<table>
<thead>
<tr>
<th>Vision Area</th>
<th>Key Question (If relevant)</th>
<th>LO</th>
<th>Comment</th>
<th>Status</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>General NA SAB</td>
<td>Urge NOAA to maintain a strong and well-articulated focus on the health, diversity, productivity and sustainability of the nation’s marine and coastal ecosystems. Did not see reference to the two NOAA high-level priorities; namely (1) produce the best weather system in the world and (2) grow the American economy through the sustainable management of marine resources, or the “Blue Economy.” Those should be referenced up front.</td>
<td>General NA SAB</td>
<td>It’s not clear who the audience of the R&amp;D Strategic Plan is? Is it for the NOAA administration to help strategic choices or is it to the science community, the media, the public, etc.?</td>
<td>This is emphasized in the opening paragraph of Vision Area 2.</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td>Wonder if this should be called a “plan” per se. A plan generally includes milestones, budget, priorities and other relevant benchmarks against which one can measure progress. I believe the previous document was called “Research and Development at NOAA.” This plan could be an update to that or called something like NOAA Research and Development Strategy or Priority Areas.</td>
<td>General SAB</td>
<td>Be clear about the audience for the Plan. Narrow the audience down so that the plan is useful. The SAB believes the audience for this Plan should be internal; then consider how third parties that influence the NOAA budget might use the Plan.</td>
<td>Reference is located in “Summary of Vision Areas and Key Questions”, Paragraph 4.</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td>What’s the time period? A real strategic plan needs to define the scope. Are we looking for the strategy for the next year, next 5 years, next 10 years?</td>
<td>General SAB</td>
<td>A strategic plan is basically about meeting goals with specific strategies, establishing priorities and the resources to meet those priorities. Don’t see any of that.</td>
<td>Added text to the first paragraph under the Purpose section of the introduction that explains the purpose of this Plan - to provide direction on NOAA’s R&amp;D - and the mechanisms by which implementation will occur. Calling the document the NOAA R&amp;D Plan maintains consistency with previous documents (e.g., Research and Development at NOAA: Five Year Research and Development Plan 2013-2017).</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td>Overall there is much to like about the outline. - It’s rooted in the framework of higher-level NOAA, DoC, and executive planning, and Congressional legislation - It’s focused on a few key, broad questions - It aims at improving the services across NOAA’s product line/portfolio - It addresses R2S transition issues - It emphasizes evaluation. Suggest each of the “vision areas” be relabeled as goals. There is an overarching vision for the document and the three areas are really goals to attain the vision in my opinion.</td>
<td>General SAB</td>
<td>Suggest recording each of the highlighted questions under each vision/goal to be a positive statement rather than a question. For example, “How can forecasts and warnings for severe weather and other environment phenomena be improved?” to “Improve forecasts and warnings for severe weather and other environment phenomena” or even something like “Reduce impacts of severe weather and environment phenomena (natural disasters).”</td>
<td>The key questions represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas. Unanswered questions provide the impetus to do R&amp;D.</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td>Instead of structuring the R&amp;D Plan around a series of questions, use simple, declarative statements that relate to the NOAA mission. Each of the highlighted questions could be labeled as objectives under each goal.</td>
<td>General SAB</td>
<td>Hard to tell if each bullet is a separate R&amp;D area or whether they are just factors to be considered under each question, but that is a detail to be sorted out in the plan. As indicated in the outline, it is hard to find key areas of emphasis such as Polar Science, Water Prediction, Observations and Data Management, and Decision and Social Science Assessments. These areas of emphasis are buried in the long list of research areas.</td>
<td>The key questions represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas. Unanswered questions provide the impetus to do R&amp;D.</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td>Overall, believe the key elements are included in the outline, along with the public comments that were solicited. Whatever the plan is called, it cannot appear as an unconstrained list and in some way needs to relate to the budget. Not suggesting including the budget, but the “plan” has to have budget realism for implementation and to be relevant.</td>
<td>General SAB</td>
<td>Address research-to-practice or “bench-to-bedside” analyses.</td>
<td>The key questions represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas. Unanswered questions provide the impetus to do R&amp;D.</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td>Though the enabling condition “partnerships” is mentioned in the intro, it does not appear to be picked up for discussion in the topic areas.</td>
<td>General SAB</td>
<td>The situation analysis should help inform and illuminate overarching themes, topics, and approaches to R&amp;D in the opening section, including identifying cross-cutting topics relevant in general and throughout the plan. These include the cross-cutting relevance of social sciences, climate research, data science and how NOAA will address, ensuring access, quality and relevance; transdisciplinary research that cuts across the “stovepipes” of NOAA line offices; integration, to include human impacts on earth systems—the complexity and how NOAA will address interfaces in the research enterprise.</td>
<td>The key areas of emphasis are indicated by the key questions, which are represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas.</td>
<td></td>
</tr>
<tr>
<td>General SAB</td>
<td></td>
<td>General SAB</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The key questions represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas. Unanswered questions provide the impetus to do R&D. The key questions represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas. Unanswered questions provide the impetus to do R&D. The bullets in the outline have been converted to R&D objectives under the key questions. The key areas of emphasis are indicated by the key questions, which are represent the lack of some knowledge or capability that is needed to achieve NOAA’s vision areas. Comment does not suggest change. Added text "Priorityization of the projects and activities that NOAA undertakes, based on budget realities and emerging needs, are captured in Line Office annual guidance and operating plans." Reference is located in Guiding Principles for R&D section, "Translational Research to Operations...." Partnerships are discussed in the introduction and the guiding principles. Specific partnerships are outside of the scope of the plan. They will be determined by the individual projects/activities conducted to meet the plan’s objectives and are recorded in the NOAA Research and Development Database. A cross-cutting themes section has been added to map where where topics can be found across key questions. For the transdisciplinary research and integration topics, text has been added to the Summary of Vision Areas and Key Questions section that states. "Since its creation, the NOAA vision, mission areas, and science activities have been guided by the applicable authorities that drive NOAA as a science-policy agency with focused disciplines (e.g., fisheries, oceans, research, satellites, weather). NOAA has matured as an agency, past focus on R&D within a single discipline toward increasing integration between multiple disciplines (e.g., biological, physical, economic, social, behavioral sciences), with increased partnerships that research pressing topics to address the needs of the diverse communities NOAA serves. Cross-NDDA R&D includes transdisciplinary efforts that vastly improve the use of new and established observational tools (e.g. advanced satellites) to efficiently characterize and predict the state of the atmosphere, the ocean-air interface, the interface of fresh-salt water, and parameters needed to mitigate effects of climate change."
Begin the R&D Plan with a statement of how the world looks—akin to a high-level situation analysis of key context that affects NOAA’s R&D and description of some of the current key drivers that relate to NOAA’s mission. The R&D plan is a visionary document about how scientific research should be done in the 21st Century and the impact of the results of that science on people’s lives and the resources NOAA helps to manage.

