures in the publications listed. Beca use some figures were difficult to digitize, sample sizes (n) associated these figures are sometimes slightly less than n in original publications. Regression equations were used to predict f' over the range of ages or sizes observed. Note that a hump-shaped relation between f' and maternal age or size is not necessarily indicative of reproductive senescence, as this shape can also result from older , larger females sacrificing egg number for egg size. An effect of age or size on f' was estimated as the ratio of maximum to minimum predicted f'. To estimate the mean effect of female age and size on either the coefficient of determination (r^2) or the f' ratio, we first averaged values based on length and age within a year, and then averaged among years within a population, p opulations within a species, species within a family, families within an order, and orders within the class Actinopterygii. We f ound no evidence that r^2 or the f' ratio increased with reproductive life span (RLS) at any taxonomic level (regression results not shown). Blank cells indicate that data were unavailable. FL = fork lengt h, ICES = North International Council for the Exploration of the Sea, NAFO = Northwest Atlantic Fisheries Organization, P = probability, r = correlation coefficient, r_a^2 = adjusted r^2, SM, = somatic mass, TL = total length, TM = total mass.)

					predictor			f'									predicted	f'		
scientific name	common name	population	RLS	year(s)	variable	unit	range	unit	range	statistical test	result	r	r^2	r_a^2	n	P	f' range	ratio	source	notes
Atheresthes stomias	arrowtooth flounder	Gulf of Alaska	20	1993	FL	mm	480–829	eggs/g SM	178–394	regression	$f' = 0.300 \cdot FL + 89.868$	0.61	0.37	0.31	12	0.036	234–339	1.45	1 (figure 7)	our regression
Boops boops	bogue	Atlantic coast, Portugal	4	1987–1989	TL	mm	145–365	eggs/g TM	408–1458	regression	$f' = -0.041 \cdot TL^2 + 20.966 \cdot TL - 1557.391$	0.75	0.57	0.55	75	<0.001	621–1123	1.81	2 (table 1)	our regression
		"	"	"	Age	years	1–10	"	"	"	$f' = -17.180 \cdot Age^2 + 180.59 \cdot Age + 633.856$	0.57	0.33	0.31	75	<0.001	797–1107	1.39	"	"
Clupea harengus	Atlantic herring	Baltic Sea (ICES 29)	13	1988, 1991	TL	mm		eggs/g TM		correlation	f' was not correlated with TL				78				3 (text p. 70)	n : sum of all shoals and years
		Iceland (summer)	15	1999, 2000	TL	cm	25–39	eggs/g SM	200–880	regression	$f' = 590.3 - e^{11.9 - 0.2295 \cdot TL}$		0.57		451	<0.001	116–571	4.94	4 (figure 10)	
Coryphaena hippurus	common dolphinfish	Western Mediterranean	4	1990, 1991	FL	mm	65–117	eggs/g SM	71–1977	regression	$f' = -0.364 \cdot FL + 154.109$	0.21	0.04	-0.04	14	0.470	130–111	0.85	5 (table 2)	batch fecundity; our regression
