

# analysis of Alaska skate model changes in 2014



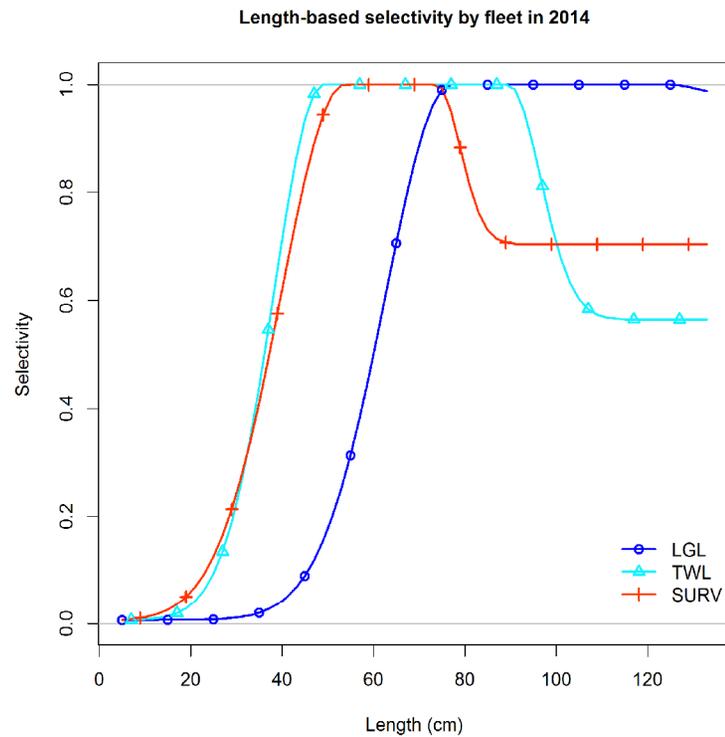
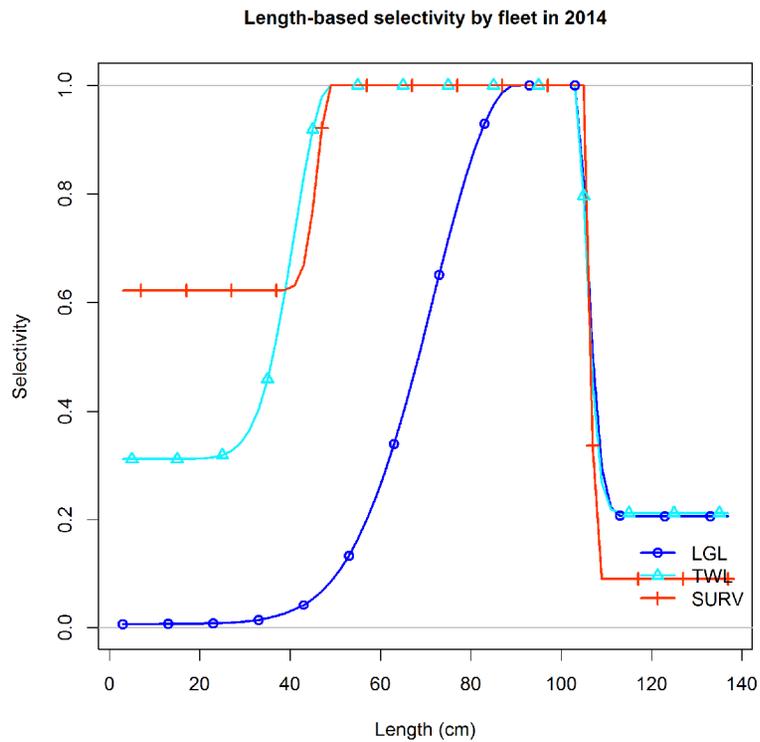
Olav Ormseth  
BSAI Plan Team meeting, September 2016

