Comparison of modeled and traditionally-read sablefish ages

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October 1 Presentation to the
SSC Groundfish Subcommittee
Pacific Fishery Management Council

Evaluation of Modeled of Sablefish Ages

Overview

Part 1 (Hastie)

- Terminology
- Scope of comparison
- Suite of Neural Network models
- Comparison of modeled and primary ages
- Comparison of double-read and primary ages
- Agreement summary statistics

Part 2 (Wetzel)

- Sensitivity Analysis

Terminology

- **Primary ages:** fish ages which are determined via traditional counting of otolith annuli, using break-and-burn methods, which would be used in an assessment
- **Modeled ages**: age estimates generated using Neural Network models, including spectral and other data
- **Spectral data**: selected portions of an otolith's near-infrared spectral response
- **Sample data**: other data that relate either to characteristics of the fish or its capture, e.g. fish weight and length, otolith weight, depth, etc.

Scope of comparison

- All 2017-2022 trawl survey samples with unbroken otoliths were included in the modeling
  - Only 2 survey vessels in 2019 and none in 2020
  - Very large cohorts estimated for 2020 and 2021

	2017-2022	2017	2018	2019	2021	2022
#s of samples	6,788	1,099	1,322	750	2,064	1,553
Average age	8.3	9.3	9.1	8.3	7.8	7.4
Maximum age	88	71	69	68	88	78
% of Pr. ages < 3	34%	25%	28%	15%	38%	47%
% of Pr. ages < 11	78%	77%	79%	80%	77%	79%

Suite of Neural Network models

Temporal Modeling Dimensions:

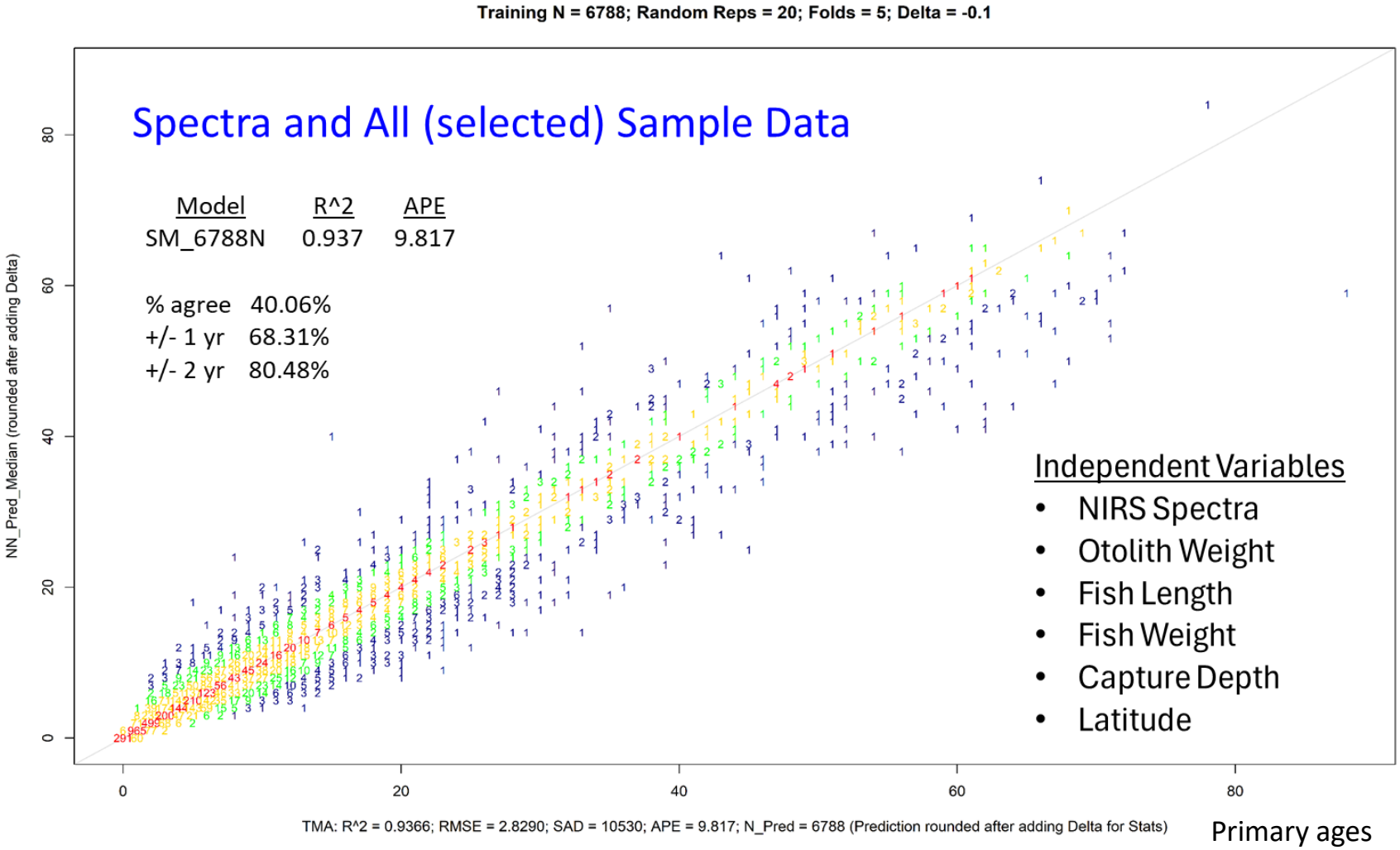
Period(s) used for training	Periods used for estimation & summary: Combined years: 2017-22	Periods used for estimation & summary: Individual years: 2017-22
Combined years: 2017-2022	**X**	**X**
Individual years: 2017-2022		**X**

