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In Search of Proxies for Fleet Readiness

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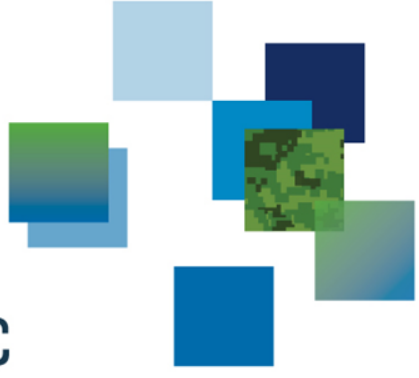

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Expectation management

- A true conference paper – i.e. a work in progress, looking for feedback
- Some initial short-turn around work will be presented
- Very much looking for suggestions and input on deepening the analysis over the medium-term

Outline

- The question(s)
- The context
- An initial look at sea day complexity
  - Background
  - Assumptions and data sources
  - Results
- Ideas on further work
  - Includes some false paths
- Summary

The question(s)

- The initial question we've addressed:
  - Is the Royal Canadian Navy (RCN) (at least on the East Coast) conducting the same intensity of effort at sea today compared to historical levels?
  - Or, more colloquially, were "the good old days" that different from now?
- The bigger question we would like to address:
  - What are the right indicators to assess and track fleet readiness, as the RCN goes through an extended period of fleet renewal?

The context

- The RCN's Halifax-class frigate fleet is going through a combined modernization and life extension process, taking ships out of service for many months at a time
  - One reason the RCN conducted a crew exchange in the Arabian Sea in 2013
- A National Shipbuilding Procurement Strategy has been launched, which will see three new ship classes introduced to the RCN over the next decade or so
  - Raises questions about the effect of technological change on required manning
- The global and domestic fiscal climate has led to successive rounds of value for money assessments
  - Brings with it a need to more clearly express the value of military 'readiness' and other nebulous concepts

Sea Day Complexity - Background

- Commander Canadian Fleet Atlantic (COMCANFLTLANT) requested a high-level look at the change – if any – in the scope and complexity of the East Coast fleet's activities over time
  - CO of HMCS Charlottetown and his WpnsO collaborated with Ops Research
  - Looked at last 10 years of frigates, destroyers and auxiliary oiler replenishment (AORs)
- Traditionally the raw number of days at sea has been relied upon to track progress between readiness levels
- Requested a year-by-year complexity score (of which more later)
- Ultimately wanted data to bring to discussions on whether perceived changes in number and type of sea days was leading to perceived changes in fleet readiness