The objectives in the Plan are stated in bullet format under each key question. We agree. This is consistent with the transition funnel, recommended in the 2004-2005 SAB review, which explains the top of the R&D funnel as research, narrowing towards development and transition. The reasoning behind this approach is that not all research is successful or a good candidate for development and transition, therefore, NOAA utilizes more research than development.

The enabling elements for R&D are taken from NAO 216-115a.

Social science has been added to Vision Area 1 through the addition of key question 1.4 (and subsequent objectives) which reads “How can NOAA enhance communications, products, and services to enable informed decision-making?” Social science has been added to Vision Area 2 through the addition of key question 2.7 (and subsequent objectives) which reads “How can NOAA utilize and improve socioeconomic information to enhance the sustainability of ecosystem services, public engagement practices, and economic benefits?”

We agree. This is consistent with the transition funnel, recommended in the 2004-2005 SAB review, which explains the top of the R&D funnel as research, narrowing towards development and transition. The reasoning behind this approach is that not all research is successful or a good candidate for development and transition, therefore, NOAA utilizes more research than development.

The objective under key question 1.2 “Advance research on atmospheric chemistry, composition, and processes, identifying their influence on air quality, climate, and weather systems.” The plan does not go into further specifics, as this is more appropriate at the line official/program/level.

The “Mission and Vision” and “Purpose” sections of the document talk about the overall relevance of NOAA’s R&D and current key drivers related to NOAA’s mission. In addition, each key question has an introductory paragraph that relates the relevance of NOAA R&D to people/properties/resources.

