



**Fig. S1. Analysis of data treating each fish as an independent data point.** (A) Under local magnetic field conditions fish from the control group were significantly oriented with a mean angle of 341 deg (Rayleigh test,  $n=208$ ,  $r=0.12$ ,  $z=3.20$ ,  $p=0.04$ ). (B) Under local magnetic field conditions salmon that experienced a strong magnetic pulse were not oriented as a group (Rayleigh test,  $n=196$ ,  $r=0.12$ ,  $z=2.78$ ,  $p=0.06$ ). (C) During a magnetic displacement to a southern ocean region, control fish were not oriented as a group (Rayleigh test,  $n=216$ ,  $r=0.06$ ,  $z=0.72$ ,  $p=0.49$ ). (D) During the magnetic displacement, salmon from the pulse group were significantly oriented with a mean angle of 66 deg (Rayleigh test,  $n=204$ ,  $r=0.13$ ,  $z=3.30$ ,  $p=0.04$ ). The length of each bar indicates the number of fish that were oriented within each 15 degree range of directions. Arrow heads indicate the mean direction of each treatment group. Dotted lines represent the 95% confidence interval for the mean. Fish that we were unable to determine a clear angle of orientation for (due to glare in the photos) were omitted from the analysis, resulting in the slightly uneven sample sizes.

**Table S1. Average orientation angle of individual fish.** Data shown are for control or pulsed fish tested under local ambient conditions and during a magnetic-displacement to a southern ocean region.

<b>Trial#</b>	<b>Treatment</b>	<b>Ambient</b>	<b>Magnetic-displacement</b>
T1	Control	6.0	191.2
T2	Pulse	52.4	135.7
T3	Control	20.6	267.6
T4	Pulse	227.9	55.0
T5	Control	295.5	356.7
T6	Pulse	70.5	215.3
T7	Control	357.0	115.0
T8	Pulse	266.4	118.9
T9	Control	304.7	169.1
T10	Pulse	53.0	11.7
T11	Control	72.0	314.1
T12	Pulse	199.4	163.3
T13	Control	30.8	126.9
T14	Pulse	294.4	50.9
T15	Control	327.4	141.9
T16	Pulse	24.1	54.4
T17	Control	322.2	288.3
T18	Pulse	26.1	336.3
T19	Control	331.2	11.8
T20	Pulse	300.6	15.9
T21	Control	351.3	137.0
T22	Pulse	312.6	114.7
T23	Control	164.5	254.9
T24	Pulse	54.9	90.2
T25	Control	215.0	122.7
T26	Pulse	321.4	38.3
T27	Control	284.5	310.5

**Table S2. Average orientation angle of individual fish.** Data shown are for control or pulsed fish tested under local ambient conditions and during a magnetic-displacement to a southern ocean region.

Trial #	Treatment	Bucket#	Ambient	Magnetic-displacement
T1	Control	1	334.3	141.7
T1	Control	2	8.1	181.9
T1	Control	3	129.4	157.5
T1	Control	4	47.8	122.8
T1	Control	5	NA	242.8
T1	Control	6	68.4	319.0
T1	Control	7	51.6	77.8
T1	Control	8	335.2	300.9
T1	Control	9	324.7	288.1
T1	Control	10	25.6	178.0
T1	Control	11	168.9	268.5
T1	Control	12	345.1	113.9
T1	Control	13	189.2	168.3
T1	Control	14	255.0	156.5
T1	Control	15	14.6	191.8
T1	Control	16	304.5	286.2
T2	Pulse	1	115.8	76.3
T2	Pulse	2	286.8	250.2
T2	Pulse	3	316.7	99.2
T2	Pulse	4	52.2	141.1
T2	Pulse	5	346.7	313.9
T2	Pulse	6	112.2	227.7
T2	Pulse	7	37.7	175.5
T2	Pulse	8	337.2	322.3
T2	Pulse	9	NA	230.3
T2	Pulse	10	316.8	74.7
T2	Pulse	11	101.5	106.0
T2	Pulse	12	161.8	188.9
T2	Pulse	13	NA	258.4
T2	Pulse	14	50.7	67.4
T2	Pulse	15	139.5	101.3
T2	Pulse	16	83.1	74.4
T3	Control	1	257.1	278.2
T3	Control	2	319.1	347.6
T3	Control	3	28.6	278.9
T3	Control	4	51.3	NA
T3	Control	5	122.0	25.6
T3	Control	6	35.3	242.4
T3	Control	7	217.8	212.1
T3	Control	8	297.6	134.5
T3	Control	9	141.1	0.6
T3	Control	10	326.9	175.5
T3	Control	11	49.0	231.1
T3	Control	12	NA	19.0
T3	Control	13	135.6	288.1
T3	Control	14	112.5	189.0
T3	Control	15	342.6	298.5
T3	Control	16	245.5	238.3
T4	Pulse	1	328.1	322.7
T4	Pulse	2	42.0	6.7
T4	Pulse	3	282.3	235.5