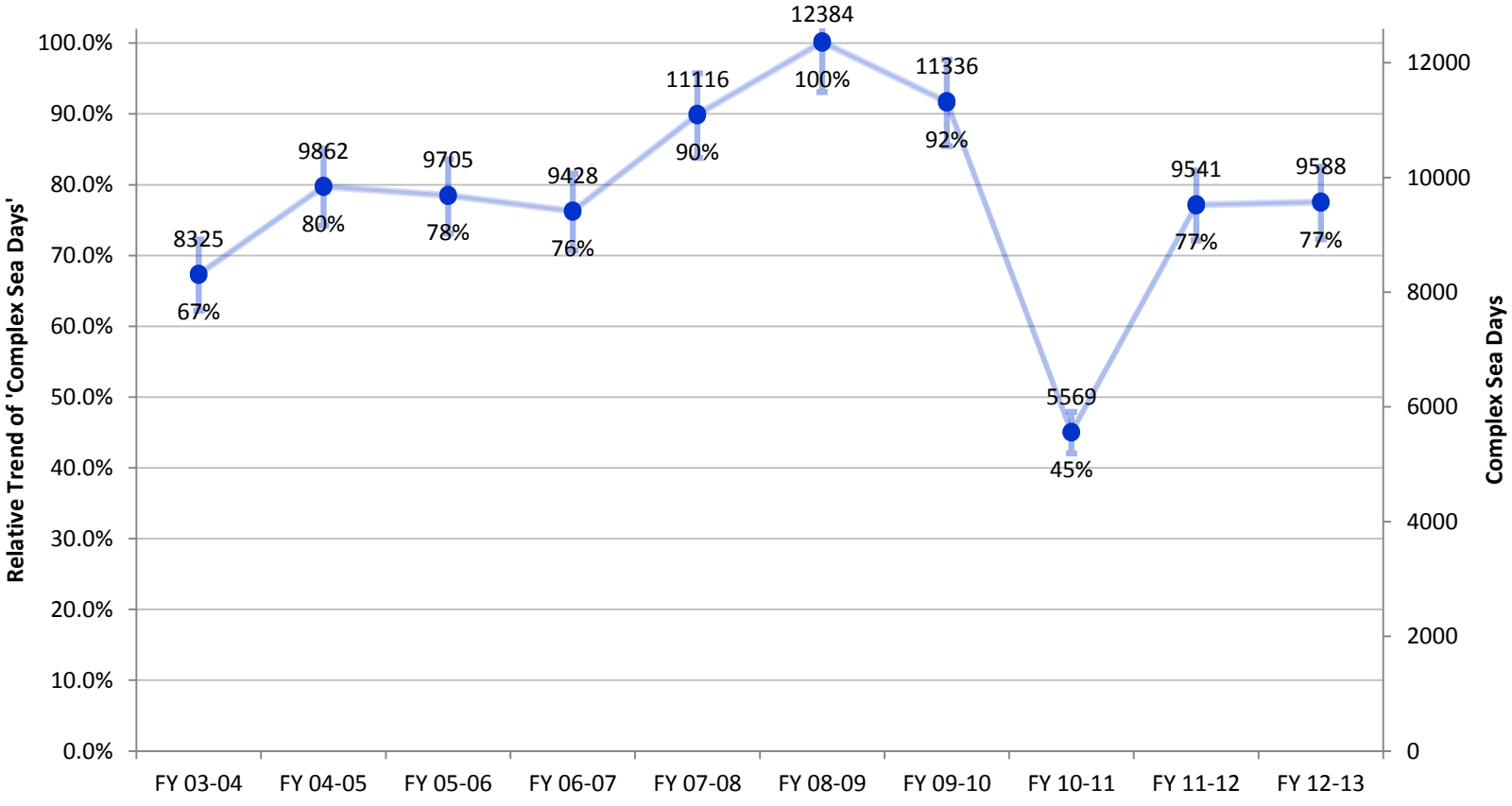
Sea Day Complexity – Assumptions and data sources

- Relied on historical operational schedules – for increased validity would want to compare to ship logs
- Divided each day at sea into generic *exercise categories*
  - e.g. national exercises, international deployments, work-ups, constabulary operations, fishery patrols, independent ship exercises, etc.
- Ship crew had four subject matter experts rate the complexity of each of these categories in several *activities*
  - Warfare areas (ASW, ASuW, etc.), use of air detachment, general seamanship, and single versus multi-ship operations.
  - Purely single ship operations which did not fall into an operation or deployment were considered to have 0 value for skills generation