Incorporate the vision from the 2018 NASEM report “Integrating NOAA mission and deserves more prominent discussion.

Reducing societal impacts is not possible without studying how society responds dynamically to threats. It is not sufficient to put all of social science research into one bullet under Vision Area 3.

The only topics related even vaguely to climate change are in Vision Area 1. Climate change research is an important component of the NOAA mission and deserves more prominent discussion.

The enabling elements for R&D are taken from NAO 216-115a.

Facilities and infrastructure are listed separate from partnerships under “Guiding Principles for R&D”, consistent with NAO 216-115a.

Major findings of the NASEM report include research on the weather enterprise system, factors influencing risk assessments and responses, and messaging. These topics are addressed in key question 1.4.

The objectives related to this topic have been added via key question 1.4 and read “Assess how people receive, interpret, perceive, and respond to weather, water, climate, and space information, especially warnings, with respect to protective action decision-making” and “Enhance the integration of social, behavioral, and economic science into weather, water, and climate research and development to understand how to blend forecast advancements with societal needs and response.”

These research topics can fit under the objectives listed in key question 1.4.

The objectives related to this topic can be found in key question 1.4 and read “Advance understanding of decision-making needs, capacity, and use of weather, water, climate, and space weather information”, “Define and implement predictive information content, including risk thresholds, uncertainty, and lead-times, to design products and services that enable decision-making and maximize effectiveness of forecast improvements”, and “Assess how people receive, interpret, perceive, and respond to weather, water, climate, and space information, especially warnings, with respect to protective action decision-making.”

The objective under key question 1.2 “Advance research on atmospheric chemistry, composition, and processes, identifying their influence on air quality, climate, and weather systems.” The plan does not go into further specifics, as this is more appropriate at the line official/program/level.

The “Mission and Vision” and “Purpose” sections of the document talk about the overall relevance of NOAA’s R&D and current key drivers related to NOAA’s mission. In addition, each key question has an introductory paragraph that relates the relevance of NOAA R&D to people/properties/resources.

The objectives in the Plan are stated in bullet format under each key question, and the document is intended for the next 7 years.

The enabling elements for R&D are taken from NAO 216-115a.

Garnering political support is outside the scope of NOAA’s R&D Plan.

Since NOAA infrastructure is extensive and critical, it might be useful to discuss it separately from partnerships.

Reducing societal impacts is not possible without studying how society responds dynamically to threats. It is not sufficient to put all of social science research into one bullet under Vision Area 3.

We agree. This is consistent with the transition funnel, recommended in the 2004-2005 SAB review, which explains the top of the R&D funnel as research, narrowing towards development and transition. The reasoning behind this approach is that not all research is successful or a good candidate for development and transition, therefore, NOAA utilizes more research than development.

The only topics related even vaguely to climate change are in Vision Area 1. Climate change research is an important component of the NOAA mission and deserves more prominent discussion.

The enabling elements for R&D are taken from NAO 216-115a.

Facilities and infrastructure are listed separate from partnerships under “Guiding Principles for R&D”, consistent with NAO 216-115a.

Major findings of the NASEM report include research on the weather enterprise system, factors influencing risk assessments and responses, and messaging. These topics are addressed in key question 1.4.

The objectives related to this topic can be found in key question 1.4 and read “Advance understanding of decision-making needs, capacity, and use of weather, water, climate, and space weather information”, “Define and implement predictive information content, including risk thresholds, uncertainty, and lead-times, to design products and services that enable decision-making and maximize effectiveness of forecast improvements”, and “Assess how people receive, interpret, perceive, and respond to weather, water, climate, and space information, especially warnings, with respect to protective action decision-making.”

These research topics can fit under the objectives listed in key question 1.4.

The objectives related to this topic can be found in key question 1.4 and read “Advance understanding of decision-making needs, capacity, and use of weather, water, climate, and space weather information”, “Define and implement predictive information content, including risk thresholds, uncertainty, and lead-times, to design products and services that enable decision-making and maximize effectiveness of forecast improvements”, and “Assess how people receive, interpret, perceive, and respond to weather, water, climate, and space information, especially warnings, with respect to protective action decision-making.”

The objective under key question 1.2 “Advance research on atmospheric chemistry, composition, and processes, identifying their influence on air quality, climate, and weather systems.” The plan does not go into further specifics, as this is more appropriate at the line official/program/level.

