COMMENTARY BY DR. KENNETH T. FRANK REGARDING -- Draft Regional Assessment Report: REGIONAL ASSESSMENT OF OFFSHORE WIND DEVELOPMENT IN NOVA SCOTIA (October 2024).

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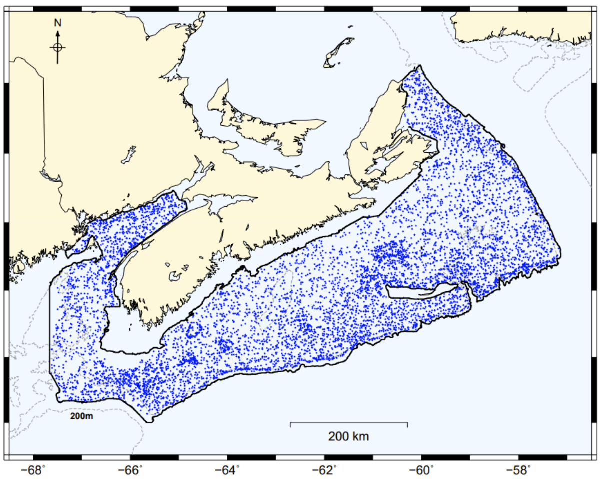
COMMENTARY

The Draft Regional Assessment Report is a static biological/ecological depiction of a dynamic system of offshore banks on the Scotian Shelf aside from documented changes that occurred during the early 1990s, and we know those changes have not persisted to present. Overall, the document with respect to the biology/ecology of the species inhabiting the banks is superficial and misleading. I am a proponent of alternative energy sources to reduce the human caused production of $CO_2$ gases in the atmosphere but the citing of such developments, such as the recommendation to construct Offshore Wind Farms on the outer banks of the Scotian Shelf, needs to be conducted with the best available information to protect and conserve the regional marine environment. However, there are alarming shortcomings of the Draft OSW Report and the threat such a development poses to the hotspots of biological production on the Scotian Shelf needs to be elucidated as shown below in my remarks concerning excerpts from the Draft Report.

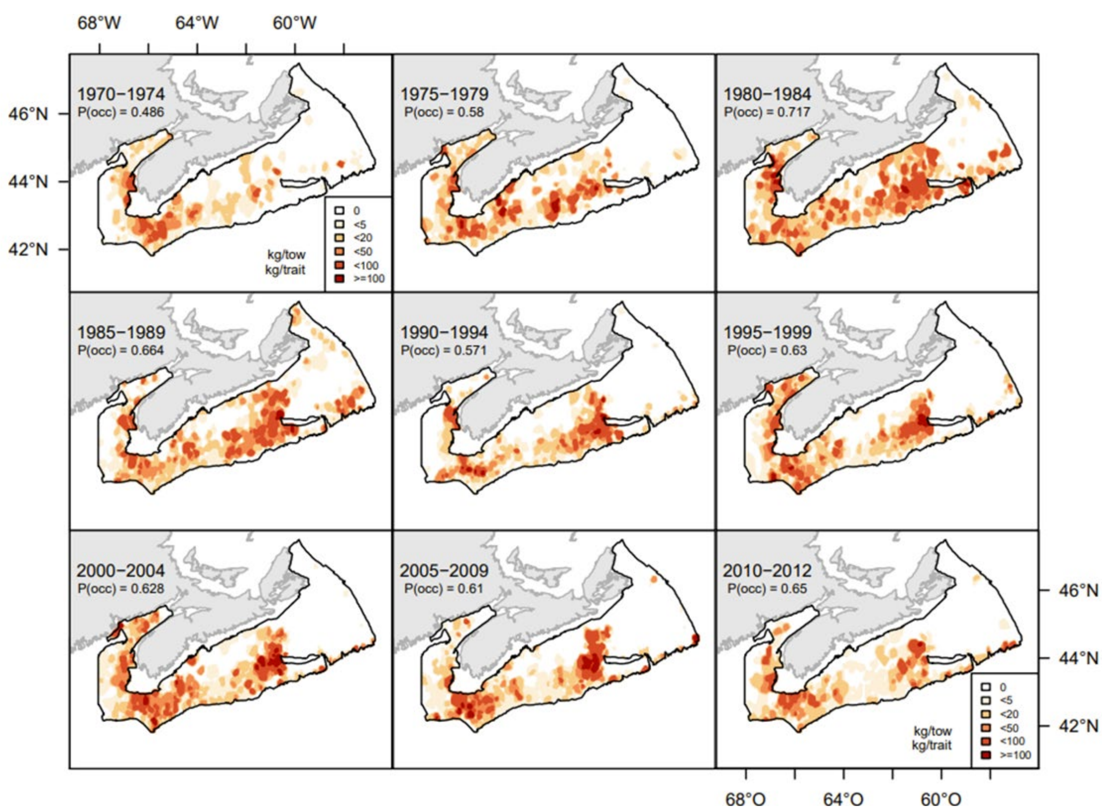
Pg. 87. "Due to the large size and ecological complexity of the Scotian Shelf, there are many uncertainties and research gaps that make predictions of the environmental effects of OSW in this area difficult. Nonetheless, with increasing access to a great variety of remote sensing techniques, underwater drones, and tagging programs, knowledge of the changes in the physical and chemical environment, of the presence, movements and interactions of organisms, and of the productivity of the ecosystem is increasing. The remaining uncertainties can and should be resolved using these techniques in a coordinated program of research as OSW farms receive regulatory approvals and are assembled (see section 10)."

These statements are indicative of the oversight of data and data products available from long-standing monitoring and research programs – particularly DFO's ecosystem surveys. One such survey has been conducted each year since 1970 and covers the entire Scotian Shelf. This survey is conducted in summer (mainly the month of July) but historically there were other surveys at different seasons (spring, winter and fall) for different time periods (e.g. see Smith et al. 2015). Bottom trawl surveys target groundfish but also provide data for use in the evaluation of pelagic fish and invertebrate resources. The figure below shows the location of individual fishing tows or sets from DFO's summer survey for the 1970-2012 period (blue dots: 7559 sets; from Ricard and Shackell 2013).

