Exploring the use of FT-NIRS for ageing Pacific Hake off the contiguous U.S. West Coast

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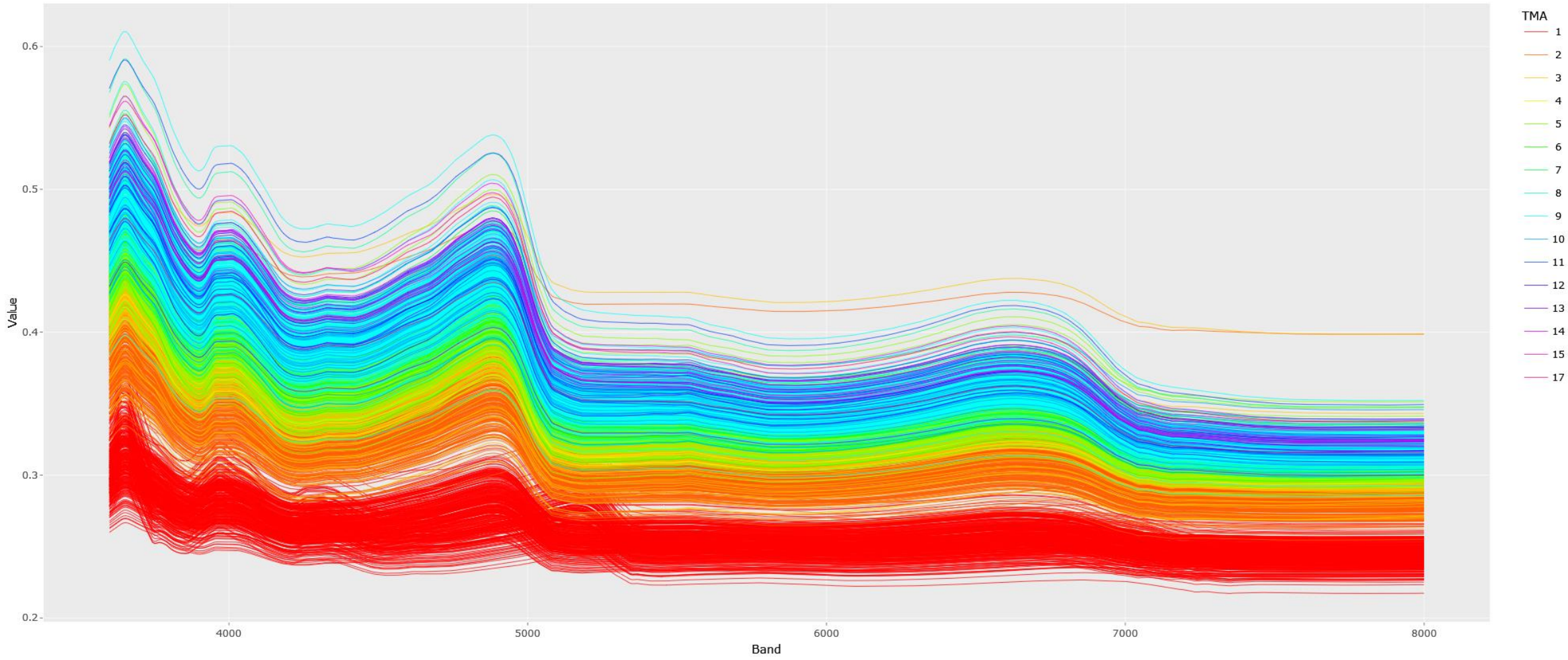
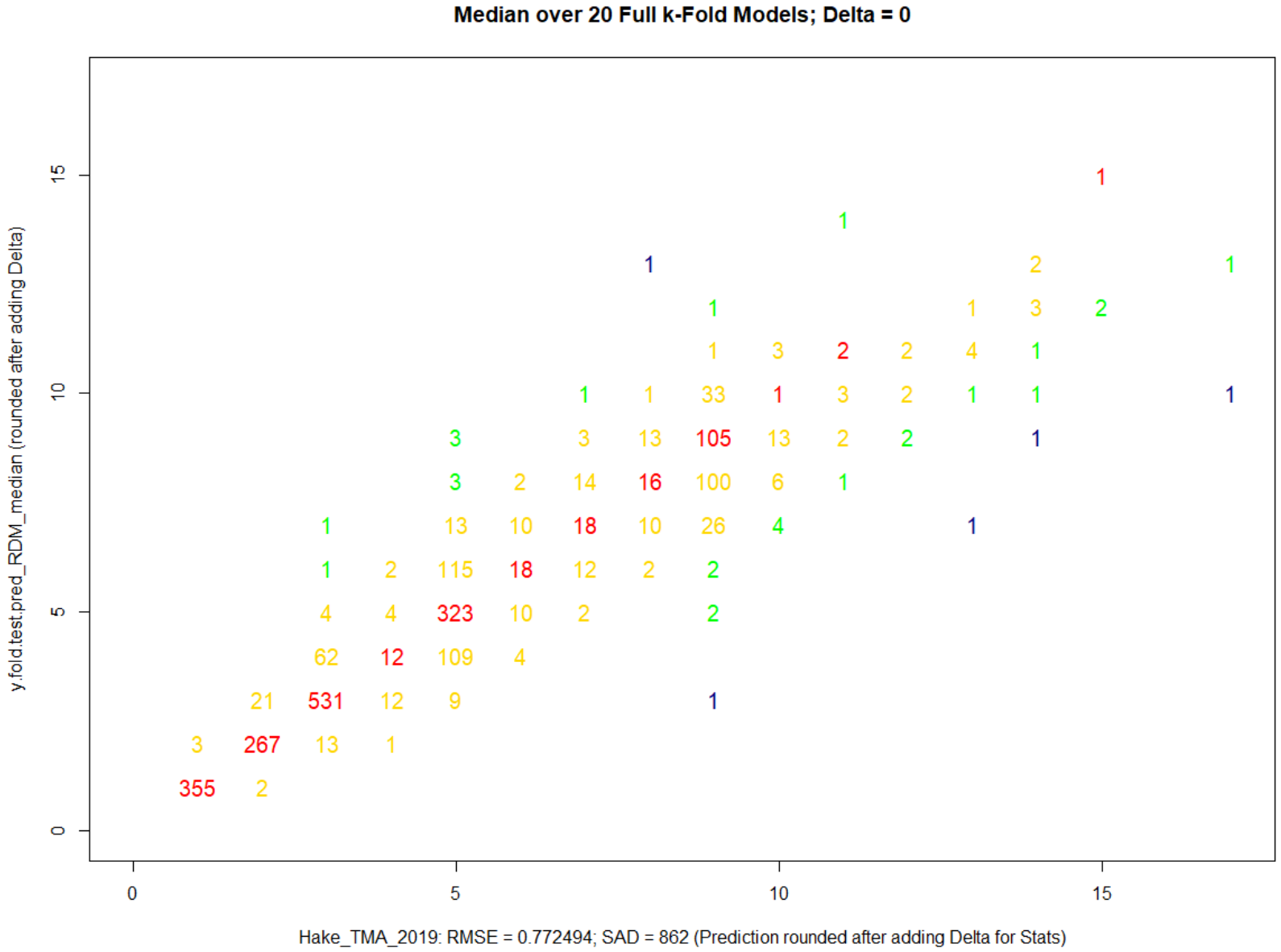
Pacific Hake