The “Mission and Vision” and “Purpose” sections of the document talk about the overall relevance of NOAA’s R&D and current key drivers related to NOAA’s mission. In addition, each key question has an introductory paragraph that relates the relevance of NOAA R&D to people/properties/resources.

Incorporate the vision from the 2018 NASEM report “Integrating NOAA mission and deserves more prominent discussion.

The enabling elements for R&D are taken from NAO 216-115a.

Garnering political support is outside the scope of NOAA’s R&D Plan.

Since NOAA infrastructure is extensive and critical, it might be useful to discuss it separately from partnerships.

Reducing societal impacts is not possible without studying how society responds dynamically to threats. It is not sufficient to put all of social science research into one bullet under Vision Area 3.

We agree. This is consistent with the transition funnel, recommended in the 2004-2005 SAB review, which explains the top of the R&D funnel as research, narrowing towards development and transition. The reasoning behind this approach is that not all research is successful or a good candidate for development and transition, therefore, NOAA utilizes more research than development.

The only topics related even vaguely to climate change are in Vision Area 1. Climate change research is an important component of the NOAA mission and deserves more prominent discussion.

The enabling elements for R&D are taken from NAO 216-115a.

Garnering political support is outside the scope of NOAA’s R&D Plan.

Since NOAA infrastructure is extensive and critical, it might be useful to discuss it separately from partnerships.

Reducing societal impacts is not possible without studying how society responds dynamically to threats. It is not sufficient to put all of social science research into one bullet under Vision Area 3.

We agree. This is consistent with the transition funnel, recommended in the 2004-2005 SAB review, which explains the top of the R&D funnel as research, narrowing towards development and transition. The reasoning behind this approach is that not all research is successful or a good candidate for development and transition, therefore, NOAA utilizes more research than development.

The only topics related even vaguely to climate change are in Vision Area 1. Climate change research is an important component of the NOAA mission and deserves more prominent discussion.

The enabling elements for R&D are taken from NAO 216-115a.

Garnering political support is outside the scope of NOAA’s R&D Plan.

Since NOAA infrastructure is extensive and critical, it might be useful to discuss it separately from partnerships.

Reducing societal impacts is not possible without studying how society responds dynamically to threats. It is not sufficient to put all of social science research into one bullet under Vision Area 3.

We agree. This is consistent with the transition funnel, recommended in the 2004-2005 SAB review, which explains the top of the R&D funnel as research, narrowing towards development and transition. The reasoning behind this approach is that not all research is successful or a good candidate for development and transition, therefore, NOAA utilizes more research than development.
When the objectives were written, GHG monitoring was encompassed.

Modified objective in key question 1.2 to read “Identify causes for

2.3

SAB

Made possible through long-term

Vision Area 2 2.3 SAB

Vision Area 2

Interactions provides critical baseline information for understanding

space-conflicts).

Address planning tools that enable decadal scale planning of

resolving disease impacts on aquaculture…

Address new genomics tools to allow aquaculture to accelerate

breeding...

Move the focus beyond precipitation and temperature only

of interest, and using "funnel approach" (from global to local) to

Clarify "environmental phenomena", timescales for the phenomena

research on the state of the oceans, atmosphere, and their

areas. Similarly, Section 1 (addressing sustainable aquaculture)

research to understand aquatic ecosystems is given minimal

level rise, and harmful algal blooms). However, for the most part,

evaluate impacts and economic tradeoffs of ocean acidification, sea

effects of environmental changes on species and ecosystems;

few topics that address ecosystem outcomes (e.g., combined

interactions between humans and natural ecosystems). There are a

ecosystem functions and interactions (including an understanding of

interactions between humans and natural ecosystems). There are a

topics that address ecosystem outcomes (e.g., combined

effects of environmental changes on species and ecosystems; model, monitor, and forecast events that degrade coastal habitats;

evaluate impacts and economic tradeoffs of ocean acidification, sea

level rise, and harmful algal blooms). However, for the most part,

research to understand aquatic ecosystems is given minimal

emphasis

There seems to be a disconnect between topic headings that imply

research on issues such as sustainability and healthy ecosystems,

and a lack of specific and well-articulated research topics in these

areas. Similarly, Section 1 (addressing sustainable aquaculture)

does not appear to include topics covering ecosystem impacts and

interactions (except to the extent covered by disease transfers and

space-conflicts).