Sea Day Complexity – First Method

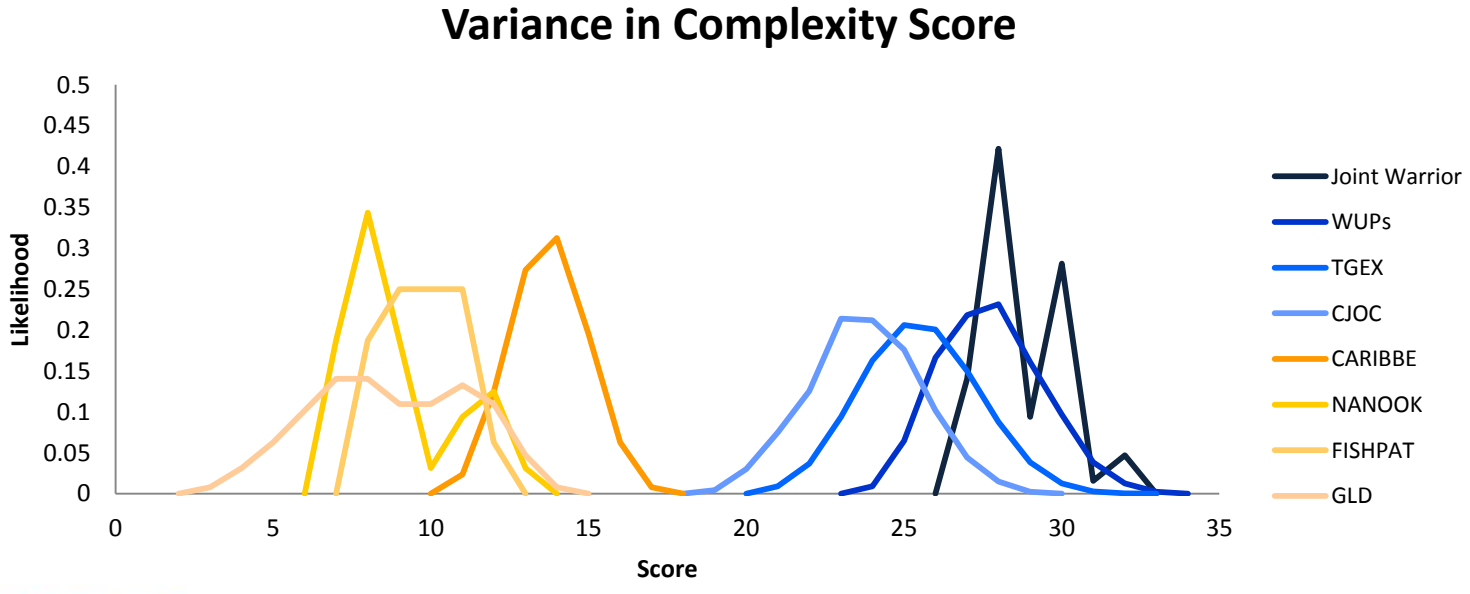
- An overall “complex sea days” score for each year was then generated by multiplying the number of sea days spent on each activity by the total complexity score assigned to that activity
- A trend analysis was done on these scores (see over)
- However, given the known issues with weighted-sums in decision support, the operational research team pursued a method of removing this dependency

