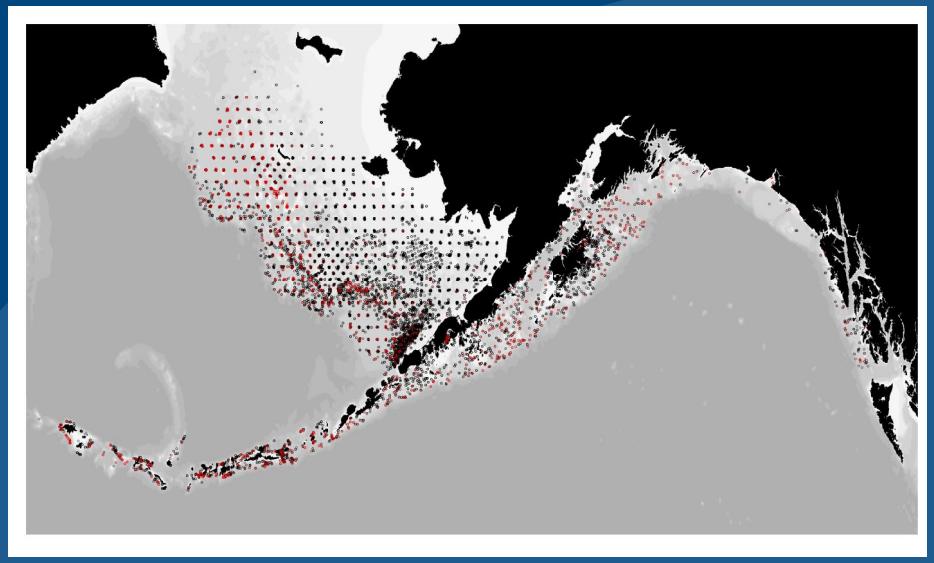
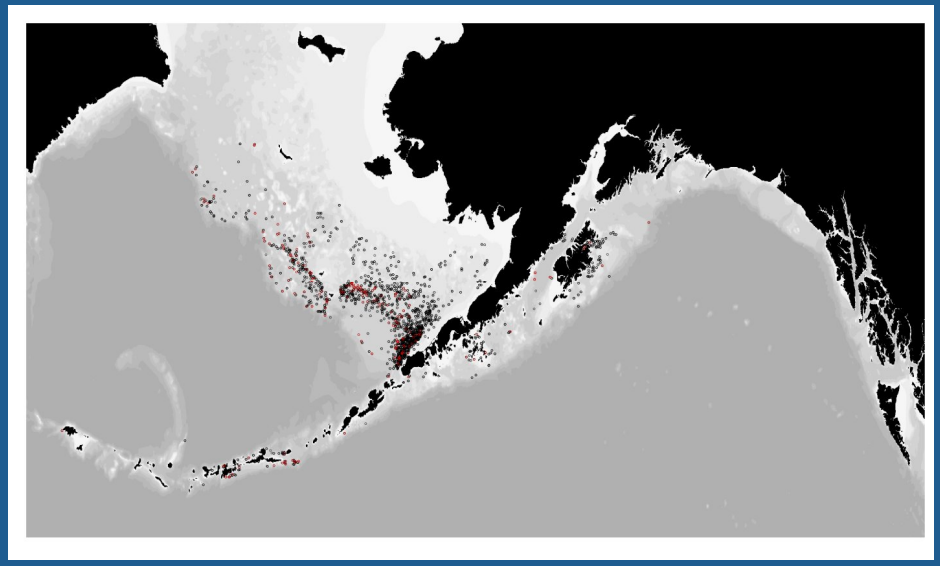
Octopus consumption-based estimates

- Octopus consumption by Bering Sea P. cod accepted as basis for recommendation in 2011; agreed to update every 5 years.
- Method performed for GOA octopus; GOA team preferred survey biomass (survey biomass currently used in GOA).





Why for Octopus, but not squid?

- Same species in diets and fishery.
- Same locations/depths.
- P. cod (well-monitored in biomass and diets) large proportion of octopus consumption. Squid consumed by many predators (including birds, mammals).
- *Disadvantage for both:* consumption is of small/juveniles, fishery is on adults.

