A reassessment of carrying capacity estimates for NE Pacific herring stocks

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Pacific herring (1)

range: coastal N Pacific (Korea to California)

- relatively large, long-lived and energy-rich
- prey for marine mammals, seabirds, fishes
- commercial, artisanal, subsistence fisheries

Pacific herring (2)

current status of some NE Pacific stocks poor

- closures, low quotas, calls for shift to EBFM

status relative to unfished spawning biomass

- clear need to reexamine stock SB_0 estimates

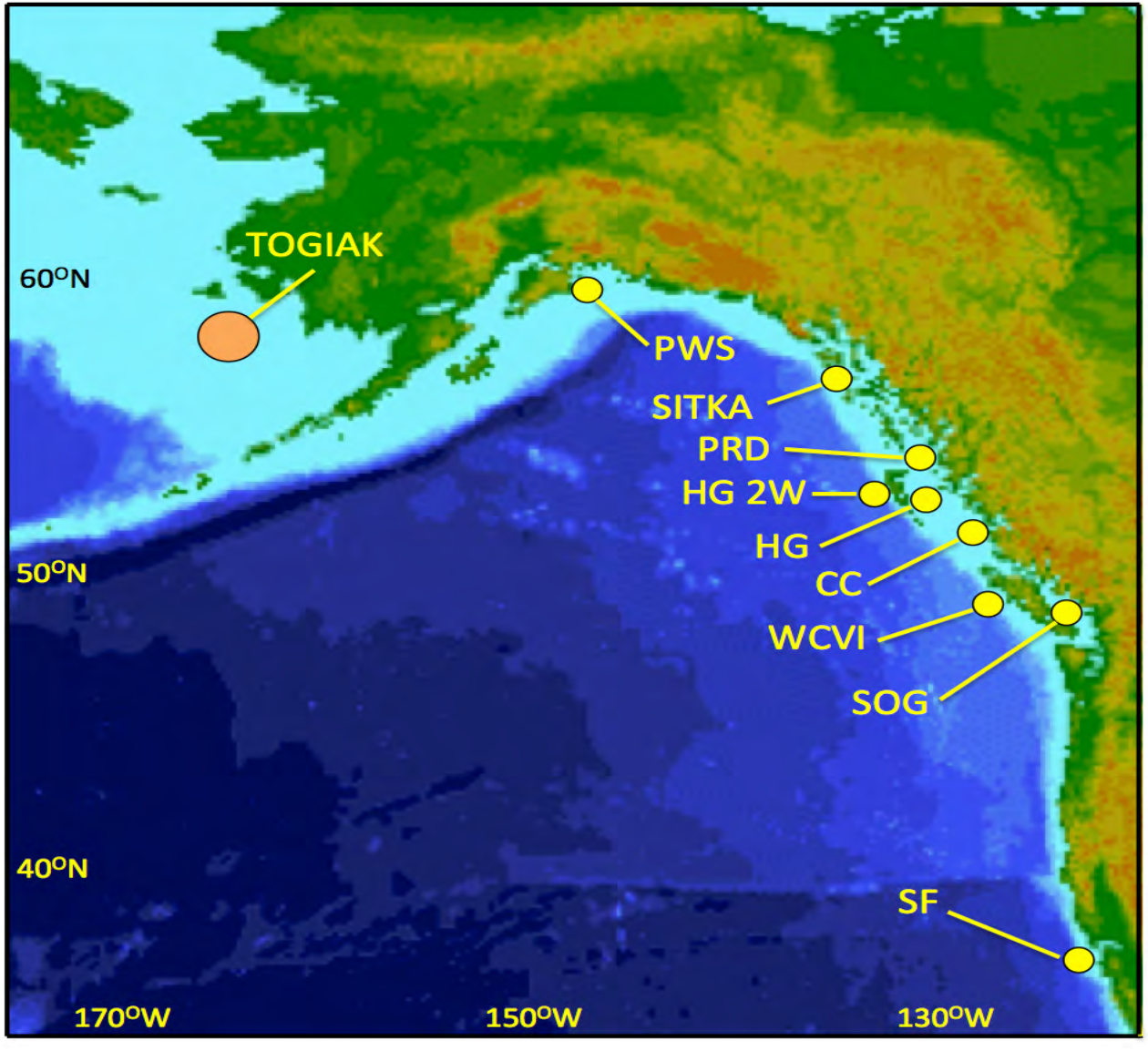
Research aims

1) re-evaluate SB_0 for NE Pacific herring stocks