Sea Day Complexity – First Method



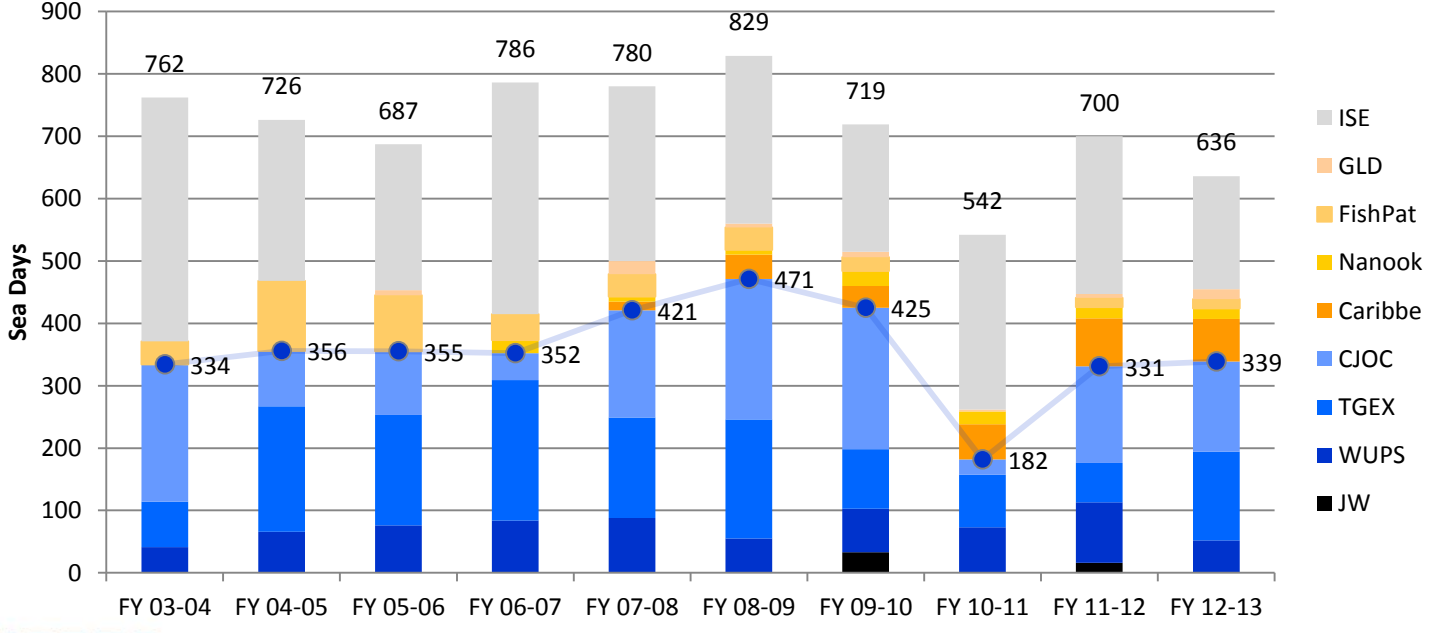
Sea Day Complexity – Second Method

- To visualize the spread in the SME responses, the distribution of the four scores for each activity were convolved and plotted together
- It is clear that there are two non-overlapping groups of exercises