Consumption Estimate: Method

M * B (cod eating octopus, t/year) =

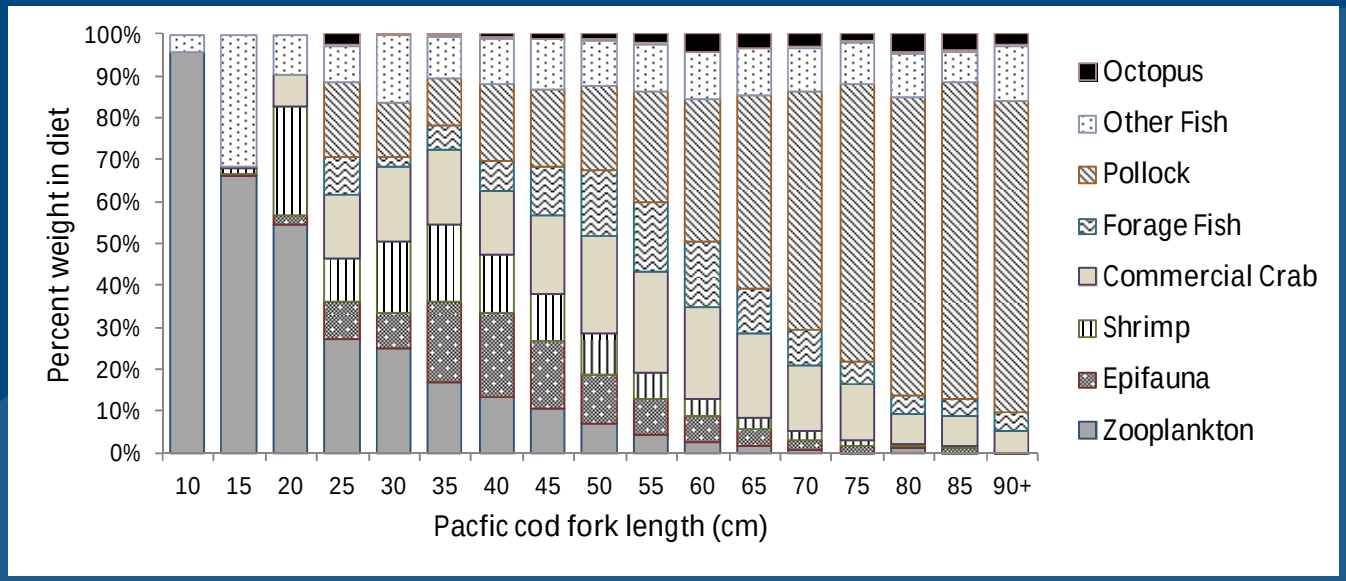
Cod $\text{Ration}_{\text{length}}$ (g/fish/year) *

Ration @ cod length: annual ration, calculated by von Bertalanffy growth fitting (Holsman and Aydin 2016). Non time-varying

Cod $\text{Nsurvey}_{\text{length,strata,year}}$ (fish) *

Survey N (including uncertainty), more conservative than stock assessment, not dependent on stock assessment choices (CIE suggestion: try both).

Diet Comp $\text{survey}_{\text{length bin,strata,year}}$ (proportion)

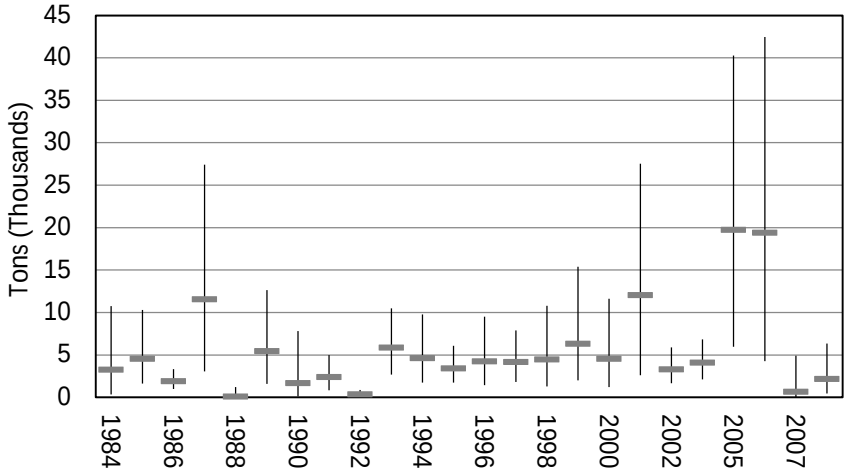


Diet composition

- Calculated per-strata and in three broad length categories.
- *Changes from last assessment*
  - Adjusted length bins to better extrapolate missing data
  - Moved from direct empirical method to fitting Dirichlet distribution
  - Several more years of data