Cynoscion nebulosus	spotted weakfish	Atlantic coast, South Carolina	6	1998–2000	TL	mm	272–530	eggs/g SM	205–1372	regression	$f' = 0.944 \cdot TL + 239.343$	0.26	0.07	0.06	113	0.006	496–740	1.49	6 (figure 5)	our regression
Dexistes rikuzenius	Rikuzen flounder	Pacific coast, Japan	10	2000, 2001	Age	years	1–8	oocytes/g SM	843–2009	regression	$f' = -31.355 \cdot Age^2 + 317.203 \cdot Age + 820.381$	0.53	0.28	0.24	41	0.002	1106–1622	1.47	7 (figure 7)	our regression
Engraulis encrasicolus	European anchovy	Southwestern Adriatic Sea	4	1993	TL	mm	119–171	eggs/g SM	271–584	regression	$f' = -0.213 \cdot TL + 466.220$	0.05	<0.01	-0.01	72	0.705	441–430	0.97	8 (table 4)	batch fecundity; our regression
Gadus morhua	Atlantic cod	Atlantic coast, Scotland	21	1969, 1970	Age	years	3–8	oocytes/g predicted SM		regression	$f' = 652.6 \cdot Age^{0.005}$		<0.01		69	0.969	656–659	1.00	9 (table 3)	
			"	2002, 2003	"	"	2–6	"	265–1226	"	$f' = 296.8 \cdot Age^{0.613}$		0.29		50	<0.001	582–1062	1.82	"	
		Baltic Sea (ICES 25)	26	1987	TL	cm	32–104	eggs/g TM		residual regression	TL did not explain residual variation in the fecundity-total mass relation				64	>0.400			10 (table 2, text p. 1911)	
			"	1988	"	"	27–76	"		"	"				115	>0.700			"	
			"	1989	"	"	37–62	"		"	"				65	>0.300			"	
			"	1990	"	"	35–68	"		"	"				104	>0.800			"	
			"	1991	"	"	38–87	"		"	"				77	>0.200			"	
			"	1992	"	"	41–98	"		"	"				43	>0.800			"	
			"	1996	"	"	36–84	"		"	"				91	>0.800			"	
			"	1998	"	"	35–91	"		"	"				40	>0.500			"	
			"	1999	"	"	26–126	"		"	"				65	>0.400			"	
			"	2000	"	"	28–108	"		"	"				94	>0.800			"	
		Iceland	20	1995	TL	cm	67–125	eggs/g TM	199–1192	regression	$f' = 4.8 \cdot TL + 91.2$		0.20			<0.001	413–691	1.67	11 (figure 7, table 5)	
			"	1996	"	"	57–133	"	342–1325	"	$f' = 4.6 \cdot TL + 184.7$		0.23			<0.001	447–796	1.78	"	
			"	1997	"	"	66–128	"	50–1241	"	$f' = 5.5 \cdot TL - 8.4$		0.14			<0.001	354–696	1.96	"	
			"	1998	"	"	59–129	"	50–1117	"	$f' = 8.3 \cdot TL - 200.2$		0.38			<0.001	289–870	3.01	"	
			"	1999	"	"	59–133	"	300–1233	"	$f' = 4.5 \cdot TL + 258.6$		0.19			<0.001	524–857	1.63	"	
			"	2000	"	"	62–131	"	182–1167	"	$f' = 5.1 \cdot TL + 168.6$		0.21			<0.001	485–834	1.73	"	
		Northeastern Arctic	22	1986	TL	cm	55–135	eggs/g TM	226–688	regression	$f' = 1.685 \cdot TL + 271.577$	0.31	0.09	0.07	48	0.035	364–499	1.37	12 (figure 3), 13 (text p. 310)	our regression
			"	1988	"	"	50–122	"	220–715	"	$f' = 3.026 \cdot TL + 139.437$	0.56	0.31	0.29	45	0.001	291–509	1.75	"	"
			"	1989	"	"	50–126	"	216–787	"	$f' = 1.668 \cdot TL + 303.492$	0.35	0.12	0.11	105	<0.001	387–514	1.33	"	"
			22	1987	TL	cm	50–86	eggs/g TM		correlation	f' was not correlated with TL				23	>0.500			13 (text p. 311)	
			"	1991	"	"	50–127	"		"	"				8	>0.500			"	