Notably absent is any reference to ecosystem “services” (whether

using that language or other terminology).

The section understandably has a discussion of ecosystems (and a

traditional juxtaposition of ecosystems and ecosystem protection vs

extraction/use/development). While this is relevant, it oversteps a

focus on ecosystems AS infrastructure and as linked to economic

outcomes, coastal resilience, etc.

In each of the vision areas, recognize explicitly that NOAA long-term

research on the state of the oceans, atmosphere, and their

interactions provides critical baseline information for understanding

impacts and shorter-term developments.

Clarify "environmental phenomena", timescales for the phenomena

of interest, and using "funnel approach" (from global to local) to

ensure that the processes/linkages and interactions across space

and time are captured.

Move the focus beyond precipitation and temperature only

Address new genomics tools to allow aquaculture to accelerate

selective breeding efforts by utilizing marker assisted selective

breeding...

Address selective breeding efforts for shellfish as best hope of

resolving disease impacts on aquaculture...

Address planning tools that enable decadal scale planning of

coastal/estuarine conditions and how space-use conflicts will be

influenced by climate/SLR

Under the objectives listed for key question 1.2 modeling and

projections for change are found in the first five objectives and impacts

are listed in the objectives 6 and 7.

Added text to the Purpose section of the introduction that reads

NOAA will use this document for planning and prioritizing projects

and guiding investments for NOAA and NOAA-funded R&D areas.

Prioritization of the projects and activities that NOAA undertakes,

based on budget realities and emerging needs, are captured in Line

Office annual guidance and operating plans.”

Key Question phrasing changed to “How can the utility of space

weather products and services be enhanced?

When the objectives were written, GHG monitoring was encompassed

in and required to achieve several objectives, and therefore not

specifically mentioned. In doing so, GHG monitoring is integrated into

several objectives.

Added text to the 3rd to last paragraph of the Purpose section of the

introduction “useful applications that benefit the communities NOAA

serves”. Changed the Summary of Vision Areas and Key Question

first paragraph, last sentence to read “NOAA has matured as an

agency, past focus on R&D within a single discipline toward

increasing integration between multiple disciplines (e.g. biological,

physical, economic, social, behavioral sciences), with increased

partnerships that research pressing topics to address the needs of

the diverse communities NOAA serves.

Added objective to key question 1.4 to read “Advance understanding

of decision-making needs, capacity, and use of weather, water,

climate, and space weather information.”

Major findings of the NASMEM report include research on the weather

understanding environment, factors influencing risk assessments and

responses, and messaging. These topics are addressed in the

objectives under key question 1.4.

Addressed in Guiding Principles "Partnerships”.

See intro paragraph for vision area 2. Also, the summary of vision

area section, Vision area 2 “NOAA needs to undertake basic R&D

such as exploring uncharted areas of the ocean, developing the

knowledge, tools and technologies to understand, protect and restore

healthy coastal and marine ecosystems…” Key question 2.2 bullet 4

reads “Develop environmental indicators that facilitate increased

ecosystem understanding and sustainable coastal development and

recreational fishing.

Added text to key question 2.3 first objective: “Develop models,

manuals, and new technologies to better determine ocean spaces

suitable for aquaculture, protect natural ecosystems, and minimize

space-use conflicts. Objective 3: Conduct studies on fish genetics

and applied genomics, disease, and hatchery feed stocks for

enhancing productivity and understanding the impacts of aquaculture

on the natural environment.”

Intro paragraph text changed “Coastal, ocean and Great Lakes

resources are vital to the coastal communities that depend on them

for ecosystem services (e.g. food, energy production, storm

mitigation, recreation, and economic prosperity). Declines in the

ecosystems that provide these services directly impact human health

and well-being. Already mentioned in 2.1 lead paragraph.

Intro paragraph text changed “sea level rise, ocean acidification, and

warming, challenge the resilience of coastal communities, change

habitats............

Changed summary of Vision area intro text “The context for R&D with

NOAA evolves over time as guided by the Department of Commerce,

federal statutes, and other planning documents. However, the context

also evolves as scientific advances, made possible through long-term

data collection and R&D, demonstrate the changes, relative to

baseline states of the oceans and atmosphere, taking place in the

coupled Earth system.