Year	No. Stomach Samples
1984	636
1985	952
1986	1,338
1987	747
1988	551
1989	1,662
1990	1,121
1991	1,546
1992	1,876
1993	2,303
1994	2,381
1995	2,395
1996	1,314
1997	1,155
1998	1,262
1999	1,049
2000	1,101
2001	1,304
2002	1,334
2003	1,770
2005	408
2006	671
2007	578
2008	1,204
2009	1,312
2010	1,169
2011	1,511
2014	1,617
2015	1,893

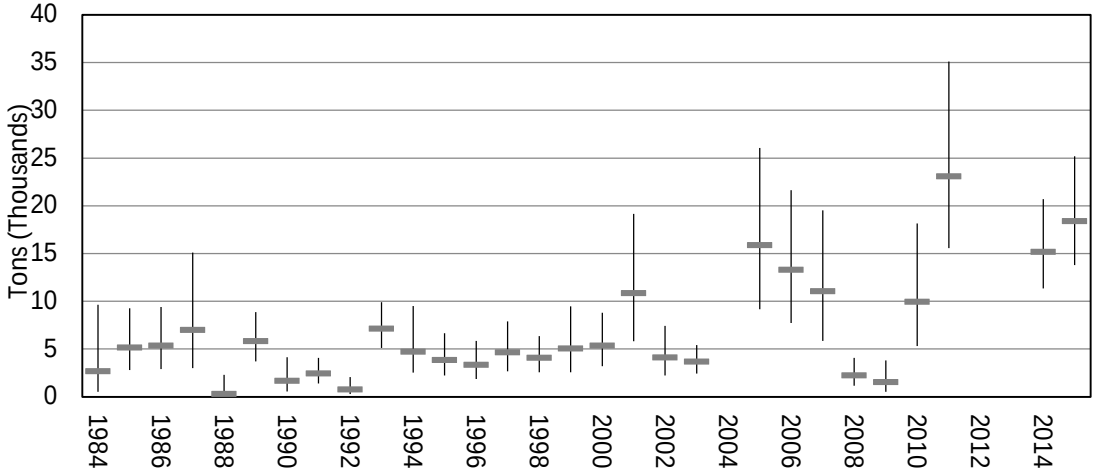
Estimated Octopus Consumption (old)