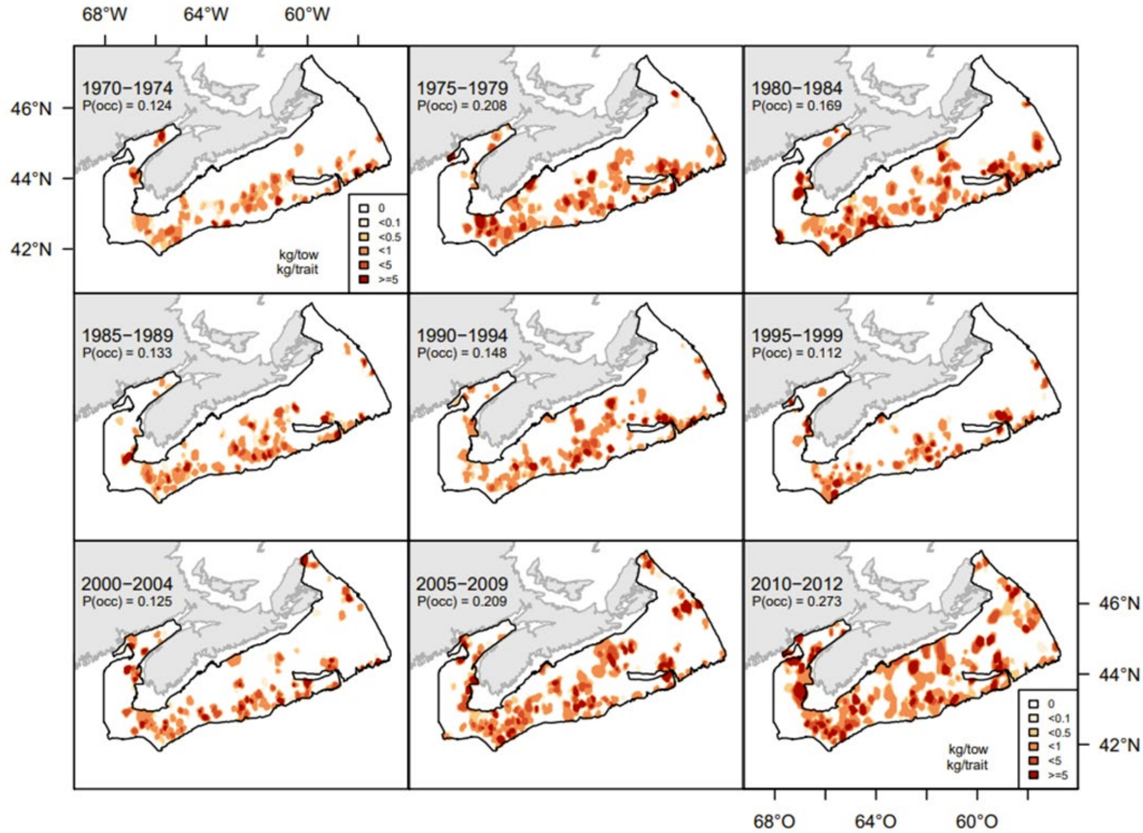



Here is some example output from the Ricard and Shackell (2013) report showing the distribution and abundance of two commercial groundfish species (haddock and halibut) at different time intervals. Of course, all this type of information could be updated to illustrate present day conditions for these and dozens of other species.

<u>Haddock</u>



Atlantic halibut




The scientific surveys are important for resource status assessment, recovery potential assessment, monitoring of species of conservation concern, and ecosystem status reporting. Summaries of these data (graphical and tabular) are contained in a variety of readily available technical documents (https://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm) as well as many publications authored by government and academic researchers and their students in scientific journals. The peer-reviewed technical documents have been published at the above website each year since 2016 and the latest entitled “Maritimes Research Vessel Survey Trends on the Scotian Shelf and Bay of Fundy for 2023” provides information on trends in abundance and distribution for most groundfish species on the Scotian Shelf (DFO. 2024).

The summer survey was originally designed for monitoring the distribution and abundance of groundfish, but beginning in 1999 selected invertebrates began to be systematically recorded and have provided very useful data on several important benthic invertebrate species. These data are contained in a technical report by Tremblay et al. (2007) which summarizes the distribution and abundance data for a variety of important invertebrates. Below are some examples figures from the Tremblay et al. (2007) report. This type of comprehensive technical summary has not been updated since 2006 but the data exist to do so up to present (but see Stortini et al. 2020).

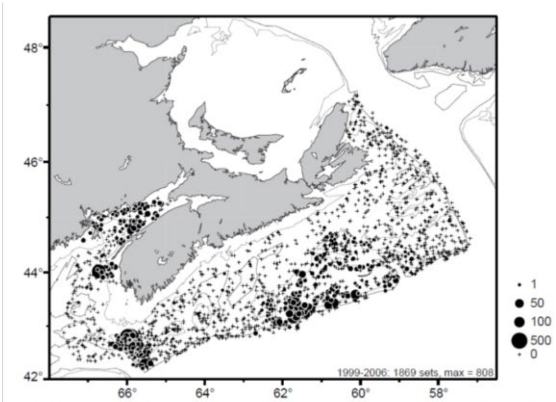



Fig. 54. Number of Sea Scallop per tow from the 1999-2006 Summer Ecosystem Surveys.

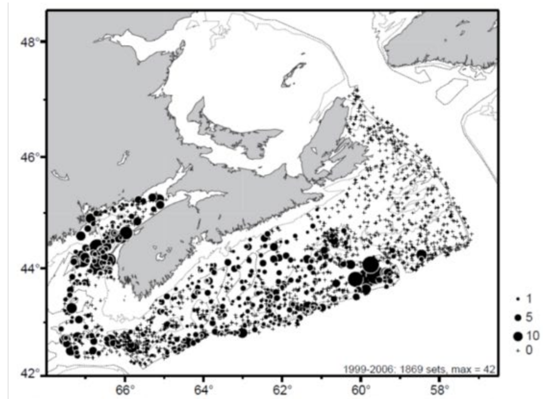



Fig. 11. Number of Jonah crab per tow from the 1999-2006 Summer Ecosystem Surveys.