2) compare new and published SB_0 estimates

3) compare SB_0, recent SB_t/SB_0 across stocks

4) compare recent SB_t/SB_0 to fishery thresholds


TOGIAK
60°N
PWS
SITKA
PRD
HG 2W
HG
CC
WCVI
SOG
50°N
40°N
SF
170°W
150°W
130°W

Study area

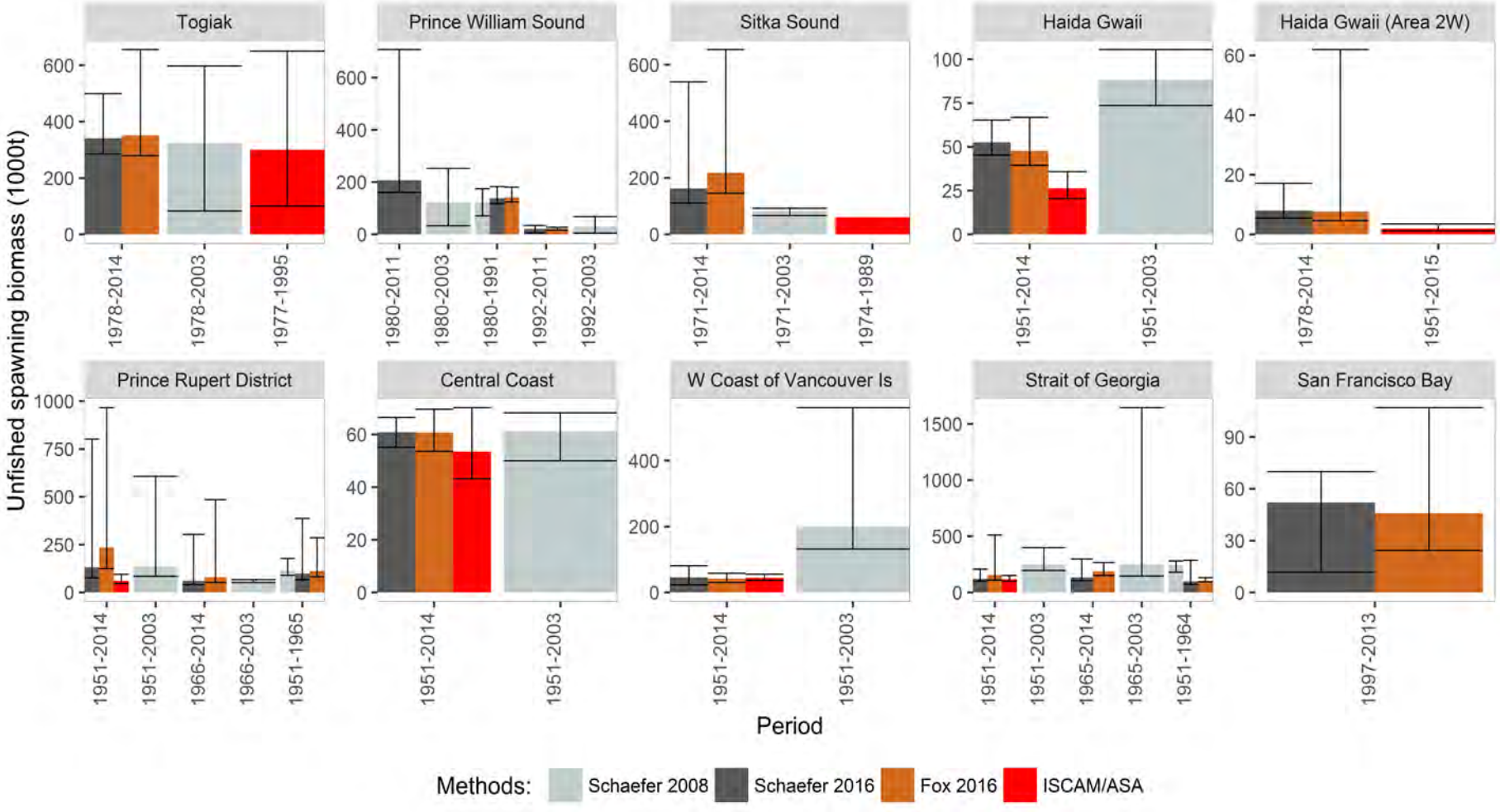
Modelling

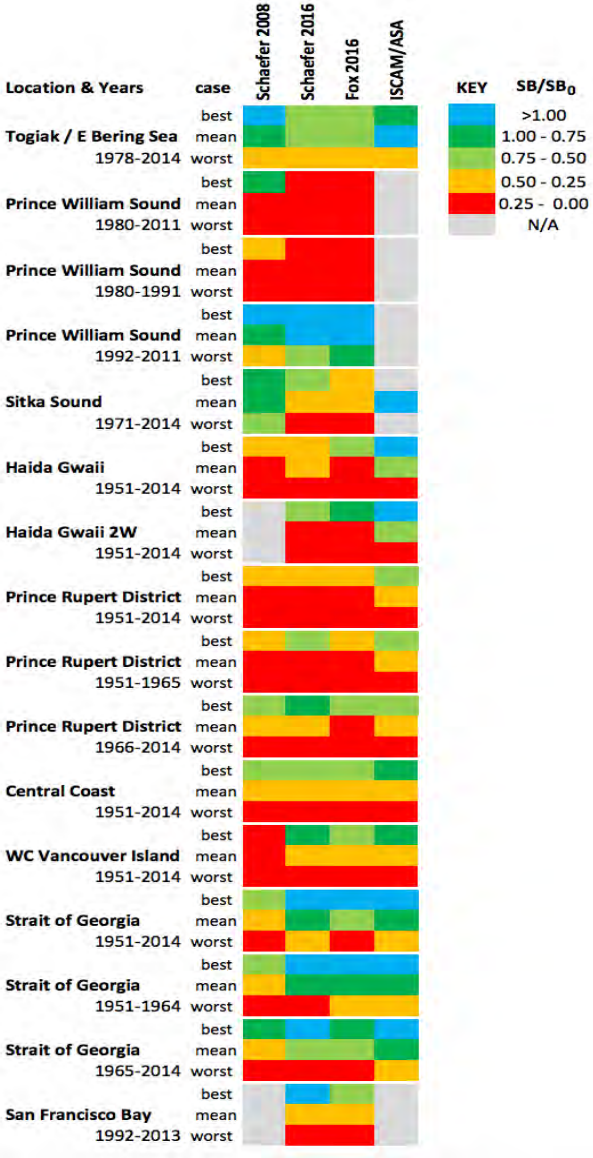
re-estimate unfished spawning biomass (SB_0)

- models: surplus production (Schaefer, Fox)
- input: annual catch, SB_t (assessment output)
- output: spawner carrying capacity K = SB_0
- confidence intervals (95%) via bootstrapping

Comparisons

- SB_0, SB_t: catch-at-age assessment models
- K = SB_0: Perry & Schweigert (2008) study
- SB_t/SB_0: current & proposed HCR thresholds
- reported vs. unreported historical catches


Togiak
Prince William Sound
Sitka Sound
Haida Gwaii
Haida Gwaii (Area 2W)
Prince Rupert District
Central Coast
W Coast of Vancouver Is
Strait of Georgia
San Francisco Bay
Unfished spawning biomass (1000t)
Period
1978-2014
1978-2003
1977-1995
1980-2011
1980-2003
1980-1991
1992-2011
1992-2003
1971-2014
1971-2003
1974-1989
1951-2014
1951-2003
1978-2014
1951-2015
1951-2014
1951-2003
1966-2014
1966-2003
1951-1965
1951-2014
1951-2003
1951-2014
1951-2003
1951-2014
1951-2003
1965-2014
1965-2003
1951-1964
1997-2013
Methods:
Schaefer 2008
Schaefer 2016
Fox 2016
ISCAM/ASA