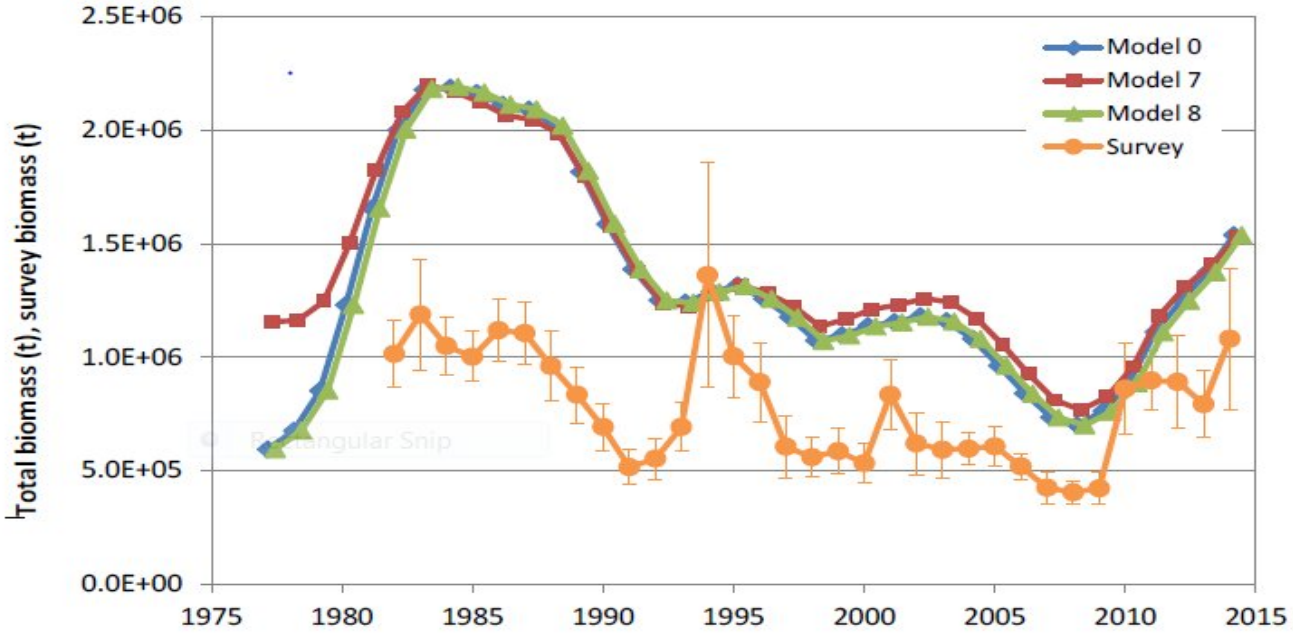


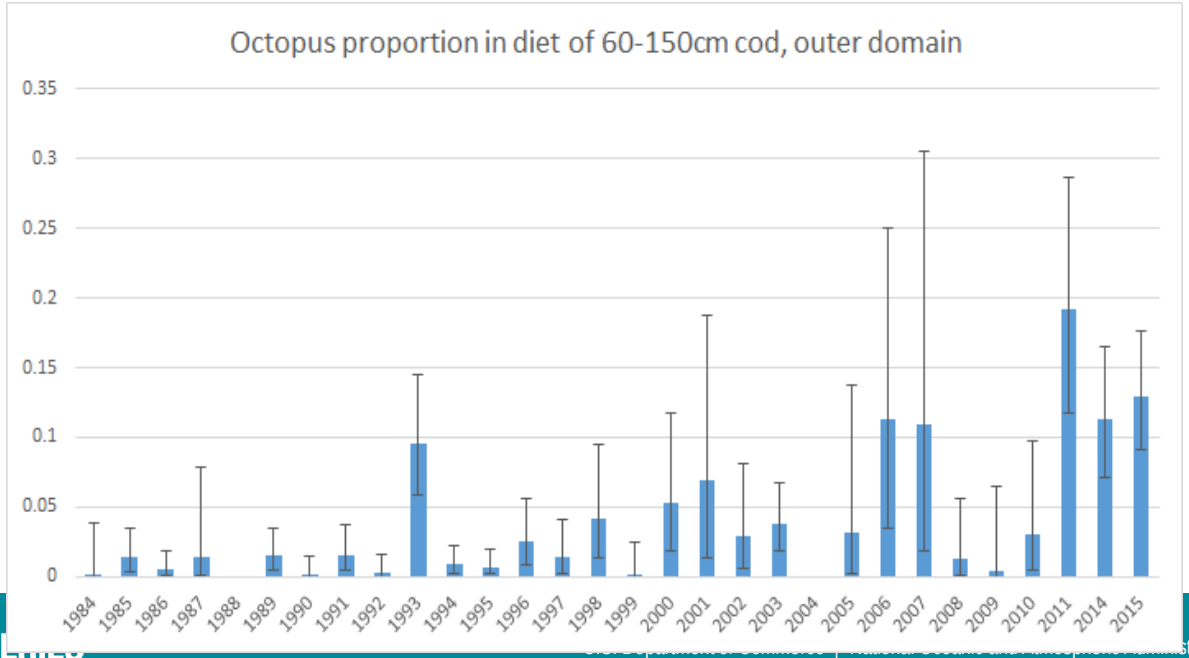
OFL: Harmonic mean of harmonic means:
3,452 t (old)
4,770 t (new)

Bering Catch 500t (TAC-limited); GOA going up (900t)

Estimated Octopus Consumption (new)




Total biomass (t), survey biomass (t)
2.5E+06
2.0E+06
1.5E+06
1.0E+06
5.0E+05
0.0E+00
1975
1980
1985
1990
1995
2000
2005
2010
2015
Model 0
Model 7
Model 8
Survey


Octopus proportion in diet of 60-150cm cod, outer domain
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2014
2015

Questions

- Use all years, accept jump?
- Use new years in future?
- Add 2012/2013 (and 2016) next year or in 5 years?
- Other methodological concerns?
- Other requested explorations or analyses?