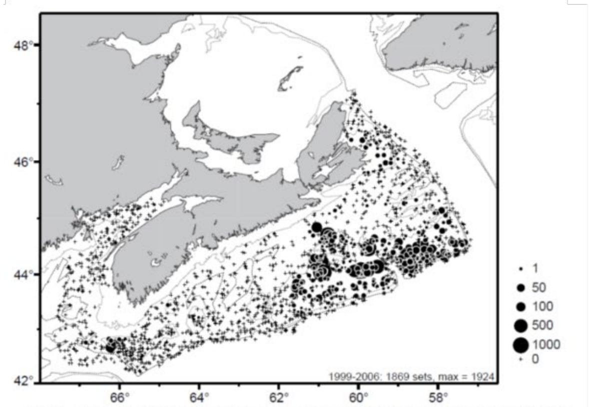



Fig. 67. Biomass (kg/tow) of Sea Cucumbers from the 1999-2006 Summer Ecosystem Surveys.

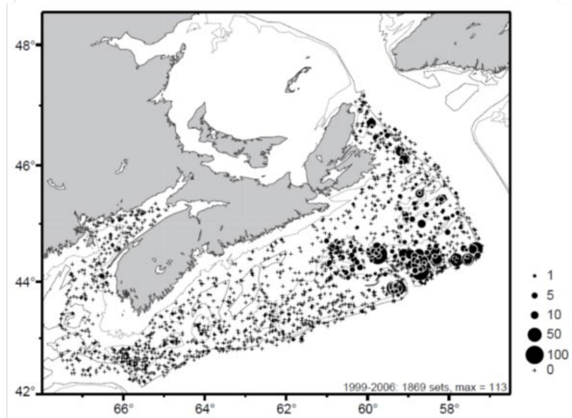
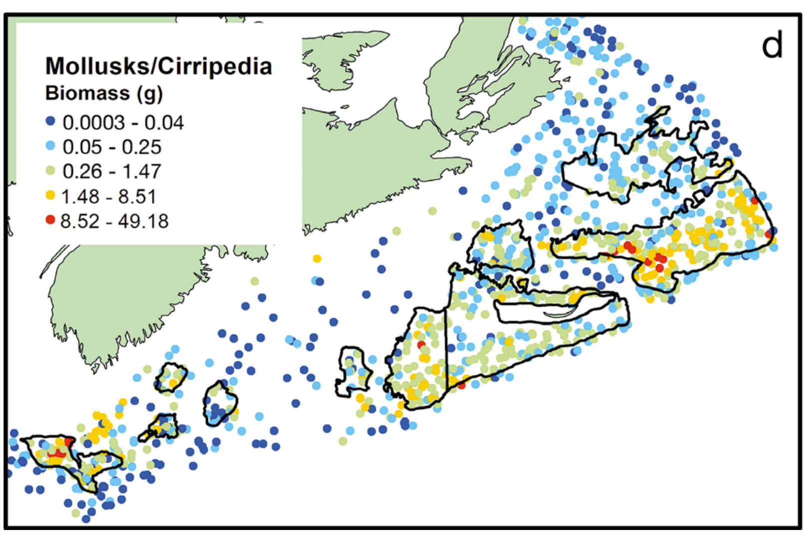
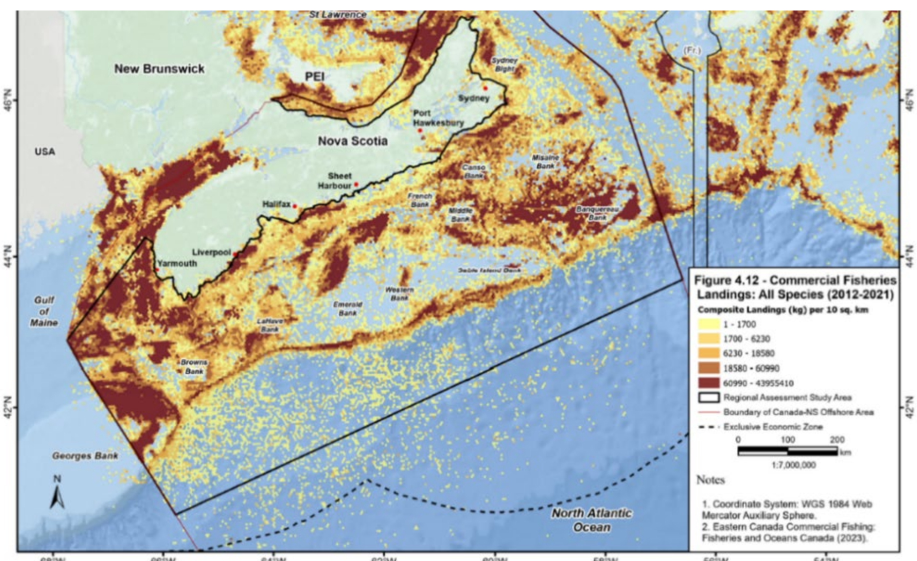



Fig. 59. Number of Iceland Scallop per tow from the 1999-2006 Summer Ecosystem Surveys.

Stortini et al. (2020) looked at the distribution of 3 broad taxonomic groupings of invertebrates from the summer survey during the interval 2005-2020 from 10 major banks on the Scotian Shelf (outlined in black). The figure from their paper is shown below and the Mollusk/Cirripedia groups includes sea scallops which dominate the biomass on Emerald (72%) and Western (57%) banks. Browns had the greatest contribution of sea scallops to the total biomass (76%). Since the raw data from the summer survey is publicly available, maps such as this one below could be produced for any benthic and many common small, semi-pelagic species.