Explanatory variables included in the models:

	Basic	With some sample data	With all sample data
Spectral data	X	X	X
Otolith weight		X	X
Fish weight		X	X
Capture depth		X	X
Latitude		X	X
Fish length			X

Comparison of modeled and primary ages

Modeled vs Primary ages, all 2017-22 survey samples



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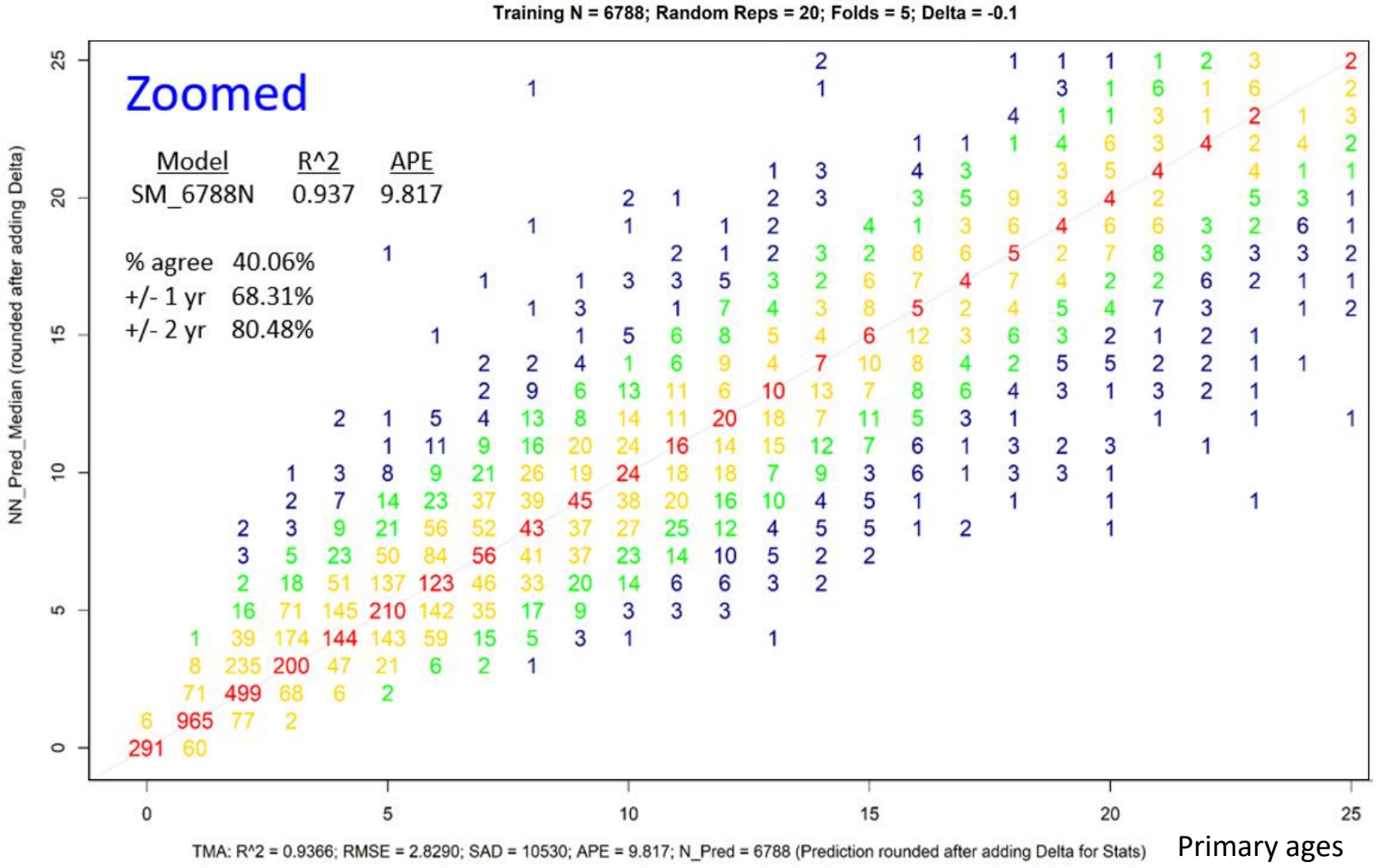
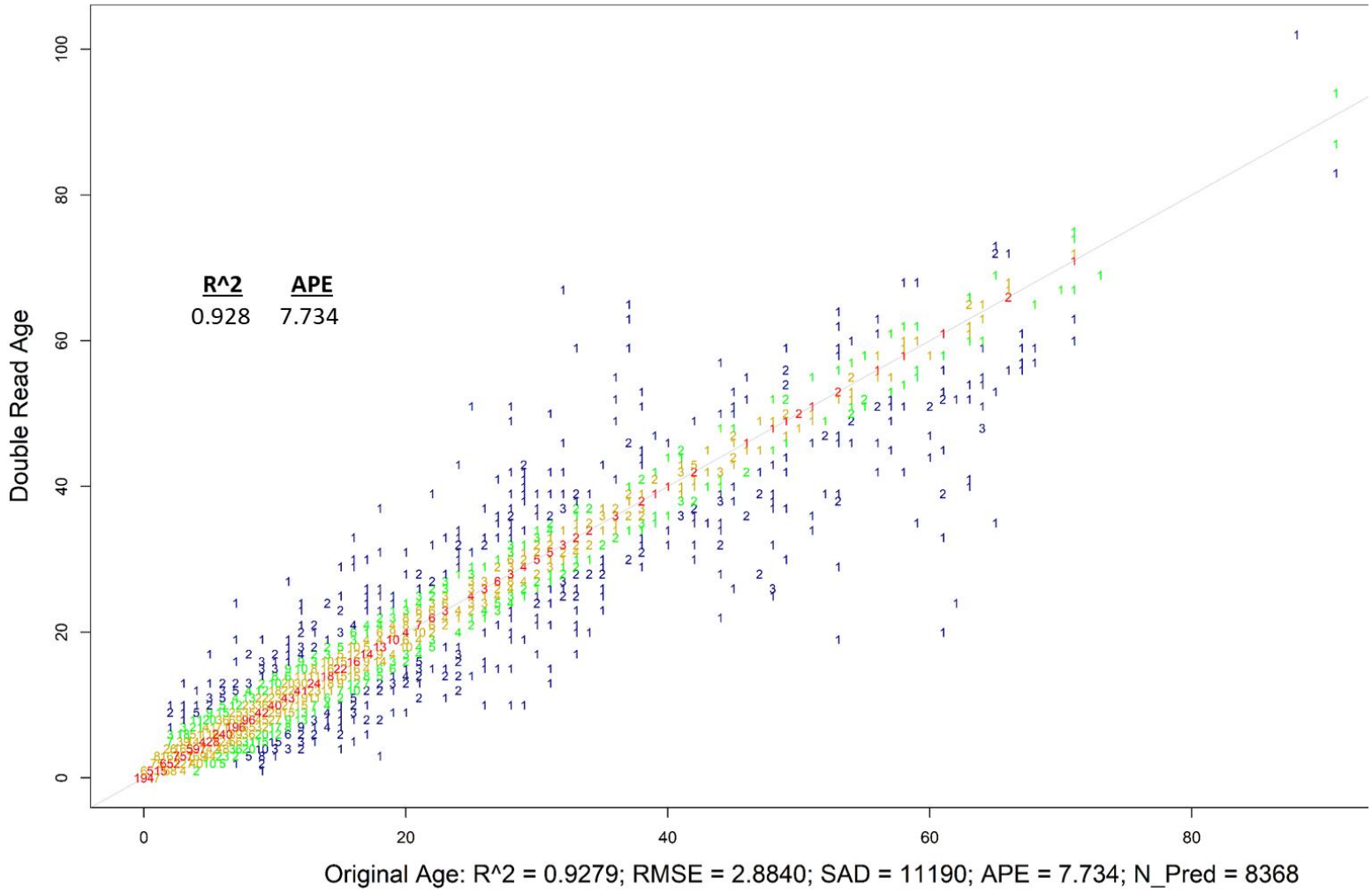


