**Subject:** Further Discussion about Area 19

Any thought? We need to discuss once more before discussing with Fabiola or discuss with Fabiola?

**During the RAP meeting:**

* Area 19 requested to increase the number of trawl stations based on their thought that the commercial crab move out our pre-fixed trawl stations at the timing of DFO trawl survey in September due to the water temperature increase.
* Area 12 (Martin Noël and Marcel Hebert) supported the idea of increasing the number of trawl stations in Area 19. Their main reason of their support is that Area 19 can be considered as a test case for the crab movement/displacement vis-à-vis temperature increase. As such, a close examination by increasing the number of trawl stations may provide important information on the crab reaction vs increasing temperature.

**Consideration:**

* They might push the idea of a spring survey that has previously been done in xxxxxxx (ref) because the estimated biomass would be more precise (1-1 ½ months before the beginning of the commercial fishing instead of 9-10 months) and the temperature would be lower in spring than in September (trawl survey timing). Based on your expertise, would this even be a viable option for a single unit stock assessment approach? How could we compare the results and provide an advice for the stock unit with different survey time period (pre vs post- fishery)? Tobie said technically feasible. But I see that this is against 2013 Workshop decision. Survey timing is depending on the question to (try to) answer i.e. Temperature-crab displacement or biomass estimate accuracy.
* The precision (confidence limit) of the biomass estimate pe se in Area 19 has never been the subject of discussion. And increase precision does not guarantee increase of biomass. It would reduce the confidence limit and improve accuracy, but it could also mean a decrease in biomass, couldn’t it? Yes based on the experience we had in Area 25/26 in 1995(ish). The biomass decreased with tighter confidence limits. But Area 19 thinks that increasing the number of trawl stations we might hit the concentration of crabs that were on the slope (by avoiding higher temperature)…..
* The request from Area 19 is meant for DFO to consider the movement of crab due to the bottom temperature increase (i.e. the survey vessel starts trawling in the area in September when bottom temperatures are warmer and we are missing the crab).
* The distribution of an equal number of trawl stations has been agreed upon at the latest Snow Crab Stock Assessment Workshop in 2013 (ref). Based on the conclusion of the workshop, the higher density of trawl stations (include number of stations) placed within Area 19 was decreased to the equal level to the other CFAs. Therefore this is a change of the survey protocol agreed upon at the workshop. It might require a re-design and approval of new methodology…in my opinion. This is more or so an administrative issue but yes we need a new Workshop. I do not thing that this Area 19 issue is trifle enough to be considered as a triggering item to call a new stock assessment methodology workshop.
* An increase of 25 trawl survey stations results in $49,910 (vessel charter costs with 15% tax included) + $7,042 (fuel cost / all miscellaneous charges included). This amount was not planned for the current agreement. If approved, the current trawl vessel contract has to be amended, which my take time with hub.
* Regardless of the budget source for the increase of the number of trawl stations, this has to be discussed with the Section 10 committee.
* Is there any ‘Can-of-worm’ possibility with other area?  Are we opening a can of worms here? Area 12E already notified fishery management of similar interest/intent if we proceed with Area 19. Important and valid concern to be raised (?)

**Science**

* By increasing the number of trawl stations, we may increase the degree of precision of the biomass estimate. In the past, we have done this in Area 25/26 (xxxxx). In this case, the biomass value decreased by x t with tighter confidence limit with X additional stations.
* Tobie thinks that there is nothing wrong with increasing the number of trawl stations for geostatistical analyses and he can easily analyze the data with two results i.e. the biomass with the original sampling stations and with 25 stations added sampling stations. I can see that the analytical aspect is feasible, but what would we do with the results of these 2 different analysis? Should this be discussed with Resource management before presenting as an idea to anyone externally? If RM is not willing to consider changing or using the results from the additional 25 stations, what we would do with this information? No idea, this is one of reasons for unwillingness of my part for the survey methodology change without a general consensus by Workshop.
* According to Joël Chassé, the oceanographic condition in Area 19 is more dynamic/unstable than Area 12 (that has a CIL). As such, the mechanisms of bottom temperature increase are different between two CFAs.
* To answer the question ,  A special project is required to study temperature and crab movement in Area 19; however, if the results says ‘yes the crab move by avoiding higher temperature’, what would be the sampling protocol in Area 19 and other CFAs? Temperature-based rigking was also proposed at the 2013 Workshop, but not considered for implementation. This is where we might be opening a can of worms, but at the same time, we might need to think about those questions, because we might need to be considering the temperature in the near future. I would like to hear your thoughts and the team on this. At the 2013 Workshop, it was suggested that the temperature might be interesting parameter to be considered for Kriging with external drift. At that time the depth was considered as a proxy of bottom temperatures. Further we have to discuss with Tobie.
* Can we trawl new 25 stations in Area 19 in July (e.g. begin the trawl survey in Area 19)? starting trawling first in July before trawling in other Areas)? This may partially satisfy Area 19’s argument that later season the crab move out the trawl station due to higher temperatures. Area 19 starts their commercial fishing in July but they would have to wait until the this additional 25 station-survey is completed and data is analyzed. This goes against the survey concept that we survey after the commercial fishery, but we would also do the regular survey in September. We have to discuss with Tobie how we would distribute these 25 stations (e.g. the same as the September survey or random).I have the same question raised in the Consideration section: How could we compare the results and provide an advice for the stock unit with different survey time period (pre vs post- fishery)? Is this not impacting the methodology, adding bias, or causing other issues with our survey method and results interpretation? Based solely on research interest, it is interesting to know how crab move vis-à-vis increasing temperature (not long term but within a year). Accordingly we can set a research project for at least 2-3 seasons, but still the ultimate question of how to incorporate the results/findings into stock assessment remains and may become a huge issue.

**Further thoughts:**

* Area 19 has done pan-Area 19 temperature assessment in circa 2015 but has never shared the results with DFO nor presented the results to support their idea of catch rate vs bottom temperature relationship. It might be interesting to hear about their data-based argument on crab displacement/temperature theory. Something we could ask them if we meet with them. Has been asking for several years, but no reply.
* Stephanie Boudreau’s electronic tagging results can be useful to answer to certain extent?

**Necessary clarifications:**

* What is the expected output/target with the increment of 25 stations? I think this is something that A19 would need to clarify (their own expectations), but also…what are our expectations? What would be the expected outcome of this based on our expertise? I do not see too much difference (I am talking about adding stations in fall survey) unless the temperature driven mass displacement of crab occurs between July (fishery) and September (survey)
* Is this essential for the stock assessment of one biological unit snow crab stock in the sGSL? Is it? What are your and the team thoughts? I have not heard from others about this question, but my understanding is ‘technically feasible (Tobie and JF)’, Workshop-decision wise (my opinion), we need the third opinion (another Workshop or technical discussion??).
* What happens if there are biomass differences between the 2 surveys (which one to use)?