All Figures (e.g. 6.13, 6.15) in the Draft OSW Report showing the location of the PDAs for each bank should be re-plotted with the DFO survey data instead of the commercial landings. This would provide a true picture of the distribution and abundance of the various groundfish and invertebrate species at virtually any time interval from 1970 to present. Commercial landings are an insufficient proxy for species abundance and/or distribution because management actions dictate where and how much of a species can be captured. The fishing industry obviously will focus on species of greater economic value as well. Surveys, either industry or science based, are the only meaningful way to assess the abundance and distribution of a species. There is no reason why DFO surveys were not incorporated into the Draft OSW Report and as mentioned before the data is readily available to the public and contained in several technical documents easily available on the web. Such an oversight renders most of the species and ecological descriptions of the fish and invertebrate communities inhabiting the banks misleading. Compare the figure below (composite of landings for all species from 2012-2012) from the Draft OSW Report to those above from the DFO surveys. The figure below makes it appear as though Emerald, Western and Sable Island bank are ecological deserts when in fact they are among the most highly productive regions on the entire Scotian Shelf. If one were to develop a figure from the DFO surveys, grouping together all species over several years, the contrast would even be greater.




The central banks also have a significant role to play in terms of their contribution to biological production across the shelf as well as to inshore areas. The upstream banks are connected to the downstream banks given the general NE – SW circulation. This can result in a strong coupling such that particles (such as eggs and larvae) spawned on Emerald and Western bank contribute to the production in the downstream areas (Browns Bank and inshore). The figures below (second one in colour) show a result of an ocean model that was used to simulate the drift of haddock eggs and larvae (Frank and Brickman 2001). Another published study based on the DFO summer survey data by Fisher and Frank (2002) showed that peak correlations in abundance among 5 different fish species between Emerald and Western banks (source areas) occurred at positive lags on Browns Bank (receiving area). The species involved were haddock, winter flounder, herring, redfish, and longhorn sculpin. In other words, production of new recruits of these species occurring each year on Emerald and Western banks spills-over to supplement the local production of these species on

Browns Bank. While not evaluated the possibility exists this connection is also true from some of the invertebrate species.

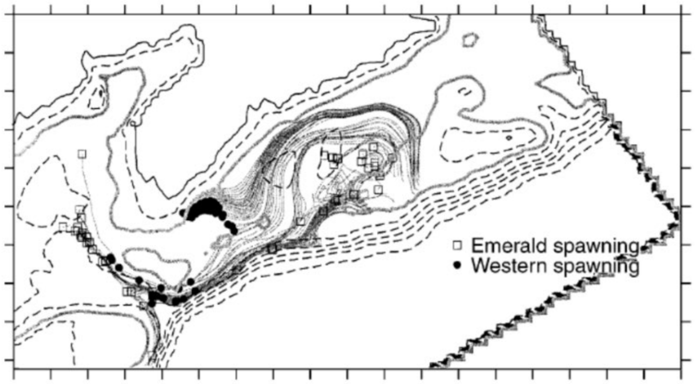
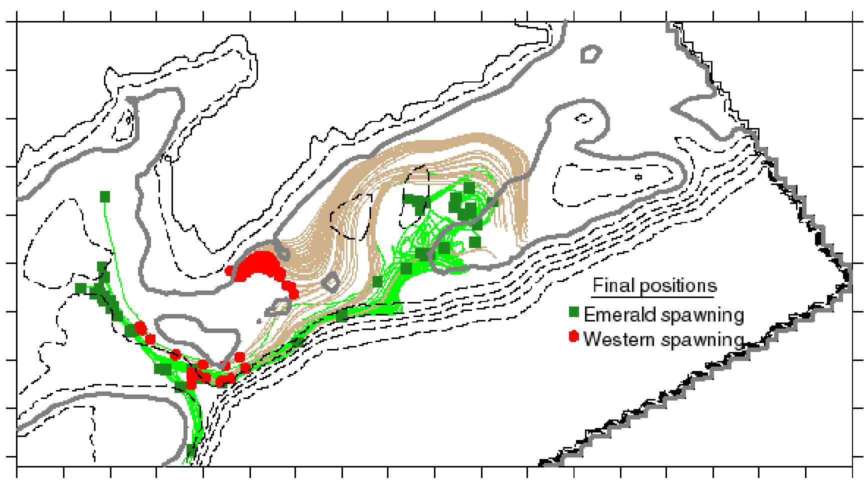



Fig. 8. Simulated trajectories of particles (haddock eggs and larvae) in 1983, based on ocean circulation modelling. Particles were released on Western and Emerald bank during springtime in the top 20 m of the water column. The final particle positions, after a 60 d period, are depicted as symbols. The displacement of particles was on the order of 200–300 km.

This is a colour figure of the one above and shows that some of the particles released from Emerald Bank remain in the vicinity of the bank as well as downstream and particles originating from Western Bank contribute to both inshore and offshore downstream areas.




In another study by Reiss et al. (2000) it was shown how herring larvae produced on the bank during November/December move across the shelf into the coastal current which are then transported downstream into SW Nova.

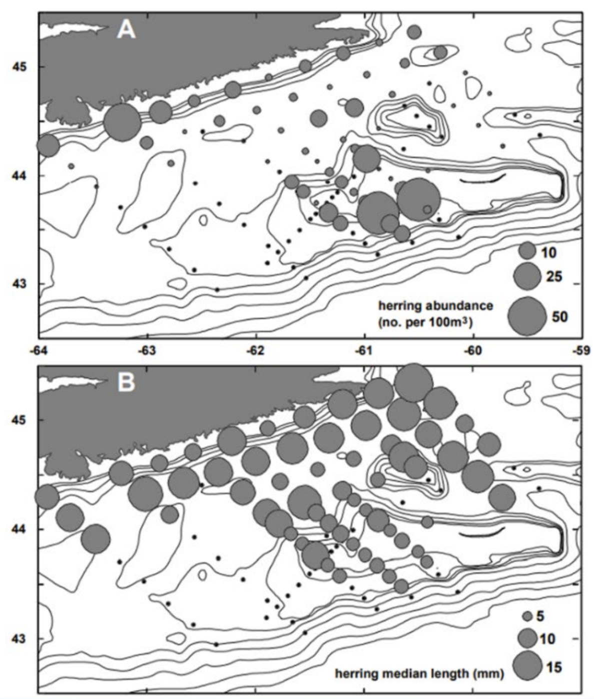



**Figure 12.** Expanding-symbol spatial distributions of: (a) larval Atlantic herring concentration (number per 100 $m^3$); and (b) their median total length (mm) on the central Scotian Shelf during 18 Nov. to 01 Dec. 1997.