The temporal and spatial scales for environmental phenomena in the

objectives, key question 1.1, 1.2, and 1.3 span from hours (e.g.,

showers) to centuries (e.g., climate), and kilometers (e.g.,

thunderstorms) to solar (e.g., space weather).

Modified objective in key question 1.2 to read “Identify causes for

observed regional and seasonal differences in U.S. trends (e.g.

temperature, precipitation, visibility, wind, clouds) across (latitude,

longitude, altitude, and topography) to improve predictions and

projections, especially for extreme events.” Added selective breeding to bullet 3

Addressed selective breeding to bullet 3

Modified objective in key question 2.3 to read, “Develop decision

support processes for aquaculture permitting that incorporate

scientific results and consideration of future conditions into the

decision making process.”
The objective "Develop analytical models and tools to understand and to allow simulation of the effects. Should the role of MPA's be explicitly included here?"

Vision Area 2 2.3 SAB

This doesn't seem like a high priority -- it may need further explanation. What is needed are models that enable the interactions between development, and different fishing pressures to be better understood and to allow simulation of the effects. Should the role of MPA's be explicitly included here?

For each of these, an example area (or two) of potential application is needed. Also, which are studies/knowledge development, which are tools and which are technologies?

Vision Area 2 2.2 SAB

Address "Improved needs assessment and market analyses" and "indicators for ecosystem sustainability"

Vision Area 2 2.2 SAB

This is an important research question for NOAA. However, the sub-bullets that define this topic do not appear to articulate research that addresses "healthy and diverse ecosystems" directly, but rather speak to (1) Next generation species stock assessments, (2) Illegal, unreported, and unregulated fishing, (3) Bycatch, and (4) Indicators for coastal development and recreational fishing. All of these influence ecosystems in various ways, but there appears to be little emphasis given to research involving ecosystems themselves (unless this is somehow captured under "indicators for coastal development...").

Bullet 5: Do you mean what are the costs and benefits? And the distribution of those costs/benefits -- who pays? Who gains?

Vision Area 2 2.2 SAB

Address ecosystem modeling here

Vision Area 2 2.1 SAB

Scale up restoration techniques: Unclear what is meant by this. It might mean improved planning tools to enable the derivation of greater system benefit from multiple smaller investments. That would be a useful addition.

Vision Area 2 2.1 SAB

Address effects of improved training and professional development.

Vision Area 2 2.5 SAB

Oil spill response technologies - This seems out of place here and would be better in knowledge tools and technologies above.

Vision Area 2 2.5 SAB

Model, monitor, and forecast events that degrade coastal habitats: This has to be more than just events. We need to model, monitor and predict (maybe not forecast) the effects of different activities. Reframe this to focus on both chronic and acute stresses -- and enable seeing one in the context of the other. Storm damage vs SLR? Also suggest adding behavior

Evaluate impacts and economic tradeoffs of ocean acidification, sea level rise, and harmful algal blooms: Clarify economic tradeoffs. Does this mean economic consequences? Who is suffering those consequences?

Vision Area 2 2.4 SAB

Growsers could benefit from advances in labor saving devices -- engineering solutions are needed to lessen the reliance on back-breaking, repetitive manual labor

NOAA could develop a competition to incentivize the development of approaches to shellfish farming that utilize areas with less conflicts such as deep-water sites on some of the larger estuaries, or moderate depth sites in some of the larger estuaries like Delaware Bay. These sites will require larger vessels and work platforms that can survive heavy seas and gear that can stand up to storms.

Vision Area 2 2.3 SAB

Continue to worry about the increasing frequency and intensity of HAB blooms of Cochlodinium which, while non-toxic to humans, are causing mortalities of shellfish and probably fish and crustaceans from the mid-Atlantic to southern New England. This species deserves greater attention.

Margalefdominum (previously Cochlodinium) is now mentioned specifically in the HMAs research highlight for key question 2.4. Harmful algal blooms are included in key question 2.4 objectives "Understand the processes and impacts of temperature, ocean acidification, sea level rise, and harmful algal blooms on marine organisms, ecosystems, and coastal communities" and "Improve capabilities for modeling, monitoring, and predict chronic and acute stressors that degrade coastal habitats and resources (e.g. hypoxia), or pose human health risks (e.g. harmful algal blooms, pathogens, and rip currents)."