### Alaska skate harvest recommendations

<b>Quantity</b>	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2014	2015	2015	2016
$M$ (natural mortality rate)	0.13	0.13	<b>0.13</b>	0.13
Tier	3a	3a	<b>3a</b>	3a
Projected total (age 0+) biomass (t)	603,520	<b>579,785</b>	<b>528,391</b>	498,957
Female spawning biomass (t)				
Projected	185,076	<b>178,762</b>	<b>115,490</b>	112,195
$B_{100\%}$	266,810	<b>266,810</b>	<b>186,923</b>	186,923
$B_{40\%}$	106,724	<b>106,724</b>	<b>74,769</b>	74,769
$B_{35\%}$	93,384	<b>93,384</b>	<b>65,423</b>	65,423
$F_{OFL}$	0.113	<b>0.113</b>	<b>0.090</b>	0.090
$maxF_{ABC}$	0.098	<b>0.098</b>	<b>0.077</b>	0.077
$F_{ABC}$	0.098	<b>0.098</b>	<b>0.077</b>	0.077
OFL (t)	32,381	<b>30,278</b>	<b>39,883</b>	37,343
maxABC (t)	28,282	<b>26,444</b>	<b>34,389</b>	32,199
ABC (t)	28,282	<b>26,444</b>	<b>34,389</b>	32,199
<b>Status</b>	As determined <i>last year for:</i>		As determined <i>this year for:</i>	
	2012	2013	2013	2014
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

relevant changes between models

- selectivity
- biology (LAA & length-weight)



SS3

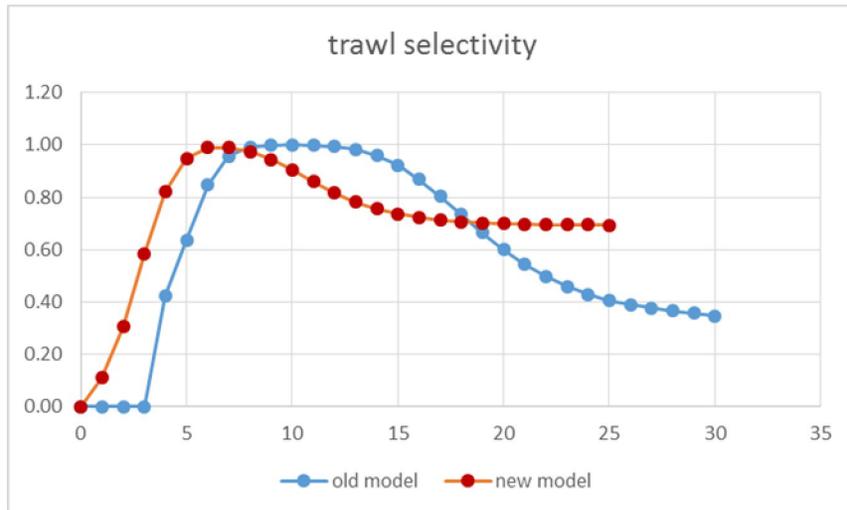
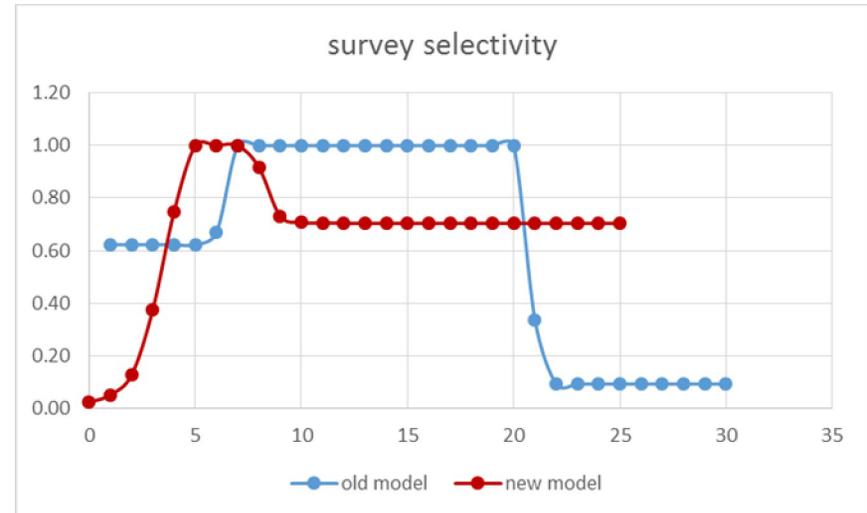
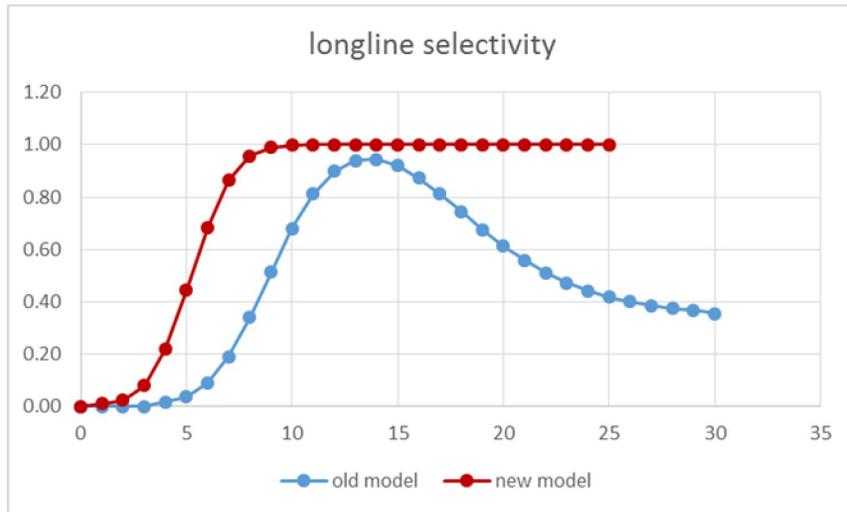