The top panel shows the concentration of herring larvae as expanding symbols, and the bottom panel shows the length (indicator of the age of the larvae) as expanding symbols – large symbol size = older larvae.

It should also be mentioned that there exists genetic structuring of bank-spawning species. Oceanographic features, such as the periodic gyre-like circulation associated with the offshore banks, appears to promote an isolating mechanism in cod such that neighboring stocks can be genetically distinct. Ruzzante et al. (1998) demonstrated genetic differences between cod on Browns Bank and the Bay of Fundy and between Banquereau and Western Bank.

Pg. 97 “observations of fishers who are finding that the centres of distribution of several important species, e.g., lobster, snow crab and halibut, appear to be shifting to the northeast, requiring fishers to travel further to harvest them.”

Currently, there is no scientific evidence to support this claim but could be assessed from the DFO survey data.

Pg. 103 contains Table 4.1 which is incomplete (many crab species missing) and some species that are of dubious importance on the banks (squid and octopus) are listed for some unknown reason.

**Table 4.1. Summary Table of Important Invertebrates in the RA Study Area**

| **Species Common Name** |
| --- |
| American lobster |
| Rock crab |
| Queen snow crab |
| Scallop, e.g., sea scallop, Iceland scallop |
| Shrimp, e.g., northern shrimp, sevenspine bay shrimp |
| Spiny crab |
| Toad crab |
| Lesser bobtail squid |
| Shortfin squid |
| Spoonarm octopus |
| Sources: Rondeau *et al.*, 2016, Coomber *et al.*, 2021, DFO Aquatic Species at Risk Critical Habitat and Distribution Geodatabase, Species at Risk documents, and COSEWIC reports and stock assessments. |

Pg. 115. “Development of large wind farms on the Scotian Shelf may add some challenges to the movements and behaviour of marine mammals, turtles, birds and fish because of vibrations or electromagnetic fields (EMFs) and could influence primary productivity as a result of changes in turbulent mixing of the water column. Such effects are likely to be minor in comparison with those caused by climate change. Nonetheless, our existing knowledge is still inadequate to assess in full the implications and potential consequences of OSW development in the region. A concentrated, coordinated effort to improve that knowledge is required.”

A concentrated, coordinated effort already exists as previously explained and was overlooked by the authors of the Draft OSW Report. Besides the fish and invertebrate communities resident of the Scotian Shelf that are routinely surveyed, there exists the Atlantic Zonal Monitoring Program (AZMP). AZMP started in 1998 and operates in four Atlantic regions (including the Scotian Shelf) by DFO whose purpose is to collect and analyze biological (phyto- and zooplankton), chemical and physical oceanographic field data. The program runs every year, and the resultant data and interpretations are published each year in a “State of the Ocean Condition” report (https://www.dfo-mpo.gc.ca/science/data-donnees/azmp-pmza/index-eng.html). AZMP provides a characterization and understanding of the causes of oceanic variability at the seasonal, inter-annual and decadal scales, provides multidisciplinary data sets that can be used to establish relationships among the biological, chemical and physical variables and provides adequate data to support the sound development of ocean activities. Noteworthy is the absence of any mention of this program in the draft report.

pg. 126. “The goal of the EBSA process is to “facilitate provision of a greater-than-usual degree of risk aversion in management of activities in areas of especially high ecological and biological significance” (DFO, 2004). While most areas have some ecological function, the EBSA process seeks to identify areas that are considered “significant” and that if the area were to be disturbed the ecological consequences (in space, in time, or outward through the food web) would likely be greater than the effect of an equal disturbance of most other areas, although it is recognized that the nature of those consequences could differ greatly among specific cases (DFO, 2004).”

“To date, there are 18 EBSAs identified in the offshore component of the Scotian Shelf Bioregion (King et al., 2016) and 47 EBSAs identified for the Atlantic coast inshore (Hastings et al., 2014). Of the 47 inshore EBSAs identified, 38 are located either fully or partially within the RA Study Area. The offshore EBSAs have undergone further study and refinement since their initial identification, and their boundaries have been adjusted based on new data and analysis (King et al., 2016).”

King et al. (2016) on page 52 of their report concluded that the Emerald-Western-Sable Island bank complex was identified as an EBSA and provide a comprehensive summary in the table copied below from their report (Table 17), providing the rationale for why this complex was given such a designation. It is an excellent summary which is in sharp contrast with the description of these banks in the Draft OSW Report.

*Table 17. Key features for the Emerald-Western-Sable Island Bank Complex EBSA. Abbreviations for DFO EBSA criteria are: U = Uniqueness, A = Aggregation, FC = Fitness Consequences, R = Resilience, N = Naturalness. Cells with an 'x' indicate that the features or characteristics meet DFO EBSA criteria. Blank cells indicate that these criteria are not met.*

