In attendance: Garry Stenson, Alejandro Buren, Hannah Murphy, Paul Regular, Fran Mowbray, Divya Vardy, Aaron Adamack, Mariano Koen-Alonso

Unable to attend: Pierre Pepin, Dominique Robert, Bill Montevecchi

Background to why we are convening to re-start the rebuttal process: Hannah was notified by Editor-in-Chief of Fisheries Research that Ken Frank is disputing results of current publication on reassessing the drivers of capelin recruitment variability post-1991 as this paper relies on the DFO spring acoustic survey.

Frank et al. 2016 has two hypotheses: changes in the timing of life cycle events is resulting in a spatiotemporal disconnect between acoustic survey and spawning migration; capelin are now non-migratory and are living in the nearshore area (no collapse).

These hypotheses feed into his theory on trophic cascades: capelin should be at large numbers as they have been released from predators = top-down control; and since acoustic survey is finding low capelin biomass offshore, capelin must be somewhere = the inshore area

Trophic cascades: based on bottom trawl survey data of pelagic species, which is not best practice.

Current research in the NL region supports the hypothesis of a bottom-up control on capelin biomass.

Title: Need a pithy title (e.g., capelin: bottom-up or top-down control?; capelin: evidence of a collapse)

Strategy:

Our hypothesis: stock collapse

Address all three hypotheses: non-collapse; change in timing of spawning migration misses acoustic survey (already refuted in Frank et al.); collapse

We will set up rebuttal as a ‘weight of evidence’ approach where we address each point raised in paper using our data to address both the collapse and non-collapse hypotheses. Presumably, the end result will be support for the collapse hypothesis.

Split sections among us: I have attached a separate document with tasks assigned. Ale and I will work on introduction. Once we receive your sections, we will compile document and work on discussion. We will then pass around group.

Capelin distribution data:

1980-1994: 2J3KL fall and spring acoustics

1994-present: 3L spring acoustics and bottom-trawl survey

Noisy correlation between 3L spring acoustics and bottom trawl capelin presence/absence but trends are seen = needs to be included in paper

Missing age classes: truncated ages in fishery= capelin are not doing well

Total capelin biomass and phenology changing= linked to environment (Published data)

Rather than shifting inshore, capelin abundance shifted offshore and out of survey area, early 1990s acoustic surveys

We all acknowledge issues with acoustic survey (reduced survey area, fixed in time): but acoustic data is used in a variety of ways (input and output) with cod model, ice-model, and we’re seeing good results.

Seals= easy to refute; increased abortions with low capelin abundance, switch to Arctic cod inshore; seal consumption is higher than capelin biomass in acoustics= always going to happen; 3L acoustic survey is an index of immature portion of stock; in Frank et al. they include Arctic cod in diet analyses rather than capelin. Published data available.

Cod stomachs= shrimp dominating diet rather than forage fish post-1991, percent empty stomachs increased in 1990s, decrease in cod condition. Published data available.

Birds: removal of fishing nets to reduce/eliminate bycatch of inshore murres and gannets had a higher effect on survival than reduction in capelin biomass, reduction in bycatch occurred in the 1990s and masks capelin decrease; gulls and kittiwakes are declining (were never caught as bycatch). Published data available.

Seals and birds now have access to capelin with little to no competition from cod. This may explain why capelin are still an important component of their diets and is not necessarily a reflection of a non-collapse of capelin.

CPR data: good coverage from Scotia Shelf; only 2 transects in NL; used at decadal level in NL rather than annual scale. AZMP provides better productivity data in our ecosystem and there have been a decrease in productivity of larger copepods which may be linked capelin condition and growth. Published data available.

Barents Sea: localized depletion of zoopl by capelin in autumn only, mainly bottom-up not top down processes affecting capelin survival in this region.

Lags involved- effect of decrease in capelin biomass seen by 1992

Recent condition analysis by Aaron using capelin from bottom-trawl and acoustic surveys from 1980s-present: change in condition of capelin after 1991 with a decrease in condition for females not males

No decrease in larval abundances in 1990s: this is true, and we can argue that our survey is localized to only 1 bay which may be the best habitat for capelin spawning. Furthermore, persistently late spawning has occurred since 1991 and is likely affecting larval survival due to mismatch with onshore winds and small overwintering size. In the 2000s, Murphy et al. found a strong relationship between 1-2 week old capelin densities in TB and age-2 acoustic data, which explained 40% of variability. There is also data on spawning timing and spatial extent based on spawning diaries from 1991-2017, which show consistent spawning in TB, CB. In years with lower biomass (as estimated by acoustics), spawning is restricted to 3L, lower 3K with zero spawning at beaches in north and south. Better years have a wider coastal extent of spawning. This suggests that the bays on the Avalon Peninsula are ideal for capelin spawning and that when population numbers decrease, there is a contraction of spawning locations.

Distribution: centre of gravity; re-do figure S2; bottom-trawl fall survey, why use 3NO?; Engels vs Campellen; also year groupings in Figure 4 are misleading

Can’t calculate CPUE: only open for a few days in prime fishing time

Need to include data on opportunistic acoustic surveys into nearshore over the years

Whale distribution: too if-y to use

When capelin are inshore, are the densities lower than they used to be? This is difficult to answer. Aerial surveys used to be in 1980s and 1990s, and didn’t show much change. However, opportunistic capelin acoustics in 2000s in inshore bays has found very little maturing capelin. Note that there was also a disconnect between inshore (aerial, capelin trap data) and offshore (acoustic) indices in the 1980s. This was explained as the indices measuring different components of population (mature inshore; immature offshore).

Hypothesis from the 1990s: Contraction of cod offshore= is that where capelin were? No one had an explanation. Seals? But seals were likely responding to the change in winter cod fishery from March to January with seals eating fishery discards in Jan, seals are whelping in March.

The two increases in capelin abundance seen in acoustic survey in late 2000s and then again for 2011, 2012, 2013 should be used as support that capelin stock did crash and there was a recovery that we detected using acoustics and was reflected in capelin biology (delayed maturity and earlier spawning), an increase in cod biomass, and an increase in capelin in the stomachs of predators.

An idea raised by Paul to demonstrate how 7Mt of capelin would look inshore would be to use the few inshore stratum surveyed by the multi-species survey and identify areas not surveyed (‘blind spots’) and re-distribute the missing 7Mt of capelin among these blind spots to show how much capelin would have to be inshore and their distribution. This will highlight that an inshore distribution of capelin would be impossible for us to miss and we would see the effects of a large inshore capelin biomass in the diets of predators and from harvesters.

Need to include community at large who work on capelin for this rebuttal, including Jim Carscadden and Gail Davoren