outputs by age

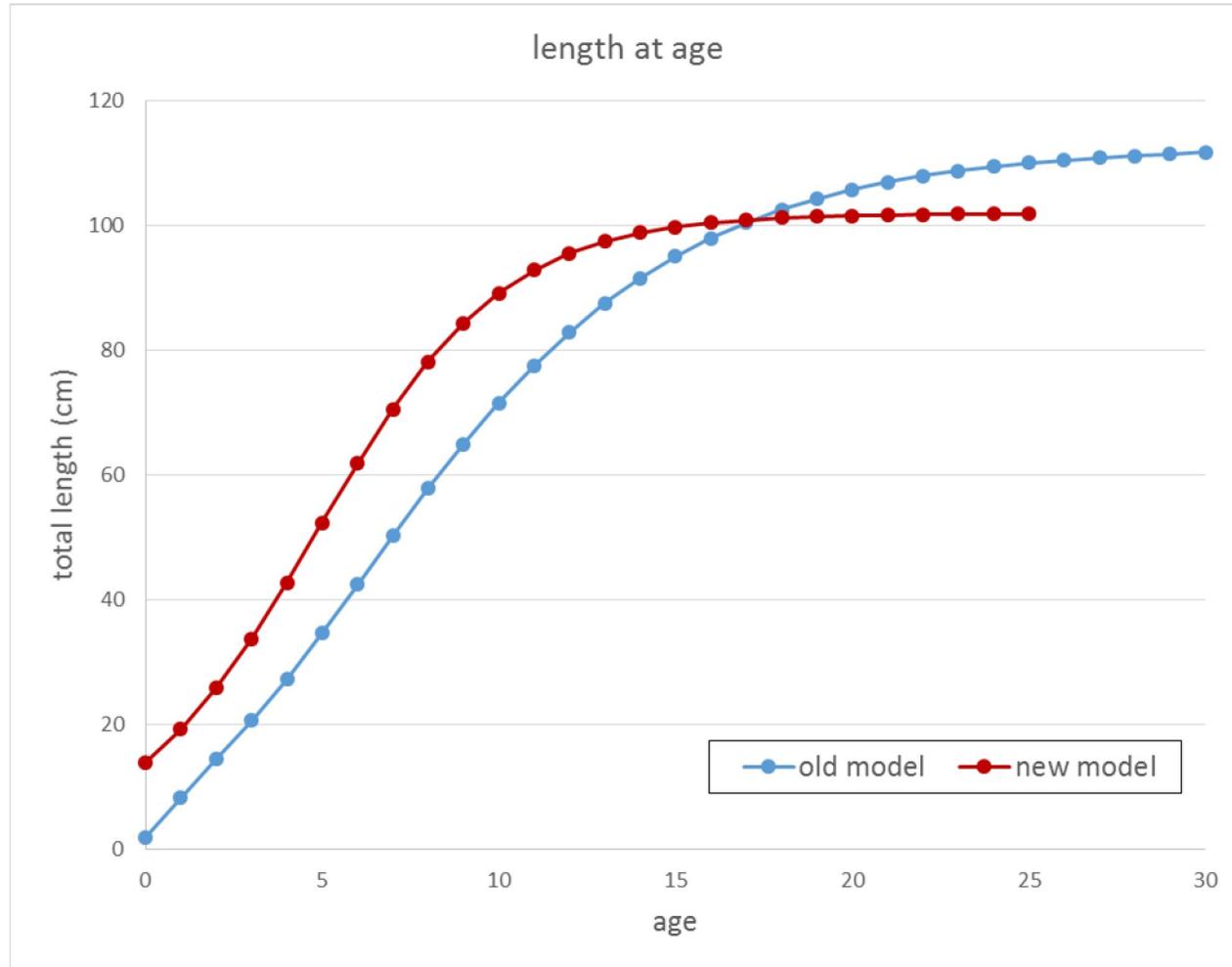
Alaska projection model

- 1) focused on changes in age-related biology
- 1) “sensitivity testing” of projection model