Comparison of double-read and primary ages

Human Double-read vs Primary ages, all 2004-2023



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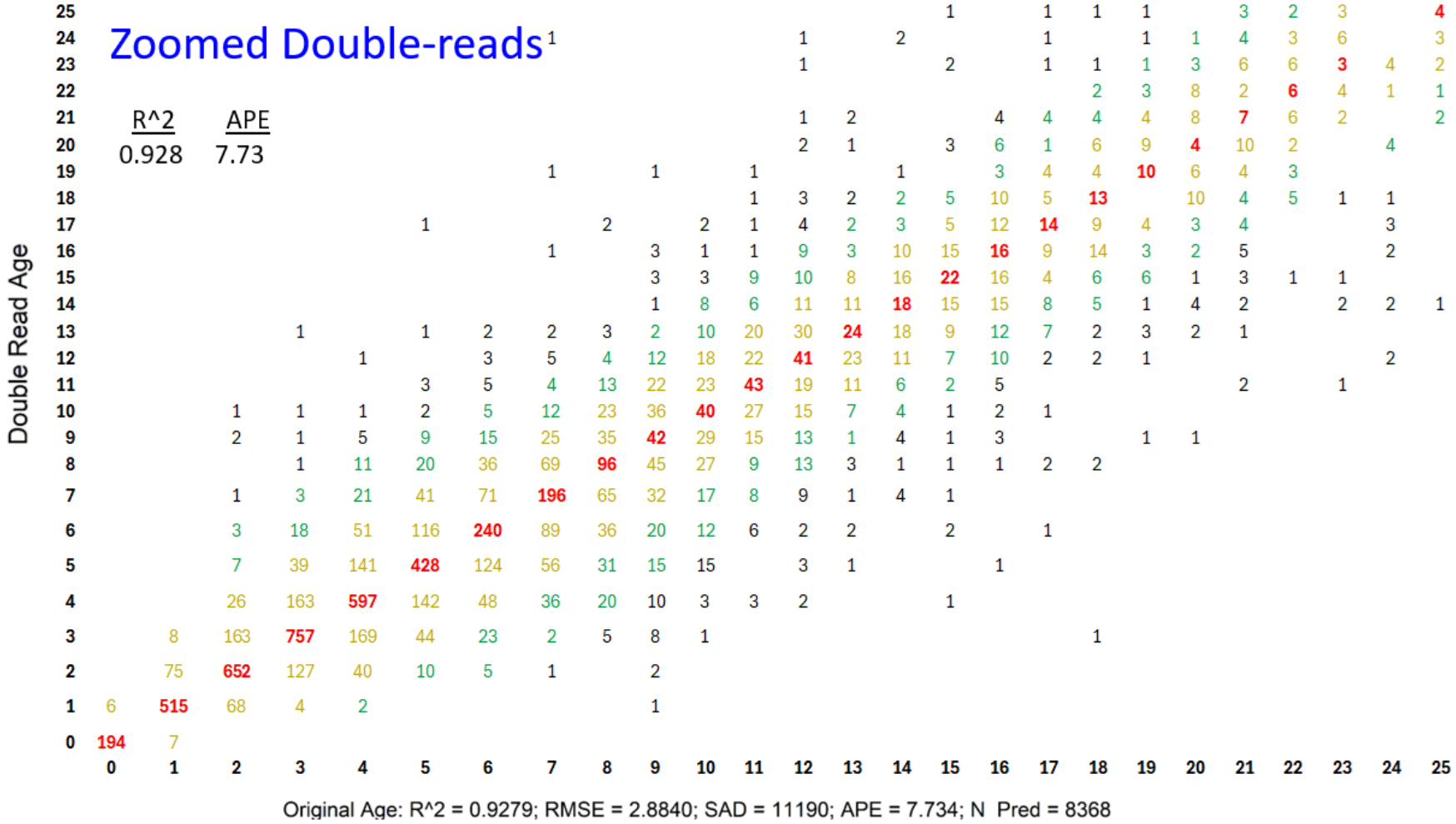
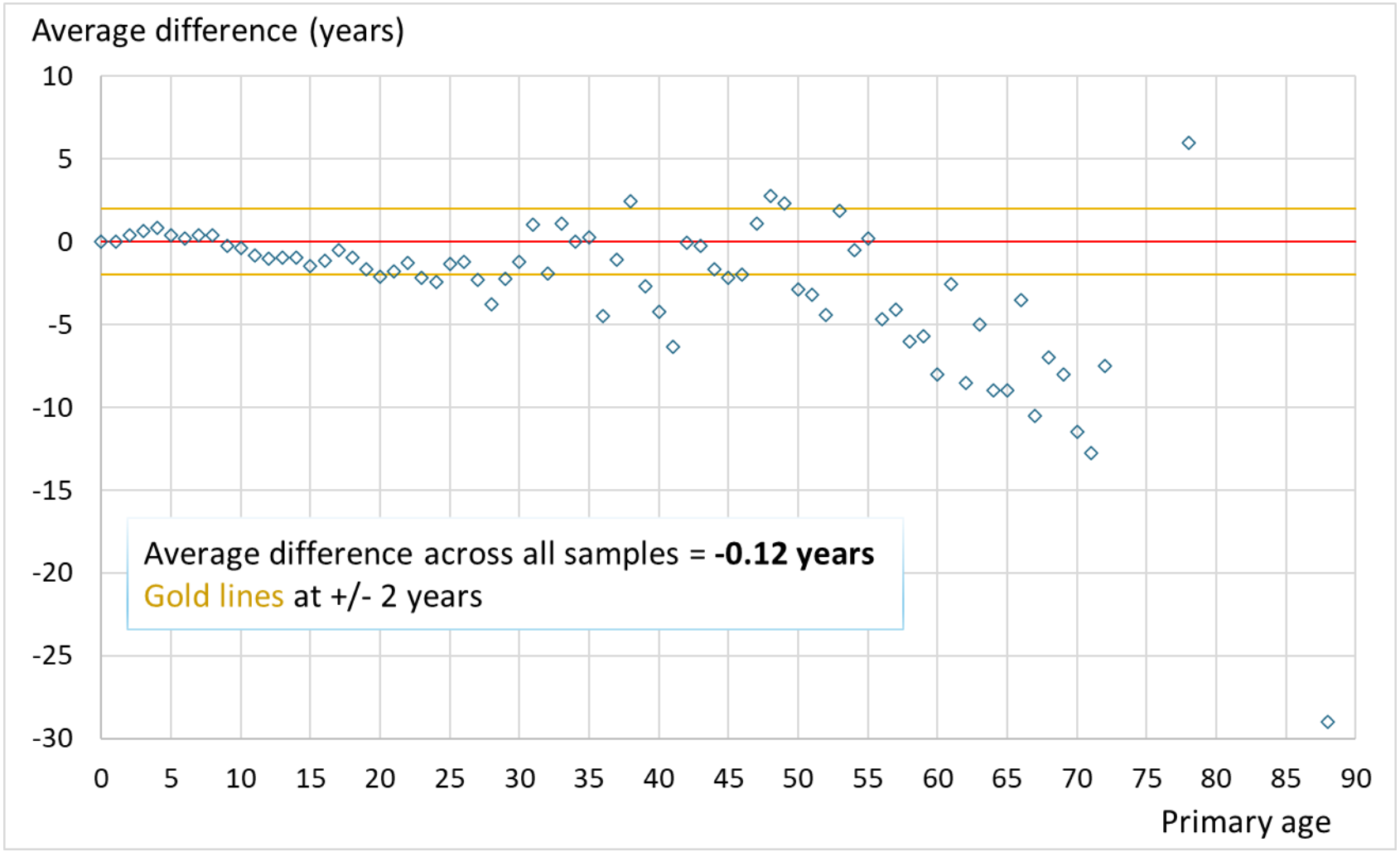