$$\frac{\text{current biomass}}{\text{unfished biomass}}$$

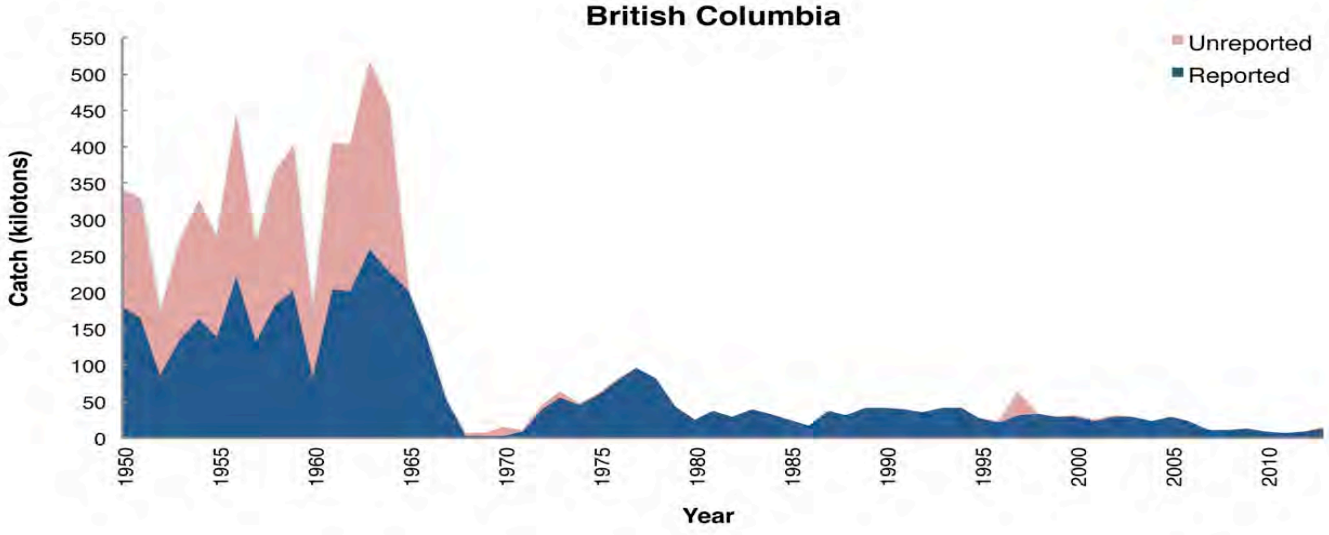
Summary

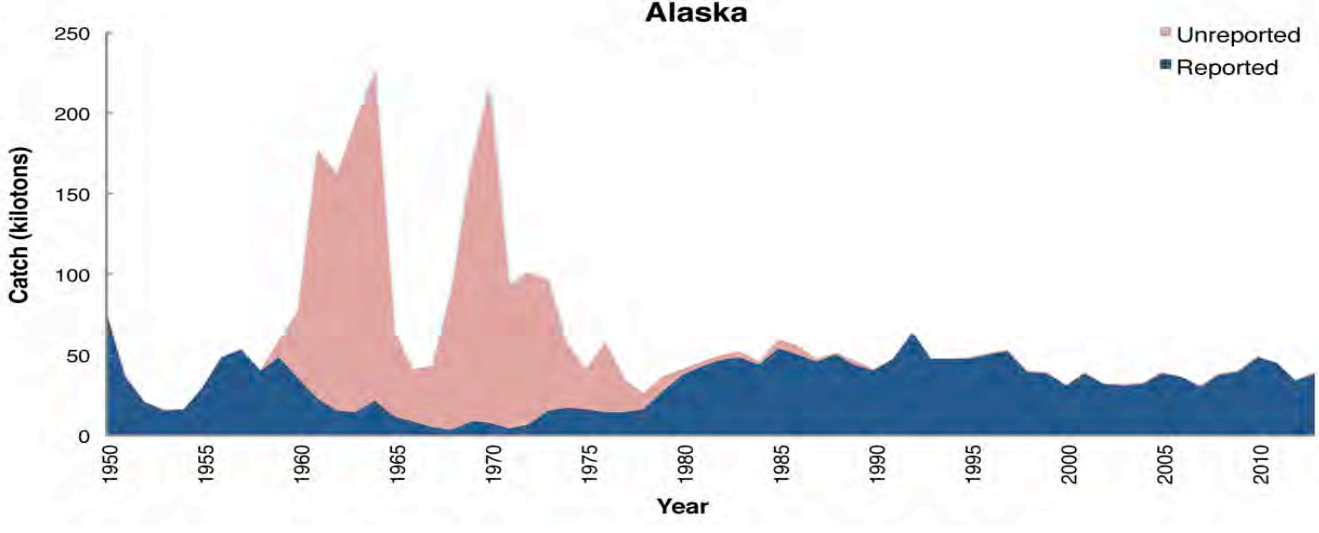
agreement between model SB_0 estimates:

- very good for new Schaefer vs. Fox
- good for Schaefer & Fox vs. catch-at-age

no confidence interval overlap between:

- most Schaefer, Fox SB_0 & recent SB_t





Historical catches

Conclusions

multimodel consensus possible for SB_0

- could use models to check one another

for most NE Pacific stocks $SB_{2015} < SB_0$

- causal mechanisms complex & diverse

Conclusions

- considerable uncertainty in stock status
- HG, HG 2W assessment overoptimistic?
- unreported catches could affect all SB_0
- precautionary approach needed & feasible

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Questions?