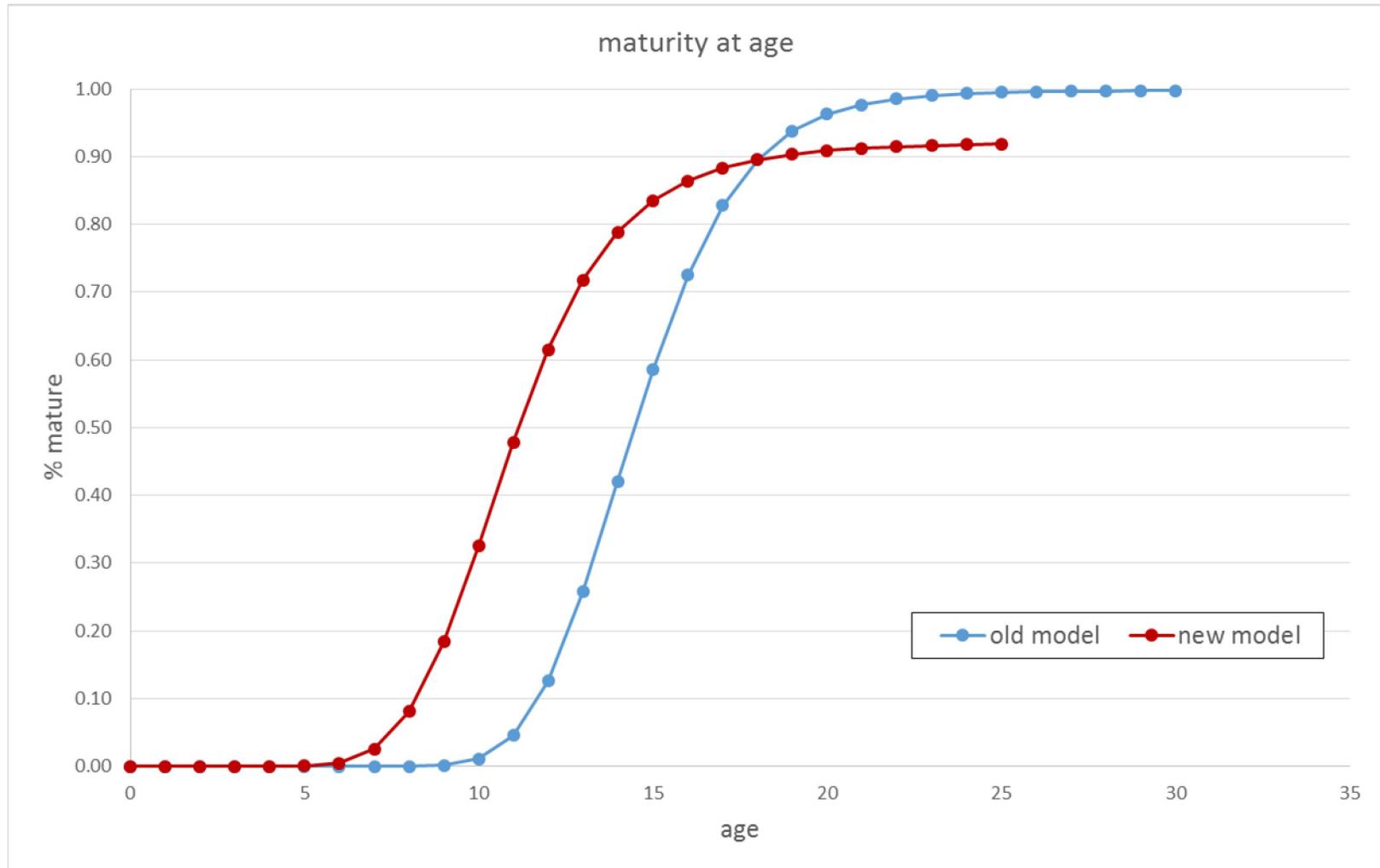
# changes in selectivity at age



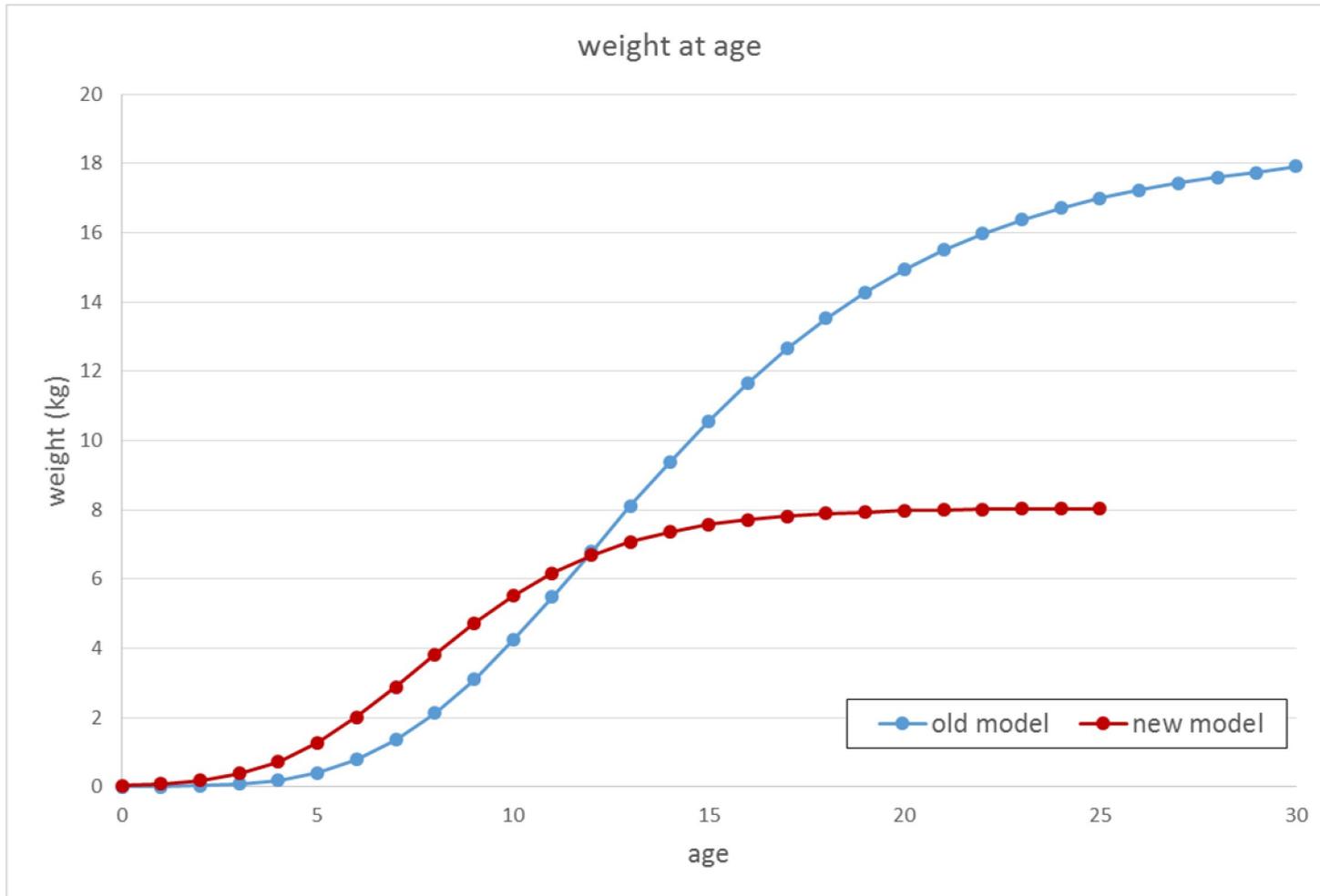
# changes in length at age



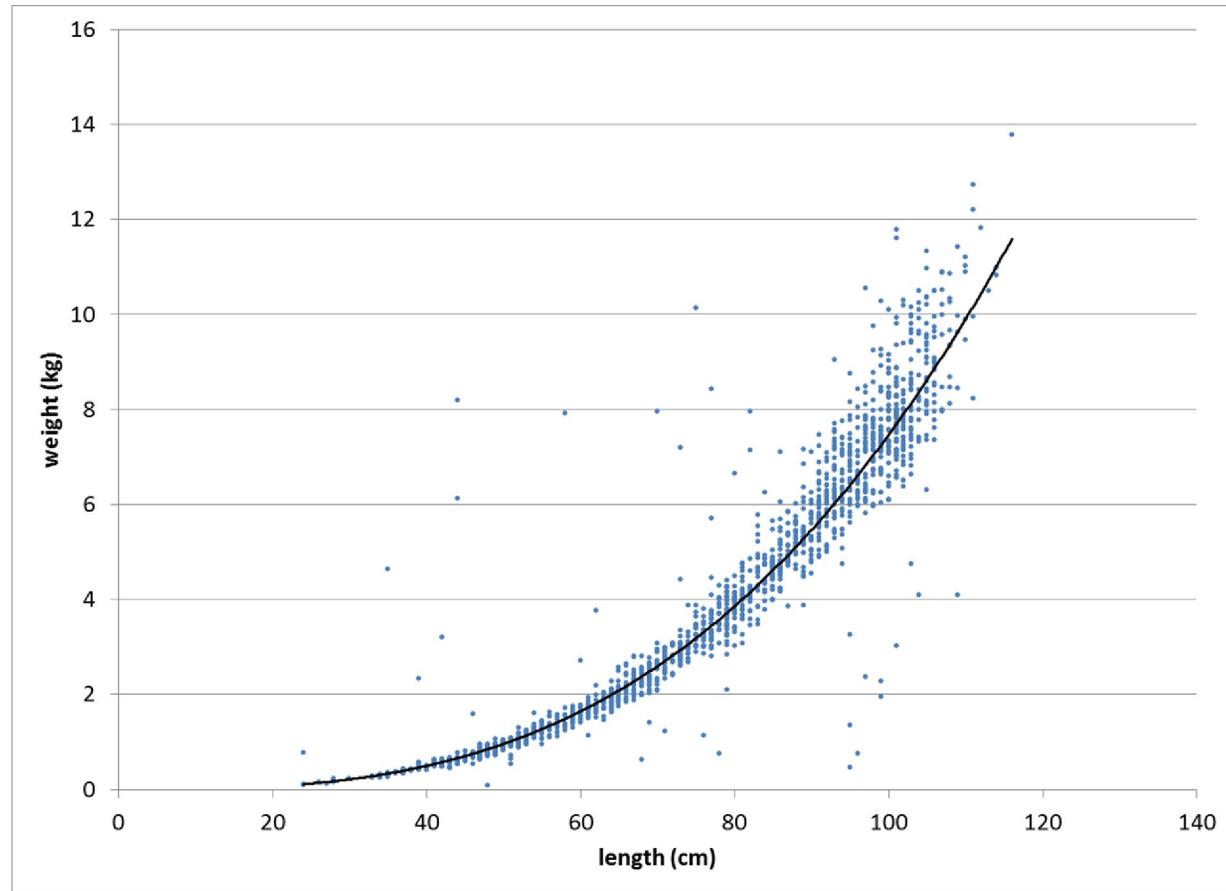
# changes in maturity at age



# changes in weight at age

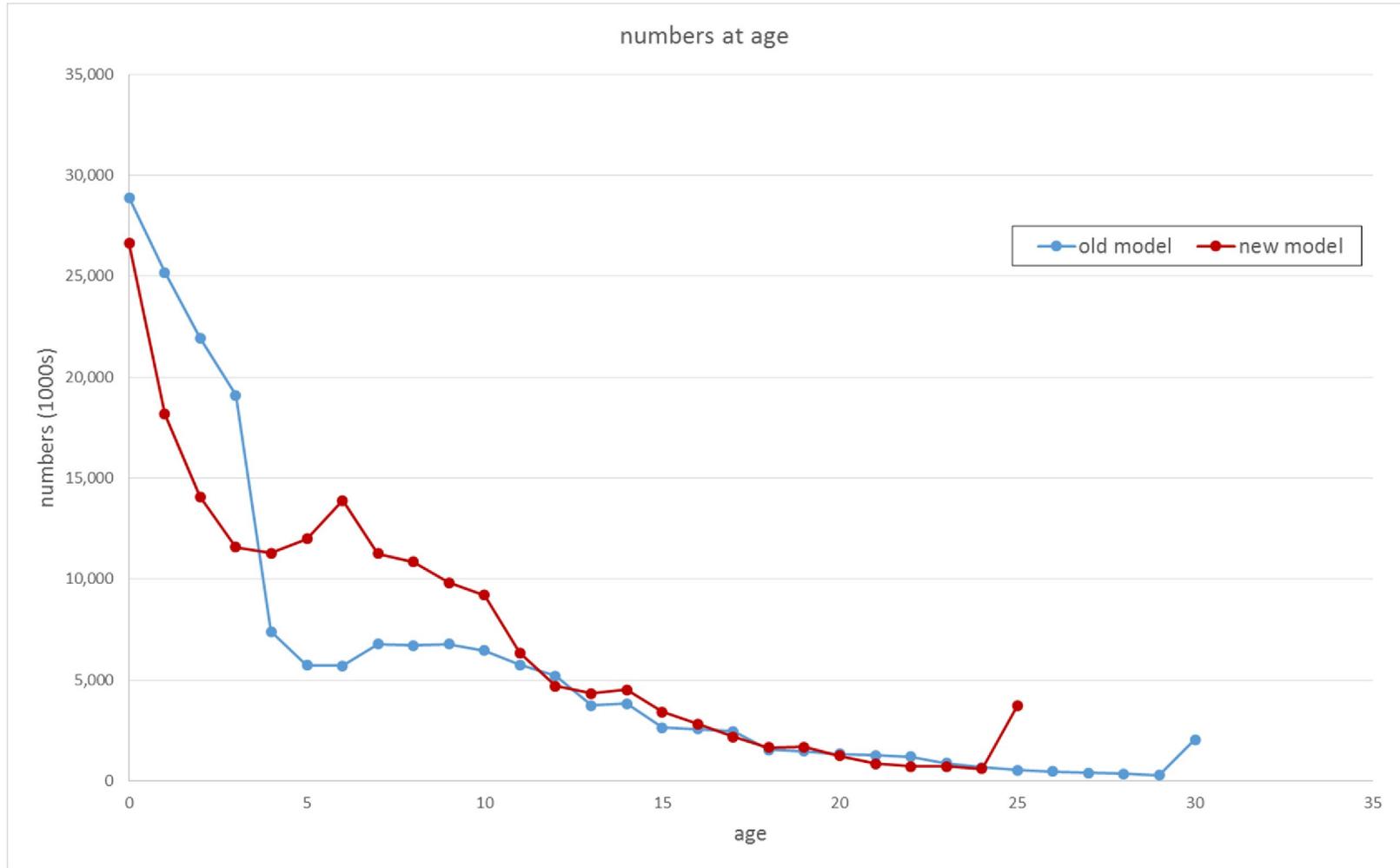


# new model empirical weight data



$$r^2 = 0.93; N = 1,515$$

# numbers at age



# summary of age-related biology

- new longline fishery is “seeing” more skates at all ages
- new trawl survey selectivity substantially changed
- all new selectivities higher for older skates
- spawning stock is younger and faster-growing
- new maturity ogive more consistent with empirical data
- weight misspecification in old model skewed the biomass proportion of older skates