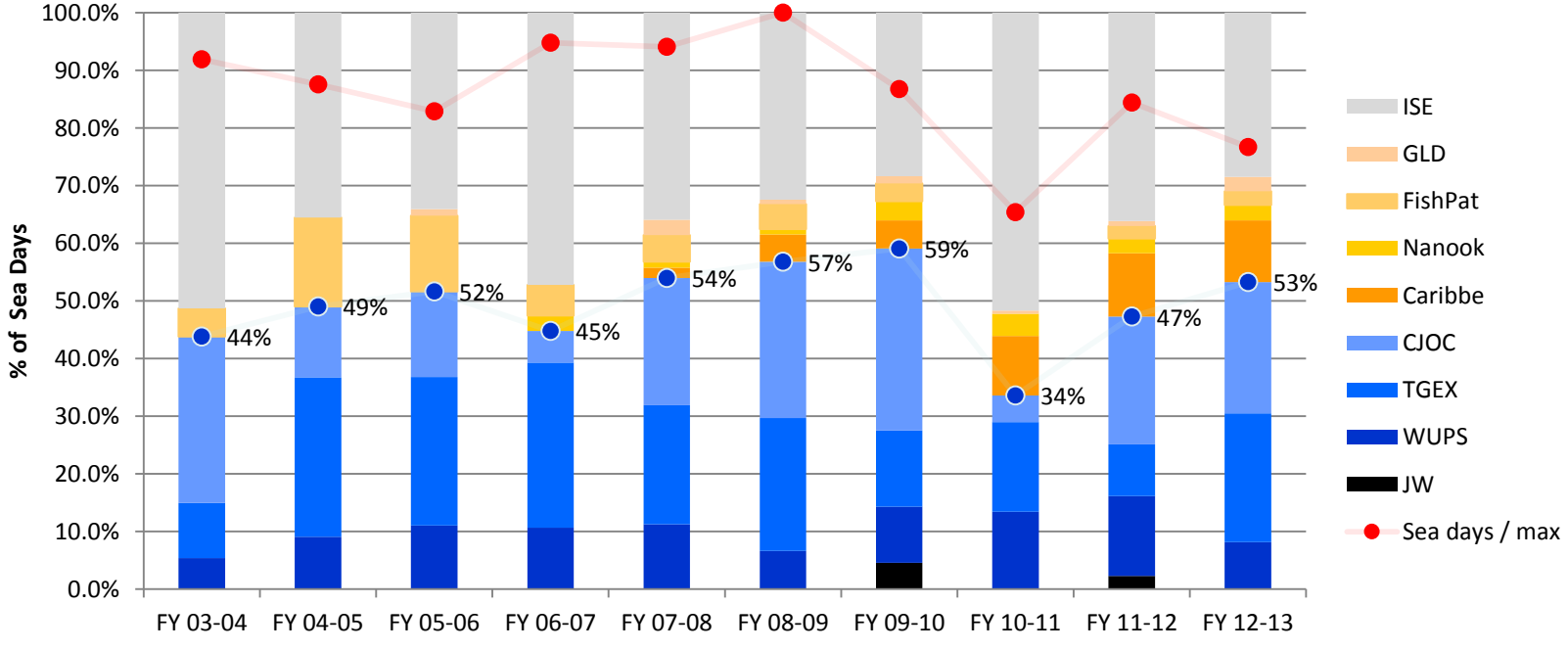
Sea Day Complexity – Second Method

- We can then proceed to look for trends in the total number of sea days, those spend on the ‘top 4’ most complex exercises (blue), and those spent in the ‘bottom 4’ (yellow)



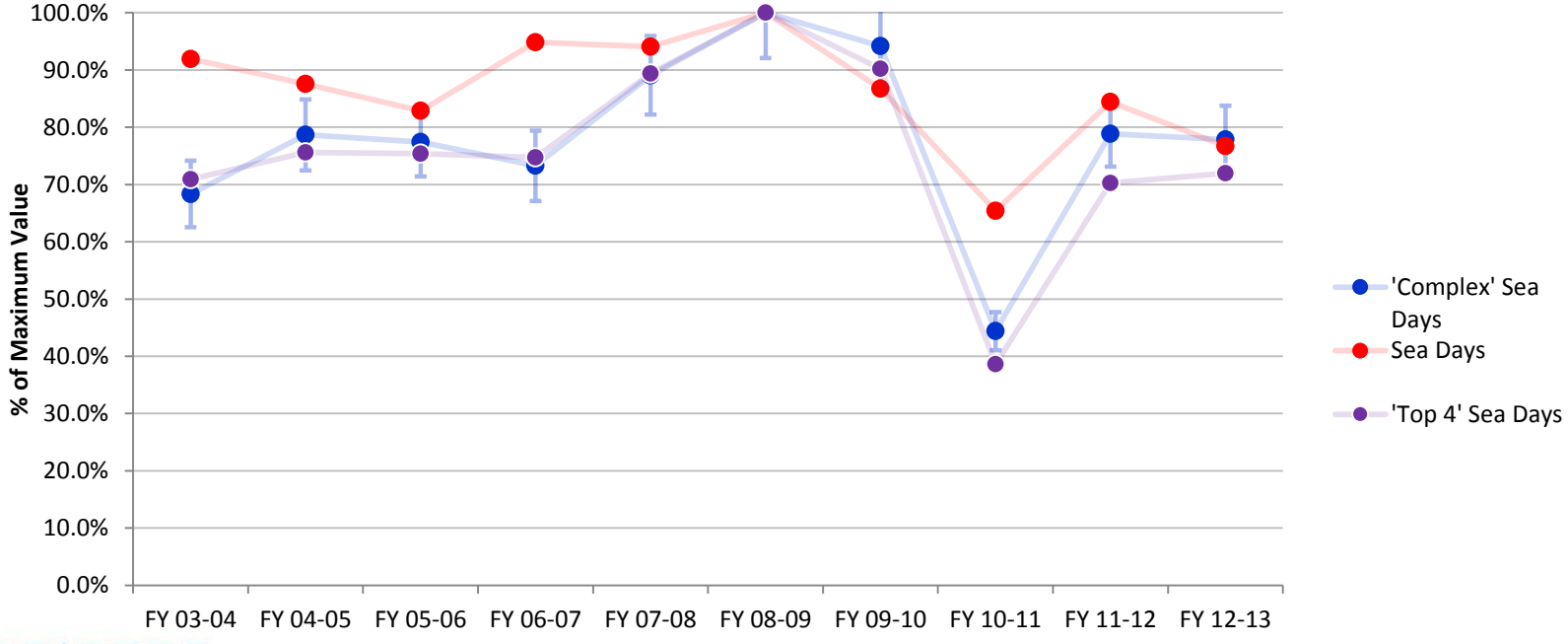
Sea Day Complexity – Second Method

- Normalizing to the total number of sea days (but keeping its trend for reference as the red line), we get the chart below