Vision Area 2 2.4 SAB

This recommendation may fit within the objective in key question 2.6 that reads "Advance coastal and offshore surveying and mapping technologies, tools, and methodologies to ensure safe navigation, support maritime commerce, discover archaeological and heritage sites, identify marine hotspots and spawning aggregation sites, and expand scientific understanding of the seafloor for economic activities, such as resource extraction siting" as well as the objective in key question 2.3 that reads "Develop models, manuals, and new technologies to better determine ocean spaces suitable for aquaculture, protect natural ecosystems, and minimize space-use conflicts."

Vision Area 2 2.3 SAB

The objective under key question 2.3 has been expanded to read "Develop models, manuals, and new technologies to better determine ocean spaces suitable for aquaculture, protect natural ecosystems, and minimize space-use conflicts."

Vision Area 2 2.3 SAB

The objective under key question 2.2 include potential applications e.g., "to optimize sustainable commercial harvest and recreational opportunities while conserving protected species" and include whether knowledge, technology, tools, etc. are being developed

Vision Area 2 2.2 SAB

The objective "Develop next-generation fisheries and protected species stock assessments that incorporate the effects of environmental and climate change on stock dynamics," and socioeconomic drivers of fisher behavior and fishing communities along with habitat-quality models to optimize sustainable commercial harvest and recreational opportunities while conserving protected species addresses needs assessments and socioeconomic drivers.

The objective "Develop environmental indicators that facilitate increased ecosystem understanding and sustainable coastal development and recreational fishing" addresses indicators for ecosystem sustainability.

The objective "Develop environmental indicators that facilitate increased ecosystem understanding and sustainable coastal development and recreational fishing" addresses fisheries ecosystem research

Vision Area 2 2.1 SAB

Costs and benefits are no longer in this objective. The Research Balance guiding principles states "R&D activities are investments in the future; therefore, tradeoffs must be assessed among competing investment options in terms of focus, benefits, costs, and risks."

The objective "Develop analytical models and tools to understand and quantify impacts of environmental change in large marine ecosystems and species of interest, including protected species" in key question 1.1 addresses ecosystem modeling

Added text to objective in key question 2.1 to read "Improve and scale-up existing and innovative restoration techniques (e.g. coral propagation and planting on damaged reefs) for coastal and marine ecosystems."

Training and professional development is mentioned in the "Workforce Excellence" portion of the "Guiding Principles for R&D" section in the introduction

The objective "Support domestic and international R&D focused on innovative oil spill and other incident response technologies and procedures, particularly those suitable for the Arctic environment" is relevant to key question 2.5 as it relates to safety improvement of increased marine vessel traffic

Modified objective in key question 2.4 to read "Improve capabilities for modeling, monitoring, and predict chronic and acute stressors that degrade coastal habitats and resources (e.g. hypoxia), or pose human health risks (e.g. harmful algal blooms, pathogens, and rip currents)."

Economic tradeoffs are no longer mentioned in this objective, which now reads "Understand the processes and impacts of temperature, ocean acidification, sea level rise, and harmful algal blooms on marine organisms, ecosystems, and coastal communities."

Modified objective in key question 2.3 to read "Develop and improve technologies (e.g., marine aquaculture feeds, automated systems) to reduce costs and labor."

This activity falls under the larger objective "Develop models, manuals, and new technologies to better determine ocean spaces suitable for aquaculture, protect natural ecosystems, and minimize space-use conflicts" in key question 2.3