		North Sea (inshore)	21	1969, 1970	Age	years	3–5	oocytes/g predicted SM		regression	$f' = 561.2 \cdot Age^{0.097}$		<0.01		52	0.752	624–656	1.05	9 (table 3)	
			"	2002, 2003	"	"	2–8	"	269–1400	"	$f' = 357.8 \cdot Age^{0.607}$		0.20		109	<0.001	545–1264	2.32	"	
		North Sea (offshore)	"	"	"	"	2–6	"	211–1182	"	$f' = 138.8 \cdot Age^{1.075}$		0.50		47	<0.001	292–953	3.26	"	
Glyptocephalus cynoglossus	witch flounder	Northwestern Atlantic (NAFO 3L)	18	1974–1977	TL	cm	44–63	eggs/g TM	128–663	regression	$f' = 61.663 \cdot TL^{0.405}$	0.08	0.01	-0.01	63	0.558	285–330	1.16	14 (figure 2, 5, 8)	our regression
			"	"	Age	years	11–23	"	"	"	$f' = -8.306 \cdot Age + 463.335$	0.16	0.03	0.01	63	0.205	372–273	0.73	"	"
			18	1993–1998	TL	cm	35–61	eggs/g TM	111–740	regression	f' was independent of TL				41				14 (text p. 1763)	
		Northwestern Atlantic (NAFO 3LNO)	18	1993–1998	TL	cm	35–61	"	119–828	"	"				177				"	
		Northwestern Atlantic (NAFO 3NO)	18	1974–1977	TL	cm	42–65	eggs/g TM	137–671	regression	$f' = 0.921 \cdot TL^{1.506}$	0.37	0.14	0.13	103	<0.001	256–495	1.93	14 (figure 2, 5, 8)	our regression
			"	"	Age	years	10–26	"	"	"	$f' = 5.094 \cdot Age + 272.133$	0.11	0.01	0.00	103	0.250	323–405	1.25	"	"
		Northwestern Atlantic (NAFO 3Ps)	18	1974–1977	TL	cm	39–59	"	116–530	"	$f' = 0.232 \cdot TL^{1.841}$	0.48	0.23	0.22	107	<0.001	198–422	2.14	"	"
			"	"	Age	years	8–22	"	"	"	$f' = 50.385 \cdot Age^{0.644}$	0.39	0.15	0.14	107	<0.001	192–369	1.92	"	"
			18	1993–1998	TL	cm	30–58	eggs/g TM	93–852	regression	f' was independent of TL				131				15 (text p. 1763)	
Hippoglossoides platessoides	American plaice	Atlantic coast, Scotland	19	1954	TL	cm	15-31	eggs/g SM	797–1807	regression	$f' = 4.759 \cdot TL + 1146.464$	0.07	0.01	0.00	117	0.464	1218–1294	1.06	16 (table 30)	our regression
			"	"	Age	years	2–5	"	"	"	$f' = 12.514 \cdot Age + 1209.854$	0.05	<0.01	-0.10	116	0.594	1235–1272	1.03	"	"
		Northwestern Atlantic (NAFO 3LNO)	19	1993–1998	TL	cm	24–67	eggs/g TM	117–1077	regression	f' was independent of TL				606				15 (table 1, text pp 1763, 1766)	
		Northwestern Atlantic (NAFO 3Ps)	"	"	"	"	26–72	"	78–1071	"	"				358				"	
Hoplostethus atlanticus	orange roughy	Northeastern Atlantic	100	2002	SL	mm	362–528	eggs/g TM	10–65	regression	$f' = 0.074 \cdot SL - 2.100$	0.23	0.05	0.04	61	0.075	25–37	1.50	17 (figure 2, 3)	our regression
Limanda ferruginea	yellowtail flounder	Northwestern Atlantic (NAFO 3LNO)	8	1993–1998	TL	cm	30–54	eggs/g TM	182–7263	regression	f' was independent of TL				444				15 (table 1, text pp 1763, 1766)	
		Northwestern Atlantic (NAFO 3Ps)	"	"	"	"	30–50	"	340–8349	"	"				102				"	
Malostus villosus	capelin	Barents Sea	9	1997	TL	mm	111–162	eggs/g SM	49–115	regression	$f' = 0.709 \cdot TL - 25.136$	0.58	0.33	0.32	64	<0.001	54–90	1.67	18 (figure 2, 3)	our regression