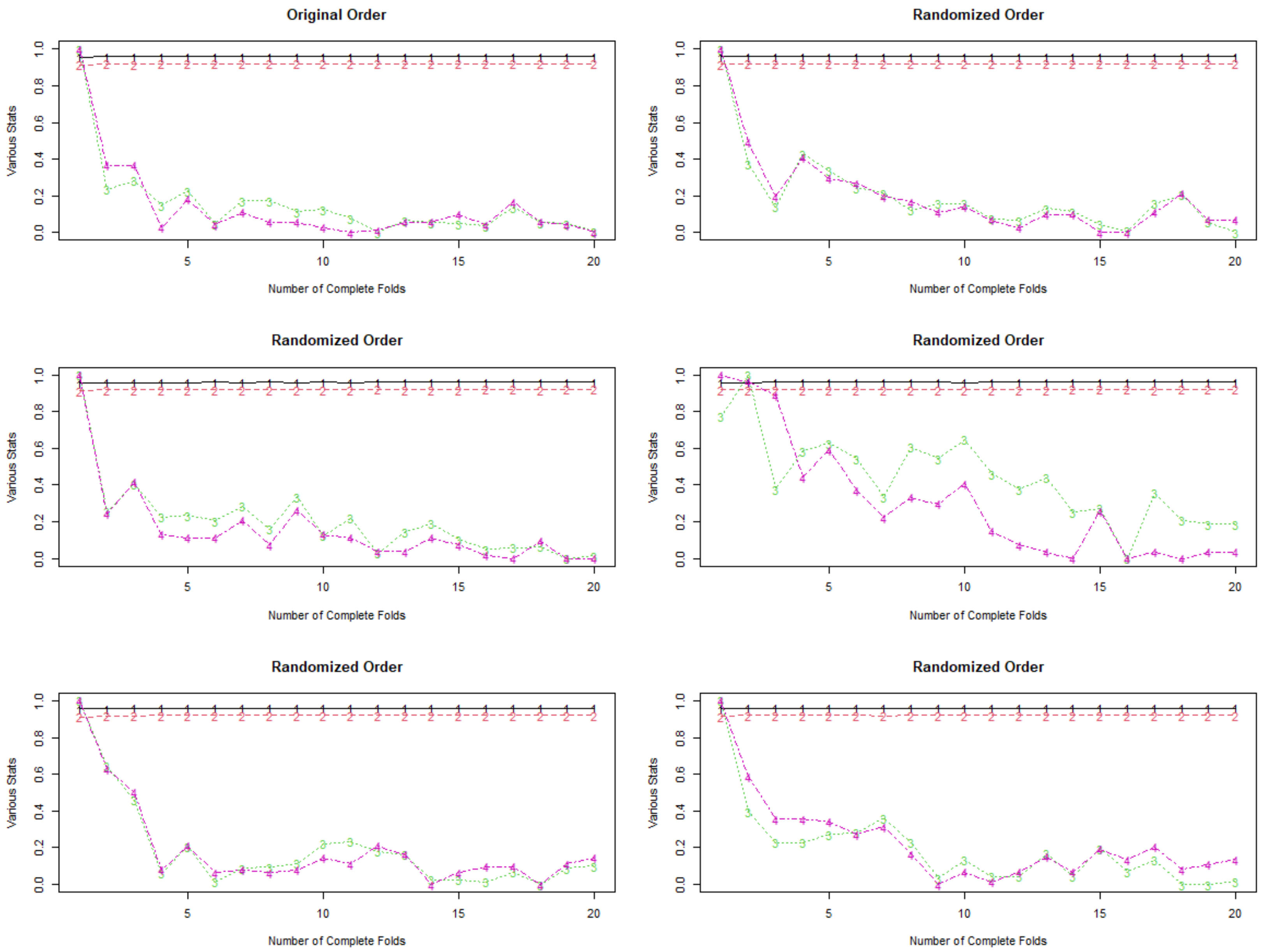
Hake, Raw Spectra



Median over 20 Full k-Fold Models



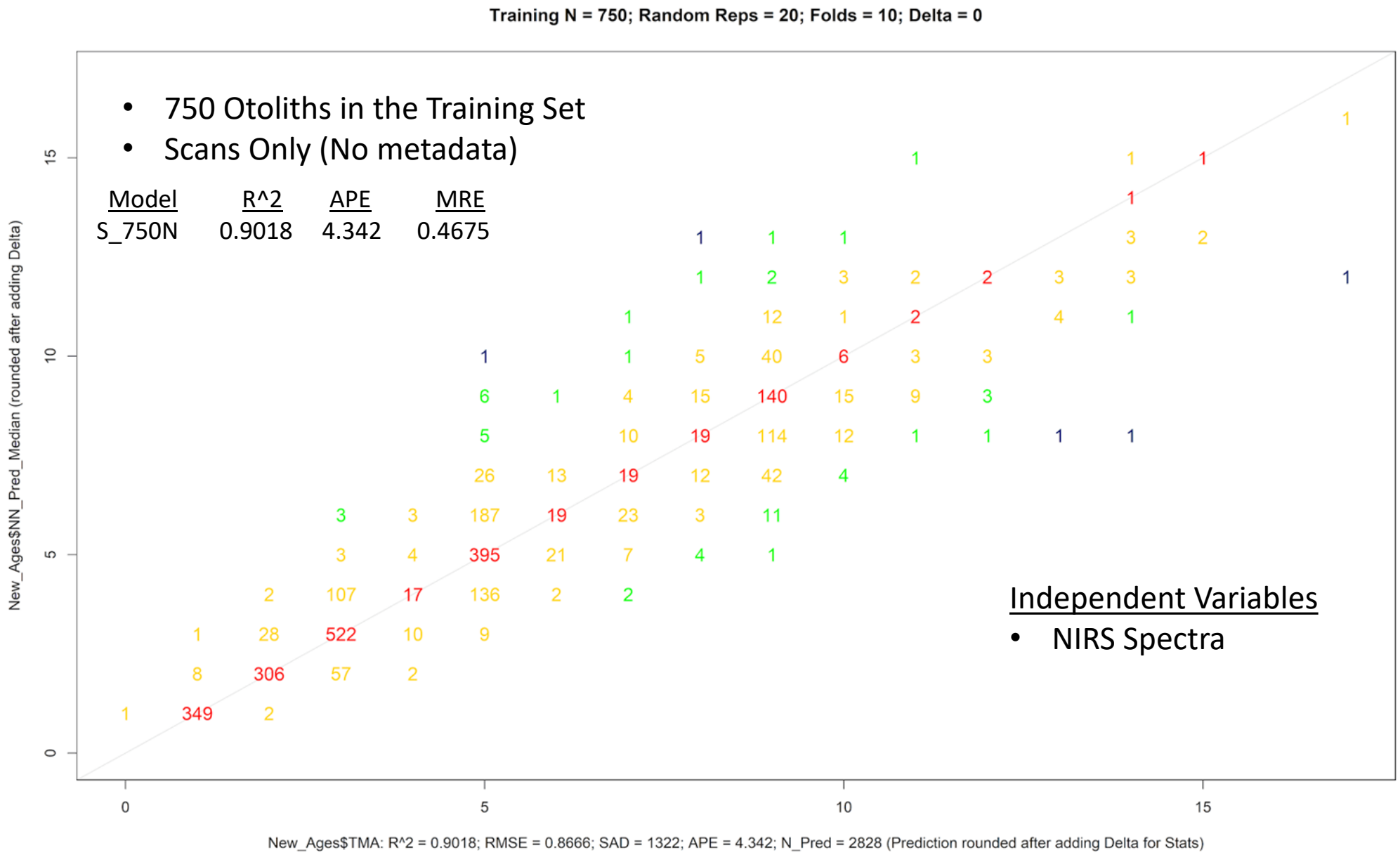
Hake, Randomized Additions of a Full k-Fold