T4	Pulse	4	166.0	108.3
T4	Pulse	5	232.2	331.2
T4	Pulse	6	211.4	46.3
T4	Pulse	7	218.8	175.5
T4	Pulse	8	150.0	121.1
T4	Pulse	9	203.2	149.9
T4	Pulse	10	325.2	105.3
T4	Pulse	11	52.6	263.8
T4	Pulse	12	NA	41.9
T4	Pulse	13	174.3	201.7
T4	Pulse	14	76.1	358.7
T4	Pulse	15	262.7	80.7
T4	Pulse	16	260.7	297.5
T5	Control	1	342.6	227.1
T5	Control	2	44.0	280.1
T5	Control	3	20.8	34.2
T5	Control	4	20.8	350.2
T5	Control	5	270.0	4.5
T5	Control	6	257.0	304.6
T5	Control	7	184.4	332.7
T5	Control	8	188.1	323.2
T5	Control	9	286.8	50.2
T5	Control	10	53.6	149.9
T5	Control	11	133.1	143.3
T5	Control	12	NA	290.0
T5	Control	13	244.2	311.9
T5	Control	14	332.9	54.2
T5	Control	15	214.3	61.7
T5	Control	16	NA	109.2
T6	Pulse	1	204.3	232.9
T6	Pulse	2	22.1	151.1
T6	Pulse	3	318.3	292.8
T6	Pulse	4	83.8	48.3
T6	Pulse	5	54.0	346.4
T6	Pulse	6	71.8	204.6
T6	Pulse	7	140.1	322.1
T6	Pulse	8	341.1	116.4
T6	Pulse	9	110.5	190.2
T6	Pulse	10	86.2	123.1
T6	Pulse	11	56.0	203.5
T6	Pulse	12	304.8	275.0
T6	Pulse	13	190.7	326.7
T6	Pulse	14	238.5	120.8
T6	Pulse	15	303.6	236.9
T6	Pulse	16	183.3	202.0
T7	Control	1	23.2	234.3
T7	Control	2	238.8	107.6
T7	Control	3	82.4	27.9
T7	Control	4	116.1	334.7
T7	Control	5	220.9	211.1
T7	Control	6	251.5	121.1
T7	Control	7	103.3	289.9

T7	Control	8	164.0	93.7
T7	Control	9	335.0	96.6
T7	Control	10	1.5	174.0
T7	Control	11	3.9	52.1
T7	Control	12	NA	15.4
T7	Control	13	290.8	252.6
T7	Control	14	1.9	160.8
T7	Control	15	248.0	248.8
T7	Control	16	94.3	69.7
T8	Pulse	1	133.7	88.9
T8	Pulse	2	54.0	319.9
T8	Pulse	3	199.3	184.9
T8	Pulse	4	191.6	127.5
T8	Pulse	5	113.9	48.0
T8	Pulse	6	260.8	10.7
T8	Pulse	7	320.1	129.2
T8	Pulse	8	3.5	82.9
T8	Pulse	9	NA	157.7
T8	Pulse	10	284.5	60.6
T8	Pulse	11	161.9	264.6
T8	Pulse	12	36.1	NA
T8	Pulse	13	274.2	291.7
T8	Pulse	14	331.2	193.4
T8	Pulse	15	301.0	119.4
T8	Pulse	16	205.6	257.5
T9	Control	1	NA	NA
T9	Control	2	295.5	156.6
T9	Control	3	358.2	194.8
T9	Control	4	177.5	178.1
T9	Control	5	NA	291.7
T9	Control	6	282.3	215.3
T9	Control	7	72.5	23.7
T9	Control	8	24.9	NA
T9	Control	9	269.0	91.1
T9	Control	10	114.6	305.9
T9	Control	11	297.7	195.6
T9	Control	12	263.4	43.9
T9	Control	13	355.1	323.1
T9	Control	14	168.7	156.1
T9	Control	15	97.3	117.7
T9	Control	16	268.8	161.3
T10	Pulse	1	199.7	61.9
T10	Pulse	2	45.5	6.4
T10	Pulse	3	65.5	69.6
T10	Pulse	4	46.0	145.4
T10	Pulse	5	251.6	230.5
T10	Pulse	6	38.7	331.3
T10	Pulse	7	139.3	160.4
T10	Pulse	8	194.4	355.8
T10	Pulse	9	333.5	355.5
T10	Pulse	10	330.4	87.4
T10	Pulse	11	57.0	12.4