Melanogrammus aeglefinus	haddock	Atlantic coast, Scotland	14	1986, 1987	Age	years	2–6	eggs/g TM			f' increased with age and then plateaued				447		278–493	1.77	19 (figure 5)	predicted range and ratio are from age-2 vs age-3+ mean
		North Sea	14	1976	TL	cm	30–47	eggs/g SM	223–701	regression	$f' = -2.557 \cdot TL^2 + 198.065 \cdot TL - 3306.375$	0.44	0.20	0.17	67	0.001	334–529	1.58	20 (appendix table 1, 2)	our regression
			"	1977	"	"	22–44	"	208–635	"	$f' = 3.164 \cdot TL + 365.821$	0.17	0.03	0.01	41	0.273	435–505	1.16	"	"
			"	1978	"	"	26–45	"	210–802	"	$f' = -1.404 \cdot TL^2 + 106.903 \cdot TL - 1458.936$	0.35	0.12	0.11	119	0.001	371–576	1.55	"	"
			"	1976	Age	years	2–5	"	223–701	"	$f' = -66.355 \cdot Age^2 + 504.795 \cdot Age - 417.589$	0.40	0.16	0.13	67	0.004	327–550	1.68	"	"
			"	1977	"	"	2–6	"	208–635	"	$f' = 0.600 \cdot Age + 464.376$	0.01	<0.01	-0.03	41	0.977	466–468	1.00	"	"
			"	1978	"	"	2–8	"	210–802	"	$f' = -24.001 \cdot Age^2 + 215.346 \cdot Age - 70.830$	0.32	0.10	0.09	119	0.002	264–406	1.54	"	"

Table 3. Continued

scientific name	common name	population	RLS	year(s)	predictor variable	predictor unit	predictor range	f' unit	f' range	statistical test	result	r	r^2	r_a^2	n	P	predicted f' range	f' ratio	source	notes
Melanogrammus aeglefinus	haddock	Northwestern Atlantic (Grand Bank)	13	1957	TL	cm	38–64	eggs/g SM	145–1468	regression	$f' = 0.403 \cdot TL^{1.910}$	0.49	0.24	0.23	92	<0.001	419–1135	2.71	21 (figure 2, 3)	our regression
			"	1958	"	"	39–53	"	262–1116	"	$f' = 0.123 \cdot TL^{2.234}$	0.46	0.22	0.18	22	0.029	441–875	1.98	"	"
			"	1960	"	"	36–54	"	109–1193	"	$f' = 0.016 \cdot TL^{2.782}$	0.60	0.37	0.35	52	<0.001	342–1056	3.09	"	"
Pleuronectes platessa	European plaice	Atlantic coast, Scotland	27	1956	TL	mm	305–566	eggs/g TM	178–400	regression	$f' = 0.133 \cdot TL + 203.872$	0.17	0.03	0.00	31	0.350	244–279	1.14	22 (appendix)	our regression
			"	1957	"	"	327–438	"	136–402	"	$f' = 0.537 \cdot TL + 60.338$	0.24	0.06	0.03	31	0.188	236–295	1.25	"	"
			"	1956	Age	years	4–10	"	178–400	"	$f' = 1.910 \cdot Age + 248.024$	0.07	0.01	-0.04	24	0.748	256–267	1.04	"	"
			"	1957	"	"	3–10	"	136–402	"	$f' = -6.688 \cdot Age^2 + 82.502 \cdot Age - 23.767$	0.38	0.14	0.08	31	0.117	163–230	1.41	"	"
		Celtic Sea (Bristol Channel)	25	1990	TL	mm	244–413	eggs/g SM	168–439	regression	$f' = 0.082 \cdot TL + 271.22$	0.04	<0.01	-0.04	25	0.836	291–305	1.05	23 (table 1)	our regression
			"	1990	Age	years	2–7	"	"	"	$f' = 15.685 \cdot Age + 239.891$	0.20	0.04	0.00	25	0.328	271–350	1.29	"	"
		Celtic Sea (Irish coast)	"	1991	TL	mm	285–455	"	136–457	"	$f' = 0.958 \cdot TL - 91.778$	0.66	0.44	0.41	23	0.001	181–344	1.90	"	"
			"	"	Age	years	3–8	"	"	"	$f' = 47.009 \cdot Age + 8.494$	0.69	0.47	0.45	23		149–385	2.57	"	"