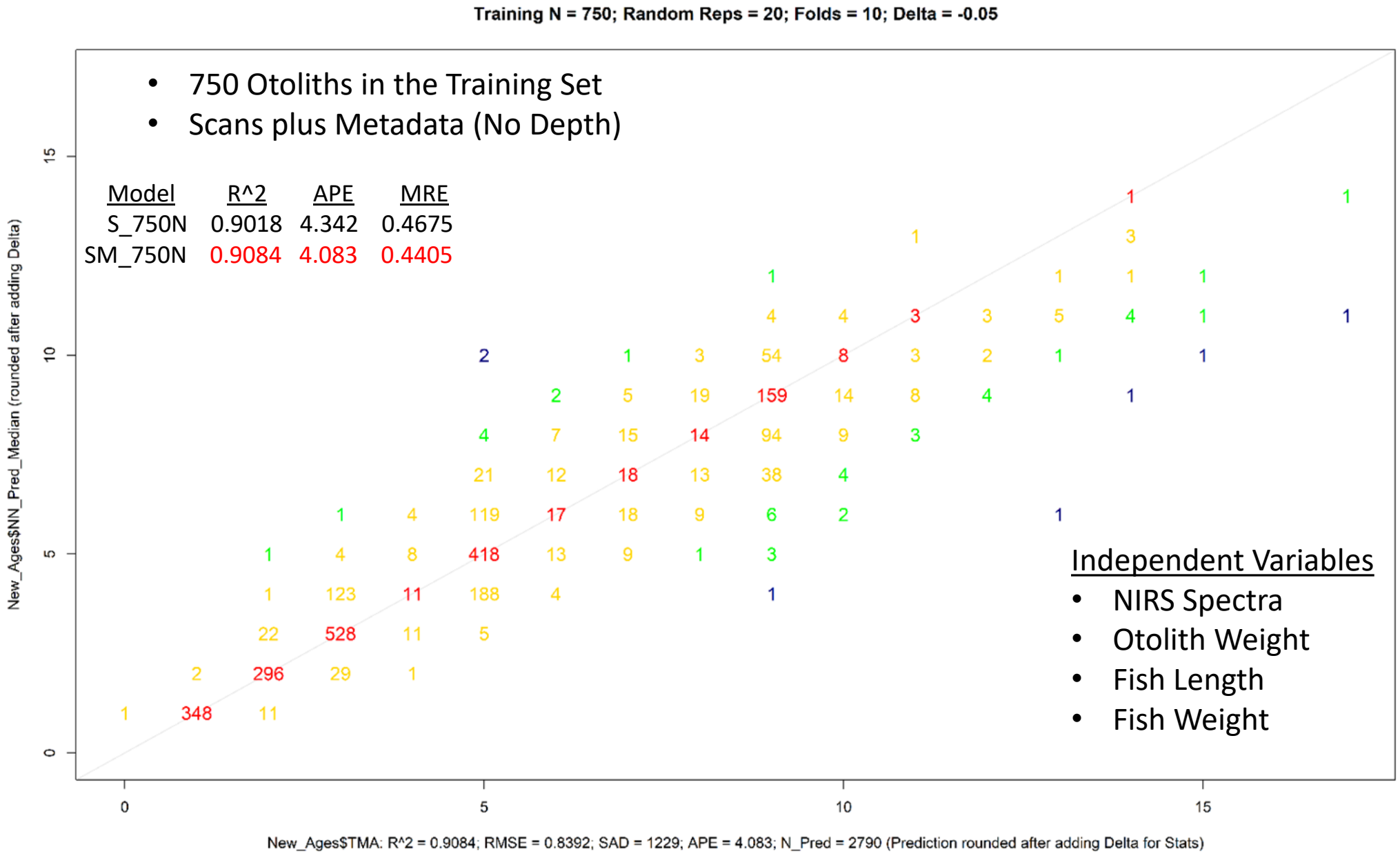
1: Correlation: Black
2: R squared: Red
3: Standardized RMSE: Green
4: Standardized SAD: Purple

In the original run order, the 20th model addition had the best stats. The 11th