T10	Pulse	12	138.6	299.4
T10	Pulse	13	140.7	311.5
T10	Pulse	14	36.0	333.0
T10	Pulse	15	277.0	42.4
T10	Pulse	16	275.3	12.8
T11	Control	1	349.1	146.5
T11	Control	2	258.6	322.1
T11	Control	3	114.0	86.0
T11	Control	4	138.8	12.8
T11	Control	5	101.8	230.8
T11	Control	6	111.6	196.1
T11	Control	7	230.2	245.2
T11	Control	8	98.5	205.6
T11	Control	9	277.0	208.7
T11	Control	10	54.5	17.1
T11	Control	11	60.3	30.8
T11	Control	12	45.8	64.4
T11	Control	13	34.6	289.7
T11	Control	14	57.9	279.4
T11	Control	15	76.8	7.9
T11	Control	16	269.4	99.2
T12	Pulse	1	160.1	314.8
T12	Pulse	2	303.0	176.2
T12	Pulse	3	218.5	74.9
T12	Pulse	4	132.3	78.7
T12	Pulse	5	211.3	354.0
T12	Pulse	6	167.4	188.8
T12	Pulse	7	6.1	89.3
T12	Pulse	8	103.5	216.2
T12	Pulse	9	255.4	146.3
T12	Pulse	10	214.0	281.0
T12	Pulse	11	298.5	183.1
T12	Pulse	12	349.5	133.9
T12	Pulse	13	52.5	338.7
T12	Pulse	14	116.6	326.3
T12	Pulse	15	181.7	277.5
T12	Pulse	16	237.5	132.4
T13	Control	1	49.3	97.8
T13	Control	2	331.8	150.4
T13	Control	3	194.2	50.4
T13	Control	4	75.6	73.2
T13	Control	5	91.4	188.5
T13	Control	6	284.7	250.3
T13	Control	7	127.1	40.1
T13	Control	8	7.3	121.9
T13	Control	9	11.2	226.4
T13	Control	10	127.6	144.7
T13	Control	11	283.7	238.7
T13	Control	12	53.6	76.3
T13	Control	13	28.8	130.4
T13	Control	14	156.7	164.2
T13	Control	15	323.4	312.8