		Irish Sea (Cumbrian coast)	25	1995	SM	g		eggs/g TM		regression	$f' = 0.059 \cdot SM + 230.40$		0.03	0.02	95				24 (table 6)	
		Irish Sea (Liverpool Bay)	"	"	"	"		"	"	"	$f' = 0.203 \cdot SM + 170.09$		0.31	0.29	42				"	
		Irish Sea, west	"	"	"	"		"	"	"	$f' = 0.197 \cdot SM + 112.54$		0.37	0.36	46				"	
		Irish Sea (Cardigan Bay)	"	"	"	"		"	"	"	$f' = 0.059 \cdot SM + 181.73$		0.15	0.13	43				"	
		North Sea	25	1982	TL	mm	284–613	eggs/g SM	121–381	regression	$f' = 0.059 \cdot TL + 218.916$	0.07	<0.01	-0.01	102	0.507	236–255	1.08	25 (appendix)	our regression
			"	1983	"	"	259–649	"	115–390	"	$f' = 0.100 \cdot TL + 184.622$	0.13	0.02	0.01	153	0.103	210–249	1.18	"	"
			"	1984	"	"	260–588	"	90–340	"	$f' = 0.169 \cdot TL + 145.148$	0.24	0.06	0.05	129	0.007	189–244	1.29	"	"
			"	1985	"	"	286–547	"	80–353	"	$f' = 0.198 \cdot TL + 133.974$	0.22	0.05	0.04	104	0.026	191–242	1.27	"	"
			"	1982	Age	years	3–19	"	121–381	"	$f' = 0.247 \cdot Age + 244.898$	0.02	<0.01	-0.01	102	0.884	246–250	1.02	"	"
			"	1983	"	"	3–18	"	115–390	"	$f' = 1.822 \cdot Age + 213.677$	0.12	0.02	0.01	153	0.133	219–246	1.12	"	"
			"	1984	"	"	3–18	"	90–340	"	$f' = 1.575 \cdot Age + 205.164$	0.09	0.01	0.00	127	0.316	210–233	1.11	"	"
			"	1985	"	"	3–16	"	80–353	"	$f' = 2.556 \cdot Age + 196.59$	0.13	0.02	0.01	104	0.181	204–237	1.16	"	"
Reinhardtius hippoglossoides	Greenland halibut	North Atlantic (ICES XIVb)	13	1997	TL	cm	63–110	eggs/g SM	6–21	regression	$f' = 0.098 \cdot TL + 5.980$	0.32	0.11	0.10	100	0.001	12–18	1.38	26 (figure 3, 5)	our regression
Salmo salar	Atlantic salmon	Barents Sea (River Teno)	8	1994–1998	TL	cm		eggs/kg TM		regression	$\log(f') = -0.358 \cdot \log(TL) + 9.143$		0.03	0.00	46	0.298			27 (table 2)	
Sardina pilchardus	European pilchard	Aegean Sea	6	2000–2001	SM	g	10–26	eggs/g TM		intercept test	The intercept of the f'-SM relation was not significantly different from 0					>0.050			28 (text p. 21)	batch fecundity
		Ionian Sea	"	"	"	"	7–24	"		"	"					"			"	"
Scomber japonicus	chub mackerel	Izu Islands, Japan	11	1993	FL	mm	329–393	eggs/g SM	32–250	regression	$f' = -0.293 \cdot FL + 266.545$	0.09	0.01	-0.08	14	0.774	170–151	0.89	29 (table 4)	batch fecundity; our regression
		Pacific coast, California	12	1985	FL	mm	300–340	eggs/g SM	53–315	regression	$f' = 0.130 \cdot FL + 129.349$	0.02	<0.01	-0.09	13	0.935	168–173	1.03	30 (table 7)	batch fecundity; our regression
Sebastes melanops	black rockfish	Pacific coast, Oregon	23	1995–1998	Age	years	6–16	eggs/g SM	170–315	parallel lines multiple linear regression	$f' = 357.7 + 17.5 \cdot Age - 106.5 \cdot stage$		0.27		166	<0.001	371–552	1.49	31 (figure 9)	stage refers to prefertilization and fertlized eggs; f' was estimated from the latter