model had the same SAD value of 862 but a higher RMSE.

Hake 2019 Acoustic Survey



Hake 2019 Acoustic Survey



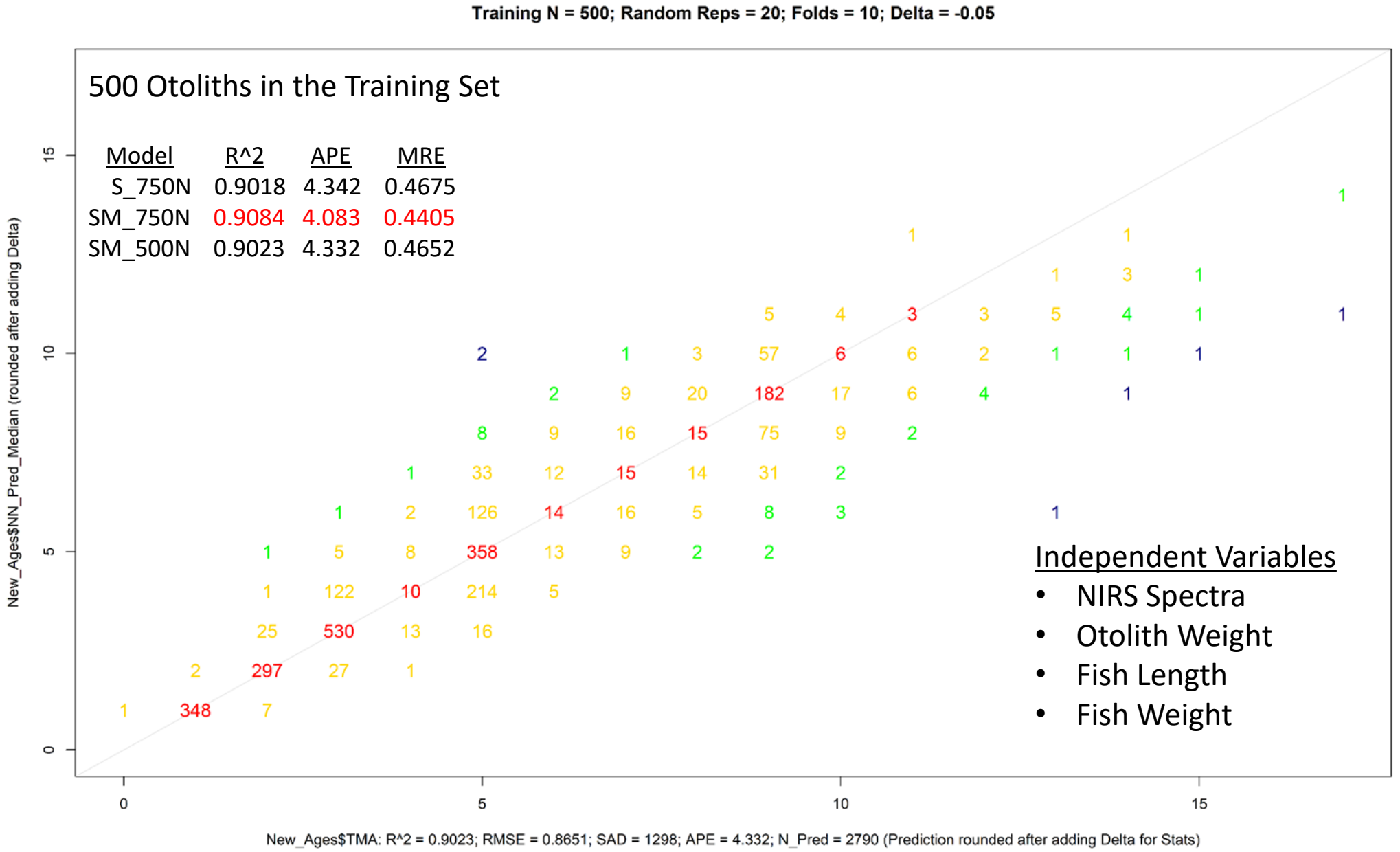
- 750 Otoliths in the Training Set
- Scans plus Metadata (No Depth)