T13	Control	16	327.0	75.7
T14	Pulse	1	68.3	352.9
T14	Pulse	2	234.0	3.8
T14	Pulse	3	248.4	348.8
T14	Pulse	4	291.2	166.0
T14	Pulse	5	NA	NA
T14	Pulse	6	122.1	74.0
T14	Pulse	7	154.4	96.1
T14	Pulse	8	328.3	138.3
T14	Pulse	9	325.6	270.0
T14	Pulse	10	106.6	235.5
T14	Pulse	11	249.5	356.6
T14	Pulse	12	10.3	54.1
T14	Pulse	13	NA	22.1
T14	Pulse	14	101.2	261.5
T14	Pulse	15	19.2	144.0
T14	Pulse	16	202.1	117.6
T15	Control	1	182.0	8.3
T15	Control	2	323.4	51.1
T15	Control	3	235.0	59.8
T15	Control	4	309.8	127.0
T15	Control	5	292.1	151.3
T15	Control	6	157.4	258.9
T15	Control	7	23.3	313.5
T15	Control	8	289.9	116.4
T15	Control	9	NA	316.8
T15	Control	10	51.0	162.7
T15	Control	11	101.0	139.2
T15	Control	12	63.5	230.4
T15	Control	13	303.6	279.4
T15	Control	14	111.0	58.1
T15	Control	15	356.5	153.9
T15	Control	16	260.8	208.3
T16	Pulse	1	360.0	61.0
T16	Pulse	2	347.0	5.3
T16	Pulse	3	237.5	81.9
T16	Pulse	4	77.1	41.4
T16	Pulse	5	285.9	98.6
T16	Pulse	6	145.3	197.6
T16	Pulse	7	96.8	123.6
T16	Pulse	8	78.3	352.2
T16	Pulse	9	345.6	21.3
T16	Pulse	10	94.7	37.9
T16	Pulse	11	3.6	250.0
T16	Pulse	12	32.7	210.3
T16	Pulse	13	50.0	11.9
T16	Pulse	14	4.7	352.0
T16	Pulse	15	274.9	189.5
T16	Pulse	16	15.3	91.4
T17	Control	1	284.7	337.4
T17	Control	2	1.4	207.7
T17	Control	3	12.2	142.2

T17	Control	4	275.1	315.0
T17	Control	5	237.2	195.0
T17	Control	6	174.5	173.7
T17	Control	7	10.5	239.1
T17	Control	8	213.7	35.6
T17	Control	9	67.1	246.7
T17	Control	10	322.8	271.7
T17	Control	11	332.4	35.9
T17	Control	12	8.3	31.7
T17	Control	13	58.4	238.7
T17	Control	14	NA	350.3
T17	Control	15	275.4	36.1
T17	Control	16	169.9	NA
T18	Pulse	1	2.4	284.8
T18	Pulse	2	333.7	179.5
T18	Pulse	3	143.4	116.5
T18	Pulse	4	122.1	103.3
T18	Pulse	5	58.9	27.9
T18	Pulse	6	243.1	247.0
T18	Pulse	7	61.4	164.7
T18	Pulse	8	70.3	149.4
T18	Pulse	9	308.9	321.5
T18	Pulse	10	298.5	40.1
T18	Pulse	11	310.1	313.6
T18	Pulse	12	60.2	346.1
T18	Pulse	13	208.6	353.8
T18	Pulse	14	44.1	28.4
T18	Pulse	15	31.0	234.7
T18	Pulse	16	33.6	302.5
T19	Control	1	352.1	240.6
T19	Control	2	187.9	36.2
T19	Control	3	51.5	71.7
T19	Control	4	302.5	78.7
T19	Control	5	70.9	301.9
T19	Control	6	348.3	278.0
T19	Control	7	341.8	277.9
T19	Control	8	16.1	98.6
T19	Control	9	128.0	250.7
T19	Control	10	244.7	8.2
T19	Control	11	253.5	48.6
T19	Control	12	76.5	302.5
T19	Control	13	347.8	246.7
T19	Control	14	287.3	130.5
T19	Control	15	303.8	144.0
T19	Control	16	223.7	120.7
T20	Pulse	1	NA	305.1
T20	Pulse	2	133.9	147.6
T20	Pulse	3	295.8	51.5
T20	Pulse	4	117.3	267.4
T20	Pulse	5	180.0	145.9
T20	Pulse	6	131.9	72.8
T20	Pulse	7	3.5	3.5