Margalefdominum (previously Cochlodinium) is now mentioned specifically in the HMAs research highlight for key question 2.4. Harmful algal blooms are included in key question 2.4 objectives "Understand the processes and impacts of temperature, ocean acidification, sea level rise, and harmful algal blooms on marine organisms, ecosystems, and coastal communities" and "Improve capabilities for modeling, monitoring, and predict chronic and acute stressors that degrade coastal habitats and resources (e.g. hypoxia), or pose human health risks (e.g. harmful algal blooms, pathogens, and rip currents)."
In each of the priority areas use of deep learning, AI, machine learning, big data, cloud computing terms are included. While this isn’t a very descriptive document, it is somewhat surprising that open source software (OSS) is not highlighted as a priority, especially since all of these computing advances rely so heavily on open source libraries and many of the active researchers work within an open source framework. It seems that OSS should be mentioned alongside these high-level priorities for NOAA. It seems like this would also respond to OMB m-16-21. Developing the capabilities for these new types of analysis and model development could be more easily enabled through code efficiencies developed through OSS algorithms for data processing, essentially developing OSS enterprise solutions. Using AI, DL, DNN, ML, etc. all require large training datasets and accurate uncertainty estimates. The development of open matchup datasets for satellite and in situ model data is a critical first step that I don’t see mentioned. ESA has already funded a number of these through their CCI program, it would be useful (and collaborative) for NOAA to contribute to this effort for the NOAA satellites, which would also move NOAA closer to advancing some of the advanced computing the NOAA is prioritizing.

Vision Area 3

Social Sciences: The NOAA R & D plan outline identifies three important vision areas for future research. They identify a number of weather and climate science initiatives, but particularly under vision areas number one and number two, the outlined research agenda does not clearly articulate a significant role for social science in bridging the gap between scientists and potential forecast and warning users. Reviewer recognizes that this is only brief outline and perhaps the issues raised below were thought to be implied, but it would be useful in the next version to make the vision clearer. Bringing in more complementary social science and coproduction activities as well as decision makers that obviously is integrated throughout the research process offers important opportunities for NOAA to address concerns about public safety and economic impacts. Doing this is not simply a matter of more communication or evaluation on the back end; it is understanding decision frameworks, decision calendars (how much lead time do various decisions need for forecasts to be useful and useful), what is the relative significance of various types of uncertainty (whether that be social, economic, regulatory, or forecast related) in determining what makes information useful and usable. Using social science to refine a project at the beginning can bring efficiencies to the total path of producing a product with the first version that is more closely aligned with stakeholder needs and less in need of revision. Would be useful (and collaborative) for NOAA to contribute to this effort for the NOAA satellites, which would also move NOAA closer to advancing some of the advanced computing the NOAA is prioritizing.

Vision Area 3

Social sciences has been added to Vision Area 1 through the addition of key question 1.4 (and subsequent objectives) which reads "How can NOAA enhance communications, products, and services to enable informed decision-making?". Social science has been added to Vision Area 2 through the addition of key question 2.7 (and subsequent objectives) which reads "How can NOAA utilize and improve socioeconomic information to enhance the sustainability of ecosystem services, public engagement practices, and economic benefits?". Social science has been added to Vision Area 3 through the addition of key question 3.1 also addresses the external research community. The first objective under key question 3.1 also addresses the external research community.

Vision Area 3

Stakeholder input is achieved through partnerships. This is addressed in the Partnership section of the introduction. The first objective under key question 3.1 also addresses the external research community. The objectives written under key question 3.2 address all current and future observing systems and data, considering all of the available platforms and analyses.

Vision Area 3

Objective in key question 3.1 amended: Evaluate the current business model for reaching targeted audiences and improving the capacity of the public and other decision makers to understand, accuracy, characterization, and monitoring (including ecosystem state and processes), while minimizing costs.

Vision Area 3

While NOAA may work with the private sector, this question is focused on NOAA’s use of big data. Workforce excellence is addressed in the Introduction of the plan.

Vision Area 3

Added text to paragraph under key question 3.4 to read "Integrating social, behavioral, and economic sciences throughout the Weather Service’s research and R&D activities is crucial to meeting the needs of NOAA stakeholders and improving the capacity of the public and other decision makers to make scientifically informed choices." And the objective in key question 3.4 expands on the phrase “methodology for reaching target audiences” to read "Develop and apply research methodologies to assess targeted audiences and engage stakeholder groups at the community level to improve NOAA’s capacity to efficiently and effectively inform decision-making.”

Vision Area 3

The objectives under key questions 3.4 list the specific type of social science discipline that is addressed.

Vision Area 3

Two way communication falls under the larger objective "Develop and apply research methodologies to assess targeted audiences and engage stakeholder groups at the community level to improve NOAA’s capacity to efficiently and effectively inform decision-making.” This is addressed in the key question: "Develop methods to integrate climate and ecological data with economic and human dimension data into coupled models and decision support tools to improve understanding of how people respond to environmental change."