Model	R^2	APE	MRE
S_750N	0.9018	4.342	0.4675
SM_750N	0.9084	4.083	0.4405

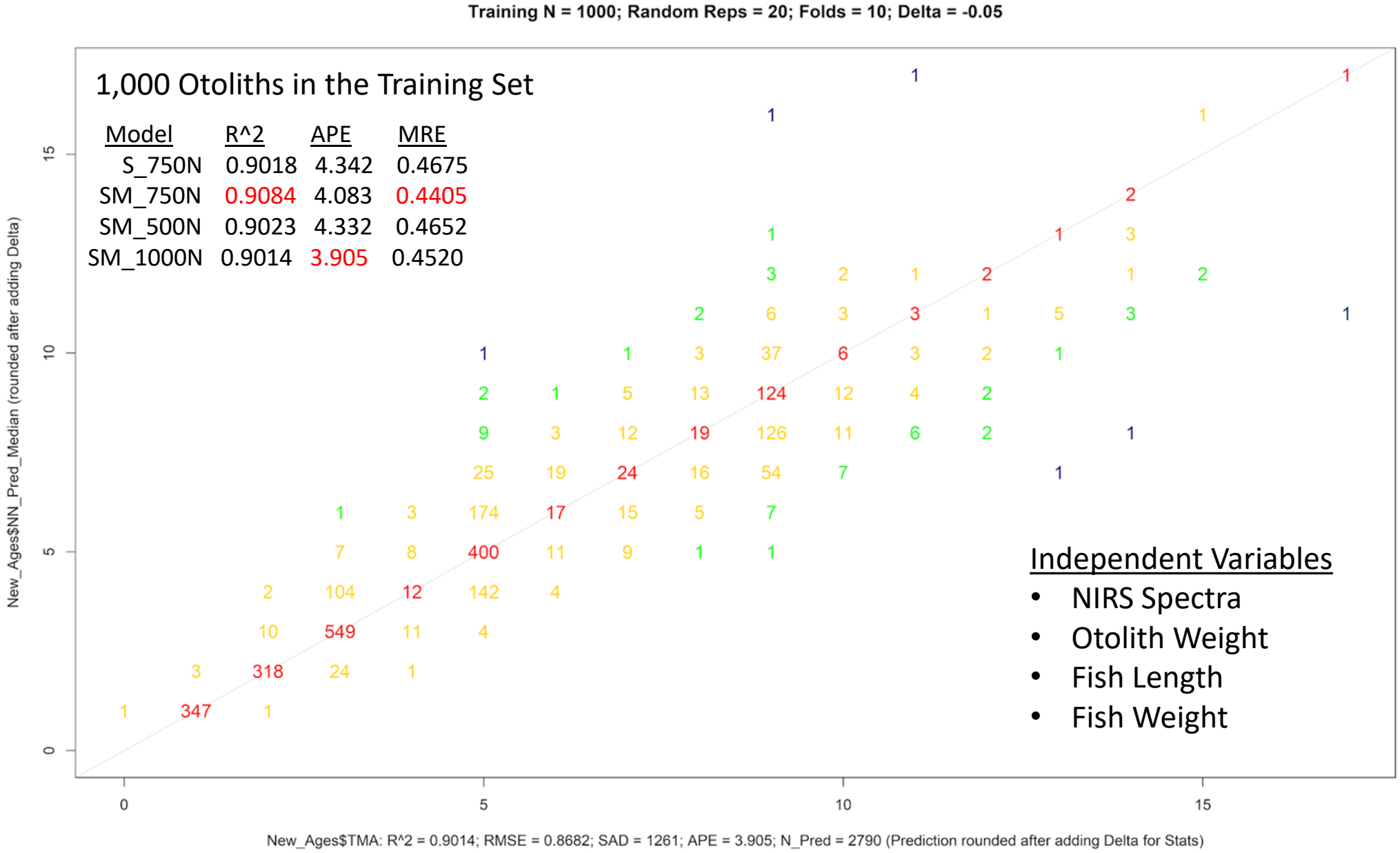
Independent Variables

- NIRS Spectra
- Otolith Weight
- Fish Length
- Fish Weight

Hake 2019 Acoustic Survey



Hake 2019 Acoustic Survey



Hake 2019 Acoustic Survey

Agreement between modeled/double-read ages and primary ages

	Modeled ages vs primary reads	Primary reads vs double reads
	Spectral sample data from 2019	All readers; samples from 2003-2023
N Obs	2,790	17,897
Avg Primary Age (years)	4.49	5.02
APE	3.90%	2.12%
R^2	0.901	0.953
% Agreement	65.4%	80.2%
+/- 1 year	92.3%	96.6%
+/- 2 years	97.9%	99.2%

Primary age	Average modeled difference	Avg diff as a % of Primary age
1	0.01	0.9%
2	0.04	2.0%
3	0.14	4.7%
4	0.03	0.7%
5	0.15	3.0%
6	0.16	2.7%
7	-0.12	-1.7%
8	-0.07	-0.8%
9	-0.53	-5.9%
10	-1.17	-11.7%
11	-1.22	-11.1%
12	-2.11	-17.6%
13	-2.38	-18.3%
14	-2.00	-14.3%
15	-1.67	-11.1%
17	-3.00	-17.6%
Grand average	-0.04	1.14%