Sea Day Complexity – Method Comparison

- Finally, we can compare the trends in the raw sea days, the “complex sea days” score, and days spent on the “top 4” most complex exercises



Sea Day Complexity – Discussion

- Generating a weighted complexity score for each year, and simply tracking the number of days spent in the most complex activities yielded similar trends
  - The weighted score is simpler in that it produces a single number, but justifying its production may be more difficult, and its absolute value has no physical meaning
  - The “top 4” method is a bit more difficult to explain, but the results are straightforward in their interpretation
- Overall there was a small downward trend in the number of sea days for the East Coast Fleet, but the number of days spent on the most complex exercises hasn’t changed much in ten years
- A noticeable dip occurred in 2010-2012, which appears attributable to a decrease in deployed operations (managed by the operational command rather than the fleet)

If the number of days at sea is not at issue (at least not currently) where to from here?

Potential Indicator #1 – Fuel Data

- The RCN already links fuel budgeting to readiness level, wanted to explore further whether fuel use is a suitable proxy for intensity of effort
  - Pros: objective and easy to measure
  - Cons: different commanding officers drive their ships differently; not necessarily reflective of how hard the crew are working
  - Misc: ashore records are only kept monthly, which led to over-determined equations and spurious results when analyzed. More detailed records are available on each ship, but more work to collect and digitize.

Potential Indicator #2 – Communications Links

- Idea: to look at the number of people who must communicate with each other to perform activities and/or the number of links key personnel have with each other (or even other ships)
  - Pros: should be able to collect once (or once per exercise type) and re-use
  - Cons: initial discussions with SMEs seems to indicate its unwieldy to consider all involved personnel; difficult to account for secondary duties/hand-off, and may vary depending on what else is happening
  - Misc: if looking only at between-ship traffic; may be able to pull records from historical databases

Potential Indicator #3 – Multivariate Methods

- Using multivariate methods (factor analysis, MANOVA, SEM, etc.) try to pull out the individual and overall effects of several individual indicators. This has been done with e.g. SORTS (Status of Resources and Training System) in the U.S.
  - Pros: can consider a number of different factors at once; tease out moderation and mediation effects of interacting variables
  - Cons: the more variables considered the more data is needed – difficult with Canada's small fleets; may not have historical records for all the variables of interest

Potential Indicator #4 – Hierarchical Goals Analysis

- Idea: perform a full workload analysis using hierarchical goals analysis or other tools to fully determine task complexity.
  - Pros: complete and defendable picture of complexity; some work already done on Canadian frigates
  - Cons: tends to be very scenario specific and focused on worst-case or average-case scenario – may be hard to justify doing for all scenarios; expensive and time consuming, cannot be easily updated and tracked over time

Potential Indicator #5 – Significant Incident Reports

- For a variety of reasons it was conjectured that an increase in injury rate could be correlated with a crew that was no longer as ‘ready’
  - Pros: data collection already in place
  - Cons: data seems to be too sparse to find robust correlations
  - Misc: discussions with SMEs indicates that although all injuries are to be reported, in practice minor bumps and the like are likely not – and it is probably those minor incidents that would be more telling.

Summation

- There is no one perfect proxy for readiness, and it is a hard problem even with good data and multiple indicators
  - See accompanying report for a survey of relevant literature
  - The US Navy (and other forces) have extensive data (SORTS, DRRS, etc.), but still many debates
- Despite some anecdotal perceptions, the Royal Canadian Navy appears to be spending the same amount of sea days on ‘core business’ as 10 years ago
- Happy to take feedback on the indicators discussed, or any other proposals

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