T20	Pulse	8	34.4	22.2
T20	Pulse	9	270.5	202.2
T20	Pulse	10	245.3	16.9
T20	Pulse	11	291.2	294.2
T20	Pulse	12	277.2	337.8
T20	Pulse	13	305.7	26.3
T20	Pulse	14	17.7	322.3
T20	Pulse	15	314.9	41.2
T20	Pulse	16	NA	121.8
T21	Control	1	NA	50.5
T21	Control	2	76.1	241.2
T21	Control	3	2.6	245.6
T21	Control	4	82.2	185.9
T21	Control	5	249.4	216.0
T21	Control	6	302.0	335.6
T21	Control	7	51.1	190.3
T21	Control	8	NA	12.9
T21	Control	9	119.4	88.9
T21	Control	10	222.3	98.4
T21	Control	11	333.9	126.8
T21	Control	12	326.2	60.4
T21	Control	13	8.8	200.7
T21	Control	14	179.3	90.8
T21	Control	15	221.4	310.0
T21	Control	16	NA	322.0
T22	Pulse	1	6.7	111.8
T22	Pulse	2	319.9	12.3
T22	Pulse	3	212.8	52.4
T22	Pulse	4	255.9	33.2
T22	Pulse	5	290.8	342.9
T22	Pulse	6	245.2	171.2
T22	Pulse	7	311.5	258.1
T22	Pulse	8	NA	240.6
T22	Pulse	9	97.4	185.2
T22	Pulse	10	32.6	171.0
T22	Pulse	11	304.1	27.2
T22	Pulse	12	NA	123.9
T22	Pulse	13	77.6	85.0
T22	Pulse	14	27.4	122.0
T22	Pulse	15	219.9	171.7
T22	Pulse	16	NA	NA
T23	Control	1	87.1	286.2
T23	Control	2	198.3	67.3
T23	Control	3	275.2	307.3
T23	Control	4	76.4	29.7
T23	Control	5	97.2	231.1
T23	Control	6	268.8	45.5
T23	Control	7	84.9	198.4
T23	Control	8	NA	NA
T23	Control	9	170.5	244.6
T23	Control	10	110.0	264.4
T23	Control	11	240.5	235.1

T23	Control	12	235.5	179.7
T23	Control	13	242.1	228.9
T23	Control	14	266.7	280.4
T23	Control	15	72.1	250.5
T23	Control	16	116.5	NA
T24	Pulse	1	8.1	59.9
T24	Pulse	2	106.0	58.1
T24	Pulse	3	118.1	19.3
T24	Pulse	4	184.1	165.8
T24	Pulse	5	30.0	NA
T24	Pulse	6	35.5	121.7
T24	Pulse	7	9.4	148.7
T24	Pulse	8	291.4	26.2
T24	Pulse	9	332.3	140.7
T24	Pulse	10	209.0	35.3
T24	Pulse	11	280.3	26.6
T24	Pulse	12	110.1	209.9
T24	Pulse	13	128.2	263.5
T24	Pulse	14	66.5	131.5
T24	Pulse	15	292.1	127.0
T24	Pulse	16	100.2	319.9
T25	Control	1	67.1	308.6
T25	Control	2	290.2	91.4
T25	Control	3	247.3	29.6
T25	Control	4	78.6	NA
T25	Control	5	202.6	221.2
T25	Control	6	58.6	138.8
T25	Control	7	250.4	3.3
T25	Control	8	NA	21.1
T25	Control	9	177.5	110.1
T25	Control	10	284.7	297.3
T25	Control	11	77.5	112.3
T25	Control	12	202.6	NA
T25	Control	13	227.0	180.8
T25	Control	14	222.0	168.9
T25	Control	15	NA	121.9
T25	Control	16	214.4	195.3
T26	Pulse	1	314.4	21.1
T26	Pulse	2	293.5	317.1
T26	Pulse	3	313.9	151.2
T26	Pulse	4	342.4	36.8
T26	Pulse	5	22.0	220.4
T26	Pulse	6	176.4	168.7
T26	Pulse	7	299.2	206.4
T26	Pulse	8	122.6	18.0
T26	Pulse	9	313.6	172.7
T26	Pulse	10	53.6	351.0
T26	Pulse	11	250.0	241.3
T26	Pulse	12	316.4	93.7
T26	Pulse	13	336.8	337.5
T26	Pulse	14	265.9	154.8
T26	Pulse	15	18.9	31.2

T26	Pulse	16	NA	7.9
T27	Control	1	215.1	147.7
T27	Control	2	308.5	206.0
T27	Control	3	338.6	338.1
T27	Control	4	242.8	127.3
T27	Control	5	125.3	7.5
T27	Control	6	155.3	69.9
T27	Control	7	60.3	332.6
T27	Control	8	285.6	284.7
T27	Control	9	283.4	302.8
T27	Control	10	28.3	288.8
T27	Control	11	301.1	340.4
T27	Control	12	NA	78.7
T27	Control	13	280.1	136.5
T27	Control	14	175.2	305.5
T27	Control	15	263.8	183.6
T27	Control	16	35.3	266.5

NA =instances when capturing fish orientation was not possible.