Hake 2019 Acoustic Survey

Differences between modeled and primary ages for 2019 hake survey samples

Modeled - Primary	Counts by Primary age																	
7										1								1
6												1						1
5						1												1
4						2				1								3
3				1		9	1	1	2	3								17
2			2	7	3	25	3	5	3	6	2							56
1	1	3	10	104	8	174	19	12	13	37	3	1				1		386
0		347	318	549	12	400	17	24	19	124	6	3	2	1	2		1	1,825
-1			1	24	11	142	11	15	16	126	12	3	1		3			365
-2					1	4	4	9	5	54	11	4	2	5	1			100
-3									1	7	7	6	2	1	3	2		29
-4										1			2					3
-6														1	1		1	3
Primary age ->	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**17**	**Total**
# of Obs	1	350	331	685	35	757	55	66	59	360	41	18	9	8	10	3	2	2,790

Hake 2019 Acoustic Survey

Differences between modeled and primary ages for 2019 hake survey samples

Modeled - Primary	Percentage distribution by Primary age																	
7										0%								0%
6												6%						0%
5						0%												0%
4						0%				0%								0%
3				0%		1%	2%	2%	3%	1%								1%
2			1%	1%	9%	3%	5%	8%	5%	2%	5%							2%
1	100%	1%	3%	15%	23%	23%	35%	18%	22%	10%	7%	6%				33%		14%
0		99%	96%	80%	34%	53%	31%	36%	32%	34%	15%	17%	22%	13%	20%		50%	65%
-1			0%	4%	31%	19%	20%	23%	27%	35%	29%	17%	11%		30%			13%
-2					3%	1%	7%	14%	8%	15%	27%	22%	22%	63%	10%			4%
-3									2%	2%	17%	33%	22%	13%	30%	67%		1%
-4										0%			22%					0%
-6														13%	10%		50%	0%
Primary age ->	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**17**	**Total**
# of Obs	1	350	331	685	35	757	55	66	59	360	41	18	9	8	10	3	2	2,790

Hake Double-reads

Differences between double-reads and primary ages for all hake double-reads

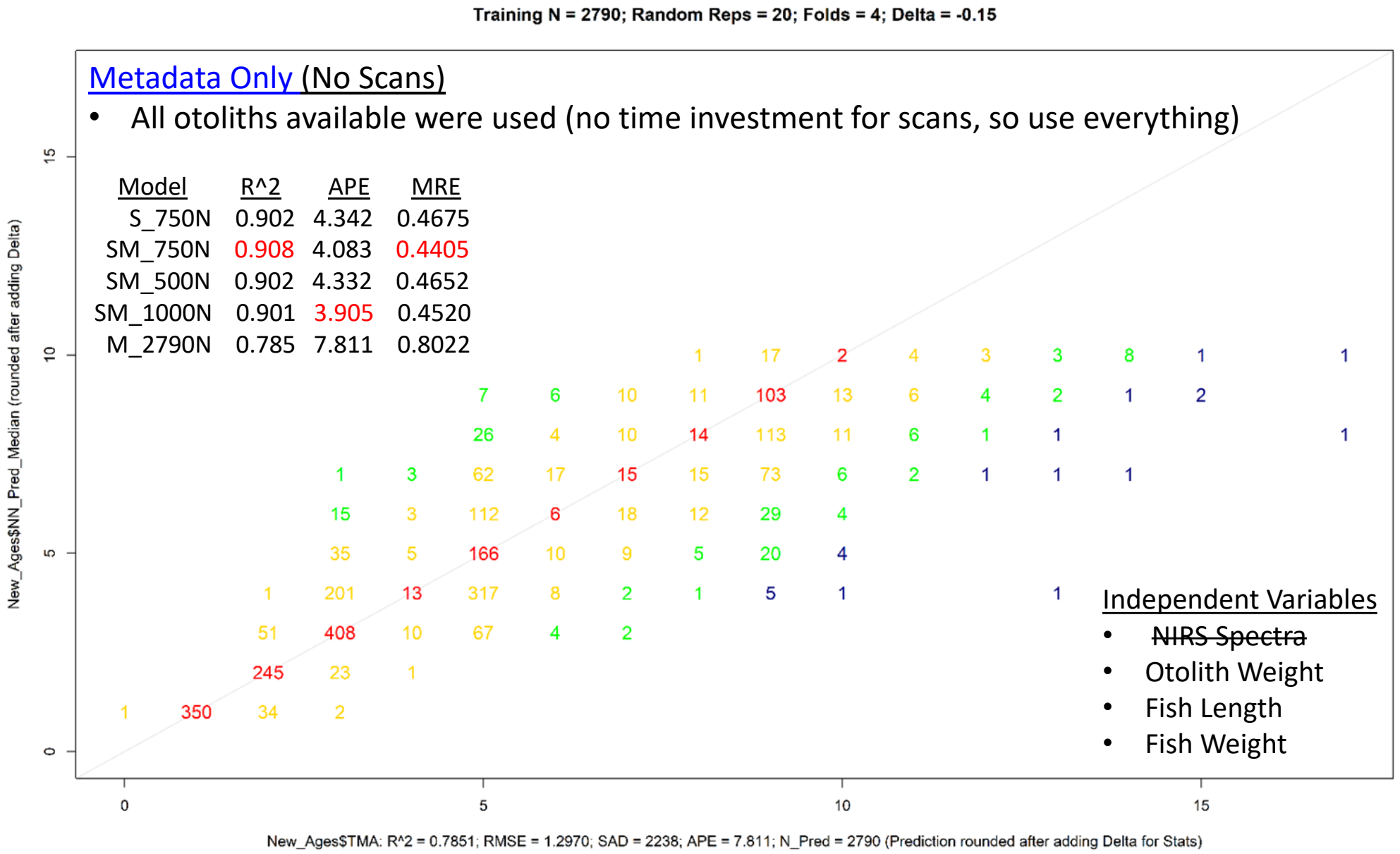
Modeled - Primary	Counts by Primary age																					
10									1													1
7									1													1
6										1	1											2
5					1			1	2	1			1									6
4					3	1		2	2	2	2	1	2									15
3			2	1	1	4	2	3	4	5	8	2	2	1	1	1						37
2			9	20	16	25	25	20	14	20	9	14	11	9	2		3					197
1	2	37	65	158	253	156	176	148	107	86	63	46	40	23	8	6	1	2				1,377
0		946	2,275	2,405	2,326	2,221	1,350	1,057	679	444	254	160	101	77	31	10	8	4		1		14,349
-1		1	25	73	182	259	206	213	184	141	87	72	43	31	16	11	10	3		1	1	1,559
-2				1	11	13	50	44	29	25	28	23	16	8	10	8	6	3			1	276
-3							2	7	7	2	6	8	7	1	2	2		2	3			49
-4								1	6	3	1	4	3	3	1	2	2					26
-5																		1				1
-6									1													1
Primary age ->	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**Total**
# of Obs	2	984	2,376	2,658	2,793	2,679	1,811	1,496	1,037	730	459	330	226	153	71	40	30	15	3	2	2	17,897