| Feature or characteristic of the area | DFO Criteria | | | | |
|---|---|---|---|---|---|
| | U | A | FC | R | N |
| Important habitat for haddock (summer/fall/spring) (Horsman and Shackell 2009, RV data). Known haddock spawning and nursery area (Frank et al. 2000, Ollerhead 2007). Emerald Bank and Western Bank have large areas of suitable spawning habitat (gravel or sand-gravel). | | x | x | | |
| Important habitat for Atlantic cod (COSEWIC-E) (Horsman and Shackell 2009). Recognized as a cod spawning area with large areas of suitable habitat. Western Bank defined as an important area of the central Scotian Shelf for larval cod (Reiss et al. 2000, Lochmann et al. 1997). | | x | x | | |
| Important habitat for silver hake (Horsman and Shackell 2009) with concentrations of silver hake eggs and larvae found in the summer (Rikhter et al. 2001). | | x | x | | |
| Important habitat for winter skate (COSEWIC-T) (summer/fall/spring) (Horsman and Shackell 2009). | | x | | x | |
| Important habitat for yellowtail flounder (summer/fall/spring) (Horsman and Shackell 2009, RV data). | | x | | | |
| Atlantic herring are known to spawn in this area during the fall (Harris and Stephenson 1999). | | x | x | | |
| Area of concentration for the eggs and larvae of several species, including haddock, mackerel, pollock, silver hake, yellowtail (SSIP[1] data). The area includes a partial gyre, which results in higher levels of retention of pelagic larvae and their food (Reiss et al. 2003). Western and Sable Island Bank were found to be areas of high larval fish diversity with higher levels of genus richness and abundance in all seasons compared to other parts of the Scotian Shelf (Shackell and Frank 2000). | | x | x | | |
| Area of high fish and invertebrate biomass (RV data). | | x | | | |
| Area of high fish species richness (RV data). Large bank areas, such as Sable Island and Western Banks, were found to be areas of high adult fish diversity when compared with other smaller bank areas of the Scotian Shelf (Frank and Shackell 2001). Western Bank may have higher levels of invertebrate diversity, compared to other eastern Scotian Shelf banks (Henry et al. 2002). Greater species richness was attributed to greater habitat heterogeneity. High diversity of zooplankton species (Doherty and Horsman 2007). | | x | | | |
| Area of high fish species evenness and ESW[2] (Ward-Paige and Bundy 2016). | x | x | | | |
| Area of high invertebrate species richness, evenness, and ESW (Ward-Paige and Bundy 2016). | x | x | | | |
| Important habitat for seabirds (most functional guilds) (CWS data). | | x | | | |

Notes: [1]Scotian Shelf Icthyoplankton Program; [2]Exponential of Shannon-Wiener Index.

Pg. 131. The statement on this page sums things up quite succinctly – "no human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area". No reason was provided in the Draft OSW Report for why this was not a consideration in the PDA.

**Table 4.10. Marine Refuges and Fisheries Closure Areas in Nova Scotia**

| Name | Area (kms²) | Conservation Objective | Prohibited Activities |
|---|---|---|---|
| Western/Emerald Banks Conservation Area (restricted fisheries zone) | 10,234 | Supports productivity objectives for groundfish species of Aboriginal, commercial and/or recreational importance, particularly NAFO Division 4VW haddock. Manages the disturbance of benthic habitat that supports juvenile and adult haddock and other groundfish species. | All commercial and recreational fisheries using bottom-contact gear and/or gear known to interact with groundfish. No human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area. |

Pg 135 "It is difficult to summarize the commercial fisheries for several reasons:

"5. changes in abundance, location and interactions of target species resulting from overfishing and/or climate change."

Climate change is a longer-term process (trends) whereas climate variability refers to short-term changes and this distinction was never made in the Draft OSW Report. Some ocean properties are more variable from year to year than others (e.g. sea surface vs bottom temperatures). Climate variability can result in changes in ocean conditions from one year to the next or be part of longer-term trend (often on the order of decades) associated with cooling and warming. The overlooked survey data has often been examined for changes on these different time scales (https://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm).

More on the unspecified nature of "climate change".
Pg. 115 "Development of large wind farms on the Scotian Shelf may add some challenges to the movements and behaviour of marine mammals, turtles, birds and fish because of vibrations or electromagnetic fields (EMFs) and could influence primary productivity as a result of changes in turbulent mixing of the water column. Such effects are likely to be minor in comparison with those caused by climate change. Nonetheless, our existing knowledge is still inadequate to assess in full the implications and potential consequences of OSW development in the region. A concentrated, coordinated effort to improve that knowledge is required."

"Climate change, however, seems set to continue and may well accelerate"

There is absolutely no support (simply opinion of the authors) for the effects to be minor in comparison with those caused by climate change and furthermore, the time scale for climate is never specified (next year, next decade, next century?) and which physical components of the marine environment will change or not. Generalizations about this topic are sweeping and largely unsupported.

Pg. 308 “The nature, timing and degree of the effects of climate are difficult to predict accurately …”

Pg. 209 “The Committee is very cognisant of the many unknowns in the marine environment including the impact of climate change on oceanographic conditions”

Pg. 139. “As groundfish stocks collapsed, the whole fishery complex changed from one dominated by fin fish to one based primarily upon shellfish – in landings, but also particularly in value (DFO, 2007, 2010; MacLean et al., 2013). Commercial landings of pelagic fish, for example, declined from > 200,000 tonnes in the 1970s to < 60,000 tonnes in 2015, while invertebrate landings rose from <25,000 to ~100,000 tonnes in the same period (Bernier et al., 2018, 2023). Despite regulatory actions intended to enable the recovery of previously important stocks, some have not recovered. In several cases, species that are adapted to cool water, e.g., Atlantic cod, might never recover if coastal waters continue to warm.”

There is no scientific support for the underlined statement (my underlining) and Atlantic cod are most abundant on the offshore banks – not the coastal waters. Virtually all the groundfish species on the eastern Scotian Shelf that were depleted have not been formerly reassessed by DFO since early 2010. Therefore, the present status for most of these stocks has not been formally reviewed but we have some indications from the DFO survey reports that improvements have occurred.

Pg. 205. “The Committee next identified primary constraints. These include the following:

•MPAs – the Gully, St. Ann’s Bank and the Laurentian Channel; •Critical Habitat – North Atlantic right whale and northern bottlenose whale; •National Park Reserves – Sable Island National Park Reserve; and •Marine Bird Sanctuaries – Big Glace Bay, Port Joli, Sable River, Port Herbert, Haley Lake and Sable Island (See Figure 4.10).”