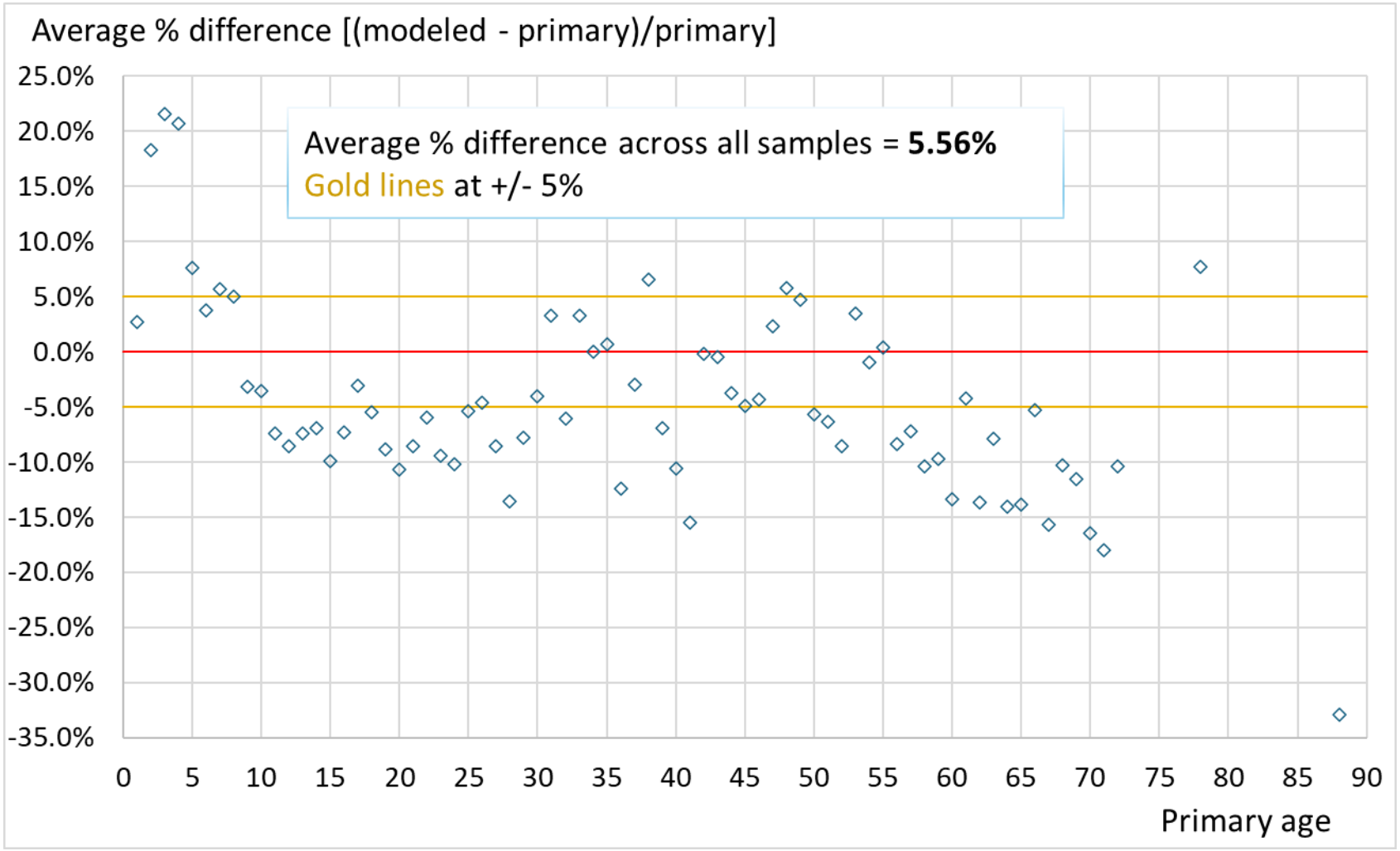
Comparison of modeled and primary ages

Average of [modeled age – primary age], by primary age



Comparison of modeled and primary ages

Average percentage difference, by primary age



Comparison of modeled and primary ages

Average differences, by year and primary age, up to 17

Primary age read	Average differences between modeled ages and the primary traditional age read, when applied to the following time periods						Average differences between modeled ages and the primary traditional age read, relative to primary age, for these time periods					
	All 2017-22	2017	2018	2019	2021	2022	All 2017-22	2017	2018	2019	2021	2022
0	0.02	0.11	0.00	0.00	0.02	0.00						
1	0.03	-0.01	0.05	0.06	0.05	0.01	3%	-1%	5%	6%	5%	1%
2	0.37	0.62	0.23	0.00	0.22	0.51	18%	31%	12%	0%	11%	25%
3	0.65	1.12	1.36	0.39	0.09	0.42	22%	37%	45%	13%	3%	14%
4	0.83	0.67	1.32	0.31	0.97	0.71	21%	17%	33%	8%	24%	18%
5	0.38	0.53	0.35	0.93	0.25	0.83	8%	11%	7%	19%	5%	17%
6	0.23	-0.15	0.23	0.09	0.49	0.28	4%	-3%	4%	2%	8%	5%
7	0.40	-0.22	0.17	0.78	1.05	0.00	6%	-3%	2%	11%	15%	0%
8	0.40	0.00	0.03	0.97	0.39	1.08	5%	0%	0%	12%	5%	14%
9	-0.28	-1.26	-0.26	-0.29	-0.05	0.14	-3%	-14%	-3%	-3%	-1%	2%
10	-0.35	-1.20	0.12	-0.56	-0.18	-0.64	-4%	-12%	1%	-6%	-2%	-6%
11	-0.81	-2.46	-0.11	-1.05	-0.35	-1.24	-7%	-22%	-1%	-10%	-3%	-11%
12	-1.02	-2.67	-0.13	-0.17	-1.28	-0.49	-9%	-22%	-1%	-1%	-11%	-4%
13	-0.97	-2.11	-0.33	0.33	-1.17	-0.81	-7%	-16%	-3%	3%	-9%	-6%
14	-0.98	-2.13	-0.08	0.73	-1.72	-0.91	-7%	-15%	-1%	5%	-12%	-6%
15	-1.48	-1.22	-2.86	-2.40	-0.48	-1.58	-10%	-8%	-19%	-16%	-3%	-11%
16	-1.17	0.71	-0.40	-1.33	-2.70	-1.67	-7%	4%	-3%	-8%	-17%	-10%
17	-0.52	-1.00	-0.29	2.67	-1.89	0.50	-3%	-6%	-2%	16%	-11%	3%

Agreement summary statistics - Overall

- Human double-reads have better agreement and lower APE values than comparisons of modeled and primary ages