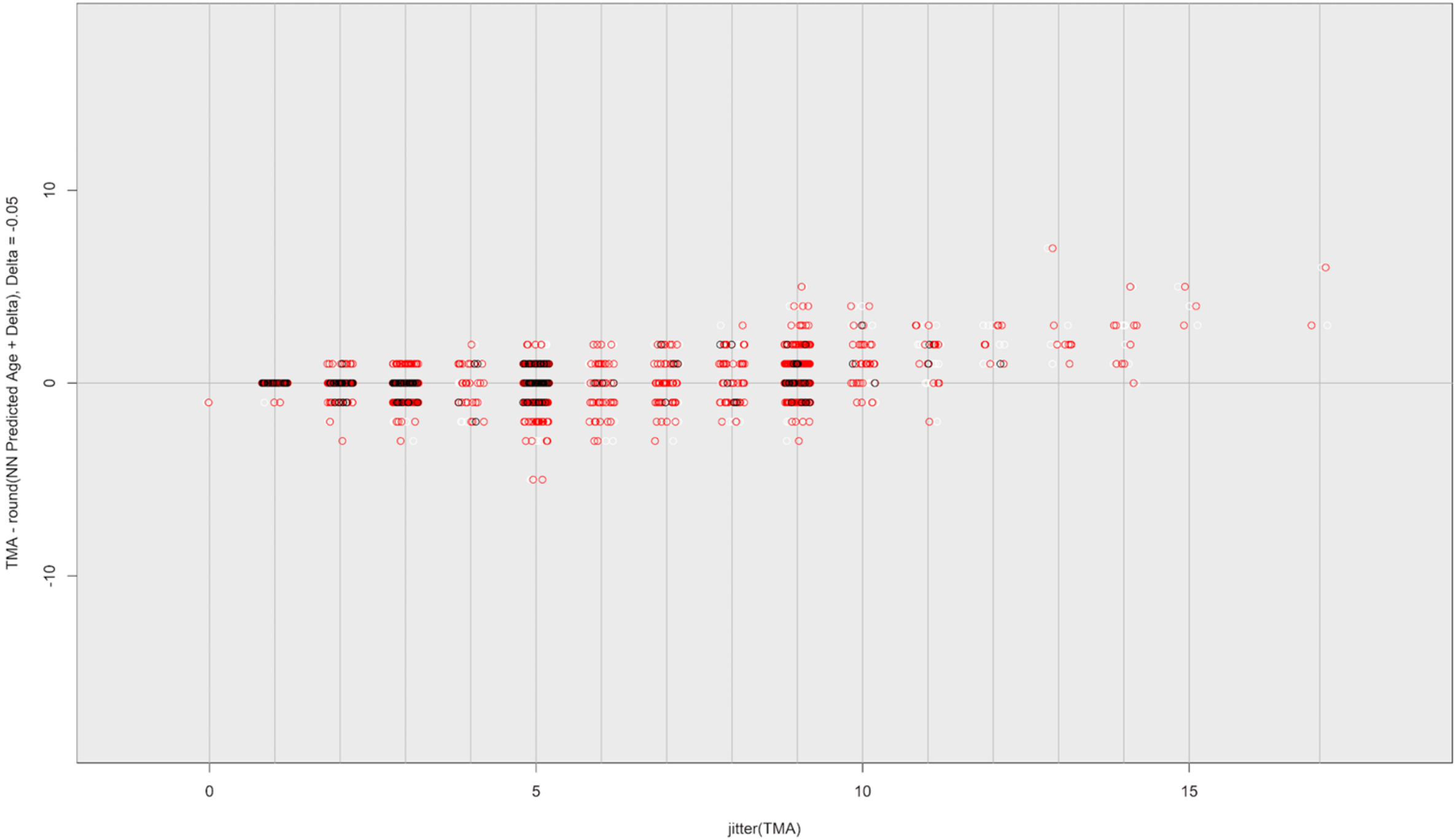
Hake Double-reads

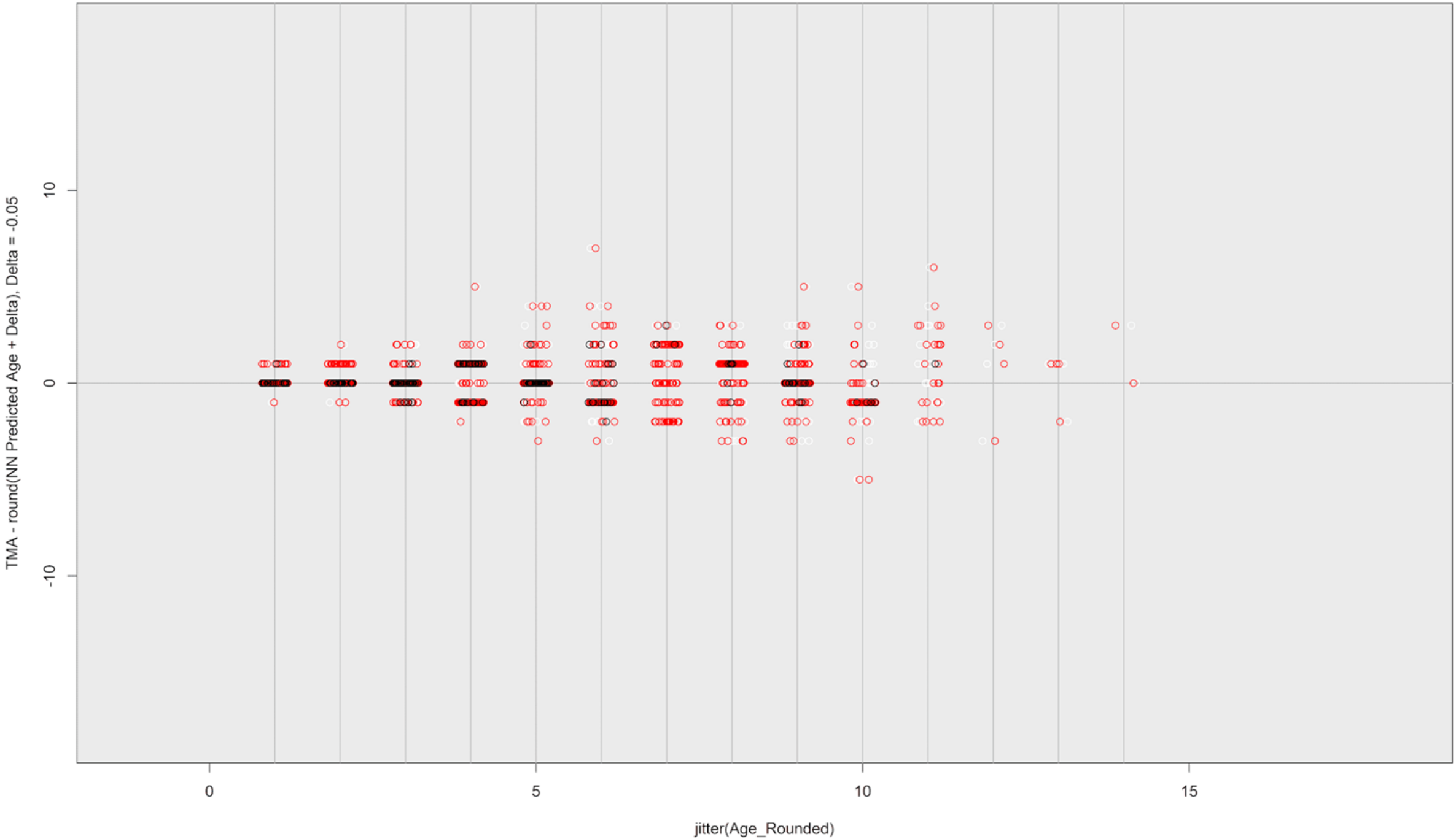
Differences between double-reads and primary ages for all hake double-reads

Modeled - Primary	Percentage distribution by Primary age																					
10									0%													0%
7									0%													0%
6										0%	0%											0%
5					0%			0%	0%	0%			0%									0%
4					0%	0%		0%	0%	0%	0%	0%	1%									0%
3			0%	0%	0%	0%	0%	0%	0%	1%	2%	1%	1%	1%	1%	3%						0%
2			0%	1%	1%	1%	1%	1%	1%	3%	2%	4%	5%	6%	3%		10%					1%
1	100%	4%	3%	6%	9%	6%	10%	10%	10%	12%	14%	14%	18%	15%	11%	15%	3%	13%				8%
0		96%	96%	90%	83%	83%	75%	71%	65%	61%	55%	48%	45%	50%	44%	25%	27%	27%		50%		80%
-1		0%	1%	3%	7%	10%	11%	14%	18%	19%	19%	22%	19%	20%	23%	28%	33%	20%		50%	50%	9%
-2				0%	0%	0%	3%	3%	3%	3%	6%	7%	7%	5%	14%	20%	20%	20%			50%	2%
-3							0%	0%	1%	0%	1%	2%	3%	1%	3%	5%		13%	100%			0%
-4								0%	1%	0%	0%	1%	1%	2%	1%	5%	7%					0%
-5																		7%				0%
-6									0%													0%
Primary age ->	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**Total**
# of Obs	2	984	2,376	2,658	2,793	2,679	1,811	1,496	1,037	730	459	330	226	153	71	40	30	15	3	2	2	17,897

Hake 2019 Acoustic Survey




TMA - round(NN Predicted Age + Delta), Delta = -0.05
10
0
-10
0
5
10
15
jitter(TMA)


TMA - round(NN Predicted Age + Delta), Delta = -0.05
10
0
-10
0
5
10
15
jitter(Age_Rounded)