What happened to the Western/Emerald bank conservation area entry in Table 4.10? No reason given for not including it as a primary constraint.

Pg. 208

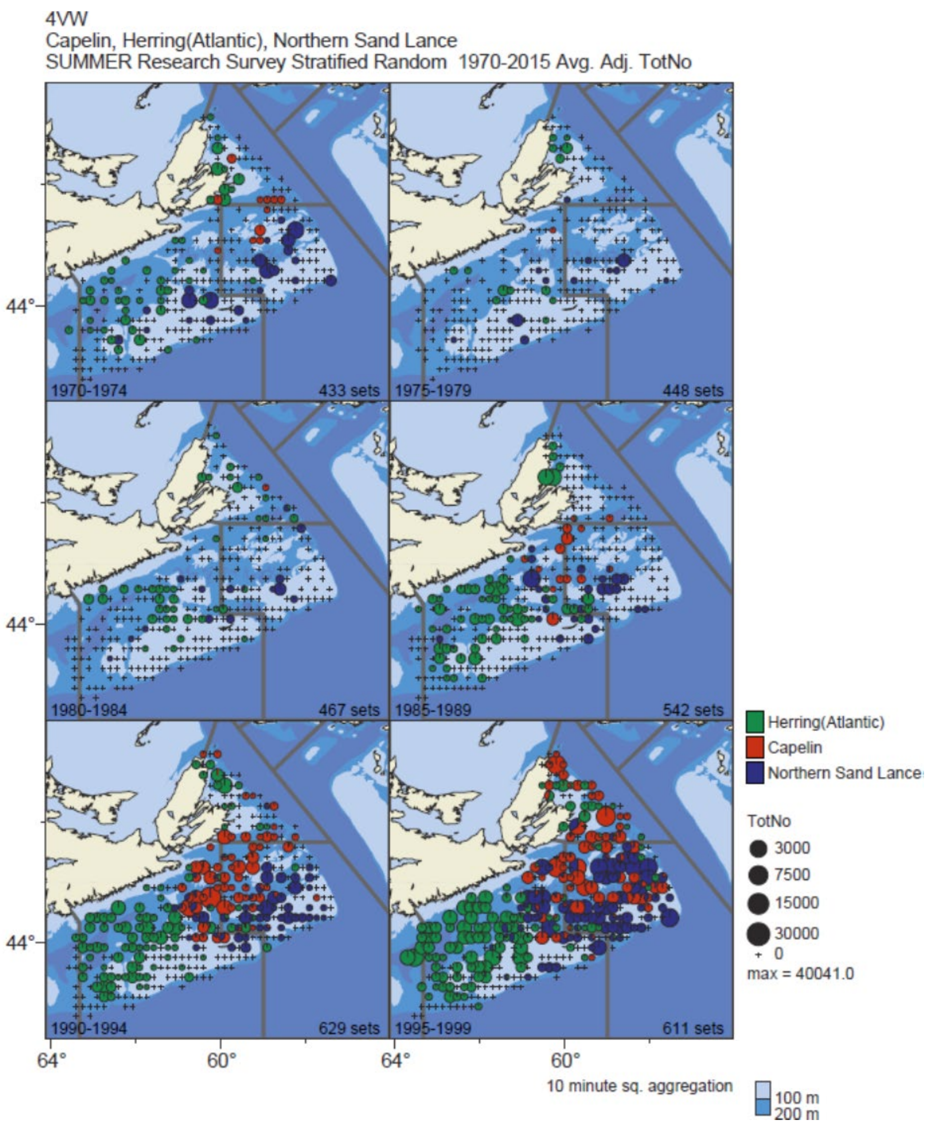
**Table 6.1. Key Secondary Constraints**

| Valued Feature / Activity | Recommendations for Further Consideration |
|---|---|
| Significant Benthic Areas (SBA) and Ecologically and Biologically Significant Areas (EBSA), i.e., coral and sponge areas and sea pen areas (see Figure 4.11) | Coexistence may be possible. Avoidance of certain areas may be indicated at the project design stage which will be determined through engagement with DFO during the permitting process. |
| Important habitat for sensitive species, i.e., habitat for Species at Risk or important spawning areas (see Figure 4.11) | Coexistence may be possible with conditions to be determined at the project design stage through engagement with DFO during the permitting process. |

Pg. 237 “A portion of the PDA falls within the Western/Emerald Banks Marine Refuge (WEBMR) which is designated as a Marine Refuge under the Fisheries Act. The refuge provides habitat for regionally important groundfish and a complex benthic-shelf habitat that supports significant spawning and nursery ground for haddock (DFO, 2024). Prohibited activities within this area include all commercial and recreational fisheries activities that use bottom-contact gear, or that are known to interact with groundfish."

This relates to the earlier point raised about the Western/Emerald conservation area.

One highly important prey fish species known as sand lance was never mentioned in the text of the report (in Tables 6.8, Appendix 4.4, 4.6) and as the name implies it is strongly associated with sandy bottoms where it buries itself during daylight and emerges and night for feeding. It is normally very abundant and a dominant prey item for most groundfish on the Scotian Shelf as well as many marine mammals (seals and whales) and seabirds. In Appendix 4.6a, sand lance was omitted from the description of the Emerald/Western/Sable Island bank complex. Why? Same could be said for capelin. Below is a previous figure I developed for the small pelagic species inhabiting the eastern Scotian Shelf. It shows the increasing abundance of three species from the summer survey in 5 year time blocks.



Pg. 236 “Based on engagement feedback, a significant number of fishers and their associations support OSW development on Western/Emerald Bank because the area is closed to all fishing that uses bottom contact gear or gear known to interact with groundfish. Fishing activity is generally low throughout the PDA; this was reinforced by the NSFAEE who identified large portions of the PDA as “low conflict” areas and supports OSW development in the area. Conversely, the longline fishery expressed reservations for the reasons expressed above, anticipating a loss of access due to required gear setbacks, i.e., drifting fishing gear and loss of ability to fish within a certain distance of the PFDA boundary. The concerns expressed by SPANS with respect to the Sable Island Bank scallop resource also apply to Western/Emerald Bank; scallop fishing is viewed as an important industry where bottom contact gear presents significant coexistence challenges with the OSW industry.”