  - The 2 main readers since 2011 are the most consistent
- However, couble-read agreement across all years and readers is closer to the best set of modeled ages
- Adding other sample data to the model improves agreement

	N Obs.	Avg Prim. Age	APE[1]	R^2	% Agree-ment	+/- 1 year	+/- 2 years
Human double reads							
between 2 primary readers, 2011-23	2,776	7.67	5.4%	0.975	58.1%	80.0%	88.6%
among all readers, 2004-23	8,368	8.49	7.7%	0.928	48.3%	74.0%	84.4%
Modeled ages vs primary reads							
Training and estimation using all 2017-22 survey otoliths and Neural-Network modeling with:							
Spectral and all sample data	6,788	8.27	9.8%	0.937	40.1%	68.3%	80.5%
Spectral and sample data, excl. leng.	6,788	8.27	10.8%	0.933	39.2%	67.6%	79.6%
Only FT-NIRS spectral data	6,788	8.27	12.6%	0.918	36.9%	65.5%	72.2%

Agreement summary statistics - Annual

- Greater agreement in both double-reads and modeled vs primary ages was associated with lower avg primary ages

	Average differences between modeled ages and the primary traditional age read, when applied to the following time periods					
	All 2017-22	2017	2018	2019	2021	2022
Overall and year-specific agreement **between primary and all available double-reads**						
# of smpls	3,333	937	729	444	570	653
Avg. age	8.2	9.0	8.7	7.3	8.1	7.1
% agree	50%	40%	41%	57%	60%	61%
+/- 1 yr	74%	67%	68%	77%	82%	81%
+/- 2 yr	85%	78%	84%	88%	91%	90%
Overall and year-specific agreement **between modeled and primary age reads**						
# of smpls	6,788	1,099	1,322	750	2,064	1,553
Avg. age	8.3	9.3	9.1	8.3	7.8	7.4
% agree	40%	35%	34%	37%	45%	45%
+/- 1 yr	68%	65%	63%	70%	70%	72%
+/- 2 yr	80%	78%	76%	84%	82%	83%

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End of Part 1

Questions and comments?

Dr Wetzel will then cover the Sensitivity Analysis