Solea solea	common sole	English Channel (ICES VIId)	25	1991	TL	mm	260–440	eggs/g SM	129–1416	regression	$f' = 1.994 \cdot TL + 75.445$	0.36	0.13	0.11	49	0.011	594–953	1.60	32 (appendix 1)	our regression
			"	"	Age	years	2–19	"	"	"	$f' = 172.716 \cdot Ln(Age) + 478.564$	0.35	0.12	0.10	49	0.014	598–987	1.65	"	"
		English Channel (ICES VIIe)	"	"	TL	mm	312–500	"	372–884	"	$f' = 0.026 \cdot TL + 585.369$	0.01	<0.01	-0.03	33	0.957	593–598	1.01	"	"
		Irish Sea (ICES VIIa)	"	"	"	"	282–411	"	465–1169	"	$f' = 1.269 \cdot TL + 412.603$	0.23	0.05	0.02	29	0.221	770–934	1.21	"	"
			"	"	Age	years	3–10	"	"	"	$f' = 23.442 \cdot Age + 682.411$	0.17	0.03	0.00	29	0.390	753–917	1.22	"	"
		North Sea (ICES IVb east)	"	"	TL	mm	258–481	"	666–1422	"	$f' = 0.819 \cdot TL + 702.787$	0.26	0.06	0.04	40	0.112	914–1097	1.20	"	"
			"	"	Age	years	3–12	"	"	"	$f' = 11.857 \cdot Age + 931.175$	0.17	0.03	0.00	40	0.291	967–1073	1.11	"	"
		North Sea (ICES IVb west)	"	"	TL	mm	241–456	"	371–1005	"	$f' = 1.650 \cdot TL + 64.039$	0.53	0.28	0.26	45	<0.001	462–816	1.77	"	"
			"	"	Age	years	3–19	"	"	"	$f' = 351.185 \cdot Age^{0.285}$	0.54	0.29	0.28	45	<0.001	480–813	1.69	"	"
		North Sea (ICES IVc)	"	"	TL	mm	248–456	"	651–1504	"	$f' = 0.849 \cdot TL + 707.530$	0.24	0.06	0.04	55	0.074	918–1095	1.19	"	"
			"	"	Age	years	3–15	"	"	"	$f' = 9.469 \cdot Age + 951.822$	0.10	0.01	-0.01	55	0.456	980–1094	1.12	"	"
		Northeastern Atlantic, Bay of Biscay (ICES VIIIa)	"	"	TL	mm	287–471	"	365–918	"	$f' = 0.978 \cdot TL + 253.557$	0.37	0.14	0.11	39	0.020	534–714	1.34	"	"
			"	"	Age	years	3–19	"	"	"	$f' = 23.442 \cdot Age + 682.411$	0.17	0.03	-0.01	39	0.390	753–1128	1.50	"	"
		Northeastern Atlantic, Portugese coast (ICES IXa)	"	"	TL	mm	290–475	"	349–776	"	$f' = 0.937 \cdot TL + 183.474$	0.37	0.14	0.11	33	0.034	455–628	1.38	"	"
Spondyliosoma cantharus	black seabream	Adriatic Sea	10	1994	TL	cm	19–34	eggs/g SM	454–1155	regression	$f' = 25.665 \cdot TL + 38.377$	0.71	0.50	0.49	59	<0.001	526–911	1.73	33 (table 1)	our regression
			"	"	Age	years	2–7	"	"	"	$f' = 385.697 \cdot Ln(Age) + 173.566$	0.65	0.42	0.41	59	<0.001	441–924	2.10	"	"
Tanakius kitaharai	willowy flounder	Pacific coast, Japan	7	2003, 2004	Age	years	2–8	oocytes/g TM		ANOVA	f' increased and then decreased with age				58	<0.050	1022–1245	1.22	34 (figure 5)	predicted range and ratio based on age class means
Theragra chalcogramma	Alaska pollock	Strait of Georgia, British Columbia	15	1980, 1981	FL	cm	32–67	oocytes/g TM	530–830		f' decreased with FL								35 (text p. 340)	
Trachurus symmetricus	Pacific jack mackerel	Pacific coast, California	27	1991	FL	mm	382–540	eggs/g SM	47–172	regression	$f' = 0.120 \cdot FL + 59.735$	0.13	0.02	-0.01	33	0.463	106–124	1.18	36 (table 4)	our regression

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