I was directly involved in the evaluation of the Emerald/Western bank closed area and it is instructive to know the reasons for its establishment (Frank et al. 2000). The management objective associated with the closure was to protect juvenile haddock (incoming recruits to the fishery) and thereby allow the stock to rebuild. The threat to juvenile haddock was the mobile gear fleet who had been discarding/dumping large quantities of small (juvenile) haddock that were bycatch in the directed adult haddock fishery. The industry pressed for this regulation at the time (mid-1980s when large year-classes of haddock were being produced) and the regulation was enacted in 1987 and in 1993 included the fixed gear sector who were targeting smaller haddock by reducing the hook sizes on their baited longlines. As time passed and the haddock stock did not recover rapidly, most of the interest/effort turned to fishing for other groundfish and invertebrates. There has been no formal stock assessment of Div. 4VW haddock since 2004 and in that document, it is stated “the directed fishery for 4TVW haddock was closed in 1993 and has not been re-opened in spite of some rebuilding. Results show that both total and spawning biomass are near the long-term average.” (DFO Res. Doc. 2004/106). For that matter most of the groundfish stocks that once supported large commercial fisheries on the eastern Scotian Shelf have not been assessed for over a decade. The last assessment of Div. 4VsW cod conducted in 2011 concluded that “the SSB of 4VsW cod reached the lowest level observed in the 53-year record in 2003 at about 7,500 t. Recently, it has rapidly grown to 64,000 t and is approaching the long-term mean (75,000 t).” (DFO Science Advisory Report 2011/028).

Pg. 304 “Almost a century of fishing activity and management has provided a basic knowledge of some of the pelagic species (especially fish) currently occurring in the RA Study Area. These data, however, are limited in many respects: they do not cover all species; they are often limited to seasonal information related to occurrence, fishing practices and commercial fishing priorities etc. and the studies/monitoring activities do not extend uniformly across the Scotian Shelf (see 9.2.1 below). Furthermore, there are ongoing changes taking place within the pelagic community that relate either to the effects of fishing pressure or to environmental changes – notably climate change. In order to assess the potential effects of OSW development, these data need to be augmented in time, frequency of monitoring and spatial coverage. An approach is outlined in section 10.”

There is far more than a limited and basic knowledge as indicated in the many overlooked DFO programs alluded to above – we know of historical and contemporary spawning locations, patterns of larval drift and retention, stock structure based on genetic analyses, seasonal distribution and abundance patterns, migration behaviour based on tagging, population dynamics and growth, etc. This information is available in scientific publications in journals, technical documents, and other publications. Unfortunately, none of it was reviewed in the Draft OSW Report giving the false impression that the banks are understudied and by extension, ecologically unimportant.

The last sentence (my underlining) in the quote taken from page 304 of the Draft OSW Report serves to underscore the lack of appreciation/knowledge regarding the monitoring effort that DFO has expended for over 50+ years involving the assessment and research of fish and invertebrate species on the Scotian Shelf. In addition, there has been past collaboration with university researchers and graduate students either on major programs or particular species and stocks to further our understanding of the production dynamics of the Scotian Shelf ecosystem.

Pg 305. "Since the collapse of the cod population and the shift towards a benthic-dominated ecosystem, a significant portion of the total fishery output of the RA Study Area has been comprised of benthic organisms, especially lobster, scallop, crab, shrimp and sea cucumber. Consequently, these are the species that are of primary concern from a socioeconomic point of view. Unfortunately, publicly available information about the production and harvesting of these species is limited. In the information provided to the RA Commitee by DFO, landings of benthic organisms from large portions of the RA Study Area were excluded for privacy reasons. Requests for more details from some of the companies involved received limited responses."

This seems odd that landings data were not available, but no details were provided regarding what stock or species. Landings data are contained in the assessments of all the major invertebrate fisheries on the eastern Scotian Shelf (shrimp, snow crab and other crab species, lobster, sea cucumber). Given the lack of details of the request made by the committee it is impossible to assess what really occurred and NAFO maintains a website where commercial data is readily available.

Some additional concerns regarding the inadequacy of the Draft OSW Report.

It does not appear as though anyone has raised the issue related to the effect the OSW farms will have on the scientific surveys DFO conducts each year and the impact it will have on future resource assessments. The banks are sampled intensively each year with a bottom trawl and are areas of high abundance at both adult and juvenile life stages. Partial or full exclusion from these areas could lead to under-estimation of population abundance and incoming recruitment for many key commercial species.

Offshore wind farms effects on marine environments have been heavily studied. Wind farms have been operational in the waters off several European countries for more than 20 years and a large body of research has been published on their effects on the biological component of the marine environment. One would have expected that the draft report would have had a comprehensive literature review of this active area of scientific research. In fact, several dozens (maybe hundreds) of studies exist over the past two decades. These studies focus on the short- and inter-mediate term impacts (5-10y) and not some unspecified time in the future as the draft report does. For example, here are the findings of a recent study by Lloret et al. (2022). The authors concluded that offshore wind farms (OWF) pose serious environmental risks to the Mediterranean Sea, OWF models cannot be simply imported from the northern European seas to other seas, OWF should be excluded from areas of high biodiversity and/or high valuable seascape, and OWF development should be forbidden in or in the vicinity of Marine Protected Areas (MPAs).

Also of note is that the International Council for Exploration of the Seas (ICES) has a Working Group on Offshore Wind Development and Fisheries (WGOWDF) which focuses on the interactions between fisheries and offshore wind energy (https://www.ices.dk/community/groups/Pages/WGOWDF.aspx). This WG has over 50 members and has produced a couple of documents without any Canadian scientific participation.

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