# projection model testing

model code	features
13.1	old model
14.2	new model
13.1.sw	re-ran old model in SS3 with new weight parameters
13.1.pw	ran projection model only for 13.1 but with weight at age from 14.2
14.2.ps	ran projection model only for 14.2 but with selectivity from 13.1

# projection model testing

	projection model outputs					output comparisons (ratio)			
	13.1	14.2	13.1.sw	13.1.pw	14.2.ps	14.2	14.2	14.2	14.2.ps
	2015	2015	2015	2015	2015	13.1	13.1.sw	13.1.pw	13.1.sw
Projected total biomass (t)	579,785	528,391	495,963	447,056	527,534	0.91	1.07	1.18	1.06
Female spawning biomass (t)									
Projected	178,762	115,490	116,874	82,779	113,859	0.65	0.99	1.40	0.97
B100%	266,810	186,923	200,171	128,127	186,923	0.70	0.93	1.46	0.93
B40%	106,724	74,769	80,068	51,251	74,769	0.70	0.93	1.46	0.93
B35%	93,384	65,423	70,060	44,844	65,423	0.70	0.93	1.46	0.93
FOFL	0.11	0.09	0.11	0.12	0.16	0.80	0.79	0.75	1.36
maxFABC	0.10	0.08	0.10	0.11	0.13	0.79	0.77	0.73	1.34
OFL (t)	30,278	39,883	28,566	23,988	42,322	1.32	1.40	1.66	1.48
maxABC (t)	26,444	34,389	24,944	20,935	36,541	1.30	1.38	1.64	1.46
B/B100	0.67	0.62	0.58	0.65	0.61				
B/total B	0.31	0.22	0.24	0.19	0.22				
OFL/B100	0.11	0.21	0.14	0.19	0.23				
OFL/B100	0.17	0.35	0.24	0.29	0.37				

## effects of model change

- lower  $F_{OFL}$  due to changes in selectivity
- lower biomass due to misspecification of length-weight relationship in old model
- mismatch between B and OFL ameliorated when old model is run with new weight parameters
- higher relative OFL due to:
  - higher productivity (faster growth, earlier maturity)
  - SSB in old model skewed by older skates unavailable to fishery
  - differences in recruitment variability?

# model changes in 2014

- The entire time series (1982-present) of EBS shelf bottom trawl biomass estimates for skates was included in the model.
  - Reconstructed historical catch data beginning in 1954 were included in the model.
  - Four length-at-age (LAA) datasets from the EBS shelf survey were included in the model (2003, 2007-2009); a LAA dataset from the longline fishery in 2005 was determined to be inadequate and was not included in the models.
  - Weight-at-length data were obtained from a dataset generated during Alaska skate tagging activities on the EBS shelf survey during 2008-2010.
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- For all Alaska skate models, growth parameters are estimated within the model.
  - The “embryonic stage” (ages 0-3 in previous models) was eliminated from the model, so that in the model age-0 skates are free-swimming individuals in their first year outside of the eggcase.
  - The recruitment function was returned to the original formulation, a Beverton-Holt curve with steepness fixed at 1.0; this effectively defines an average level of recruitment at all stock sizes.
  - The maximum age was returned to its original value of 25 (from 30 in the 2012 model).
  - Age selectivity was not included in the model.