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October 8, 2014

To: Delta Science Program

From: Delta Independent Science Board

Subject: DISB Review of the Draft Interim Science Action Agenda

The Draft Interim Science Action Agenda (draft agenda) is an important step toward organizing, coordinating, and synthesizing Delta science. We applaud the underlying effort to engage agencies and programs in a collective effort to identify the most important scientific areas that need to be investigated and that would best serve policymaker and public needs. Moreover, we were highly impressed with the authors' ability to distill such broad and disparate types of information into 17 science action areas, which are cogently described. The methods and processes used to develop the draft agenda set a positive precedent for successful implementation of the Delta Science Plan.

The six suggestions below represent ideas that many of us share. Comments from individual ISB members about the draft agenda are appended.

1. *Provide more detail on how priorities will be established and balanced.* Prioritizing actions and areas will be important but also risk over-concentration of scarce funding and expertise, so some balancing is needed in prioritization. The draft agenda could describe objectives to guide prioritization and resource allocation decisions (including additional priority for synthetic efforts, management needs, science that addresses multiple issues, and short-term achievability), and when the priorities are likely to be set.
2. *Avoid prescribing.* Stress that the overall purpose of the full Science Action Agenda is to provide a framework for collaboration and communication around priority science issues.
3. *Add emphasis on studying the Delta and its watershed at a system level, and on meshing science with policy.* The draft agenda should encourage bold and cross-cutting innovative attempts to seek insights about the Delta that embrace many of the individual topics identified in the draft agenda. Such cross-cutting efforts could be included as a criterion for prioritization.
4. *Revise the executive summary*. Rephrase the draft agenda's main points for concision and clarity, and avoid redundant text between the executive summary and the introduction.
5. *Emphasize how agencies and organizations will work together.* The Science Action Agenda may best serve the Delta Science Plan and the public by identifying agencies that are willing to, or should, take leadership responsibilities for various areas, including commitments to research productivity and support. The success of the full Science Action Agenda effort

might necessitate that each science action area has its own detailed, prioritized, and balanced plan.

6. *Emphasize the need for risk analysis.* Identification of risks that the action items are intended to address as well as risks (or probabilities of effectiveness) associated with the actions themselves will be essential. Risk analysis, either formal or informal, will be needed to accomplish any sensible prioritization approach. Because not all actions can be undertaken initially, some prioritization that considers risks will be necessary.

Comments from Individual Board Members

[The comments below were not edited. Individual comments separated by a line.]

The action areas for Delta as place and risk reduction might be strengthened. For risk reduction, for instance, the DSC's levee-prioritization effort may have yielded action items beyond those already in hand.

The executive summary could be restated to minimize duplication of the main text. It could be serve as a draft of an op-ed on the interim agenda.

The promise to provide a prioritized list (p. iii, line 27) might be reconsidered if, as is likely, the action areas are apples and oranges (unless one of the recommendations calls for a ranked list of stressors...). The interim agenda implicitly prioritizes Delta Plan subject areas by the number and specificity of the action areas linked to them (hence suggestion 1, above).

In the methods summary (p. 1-2) the DSP could take fuller responsibility (the flip side of taking credit) by using active verbs, as in Appendix A. The tone set by the passive voice (page 1, line 31; page 2, line 7), while modest on the compilers' part, runs the risk of sounding vague or evasive, while robbing the text of excitement and urgency that the interim agenda deserves.

The key role of the action agenda is to set short term priorities for research, monitoring, data management, modeling, synthesis and communication and building science capacity. The interim plan, as I understand it, is a compilation of all interests into encompassing categories. There is no clear discussion of how one moves from this list to actual prioritization. Prioritization criteria (e.g. management needs?, science that addresses multiple issues?, short term achievability) would need to be established somewhere. Also will priorities be established among the 17 action areas? Or, will priorities be established by taking the top question or two within each of the priority areas? Shouldn’t this be discussed in the document?

The role of the ISB is to review the state of the science every 4 years? How do/should our review topics align with those in the action agenda? Should they? Where does Fish and Flow fit for example?

The process used here (probably necessarily) involved lumping up of all activities/needs into very broad categories. Without establishing criteria (e.g. #1 above) this is really all that could be done. The result is categories (Action Areas) that are broad enough to cover everything. For example, "Understand the conservation needs of native species" is kind of a lifetime job for a number of scientists. All of the infrastructure action areas (13-17) fully encompass the entire Science Plan.

Does this process provide/encourage or actually discourage cross-disciplinary approaches (e.g. climate change, fish and flow, things that cut across the action areas)? Do current categorization themes restrict open ended thinking?
How do we handle emerging issues and emerging technologies?

Listing measures of success of the interim action agenda (top of page 3) is valuable to better inform folks about the purpose. Actually getting a baseline metric on any of those and measuring progress is a whole other issue. Indeed if all 17 action areas cover all ongoing activities of 315 action items, then all you are doing is measure the state of the science. Again, the lack of any priorities here really mixes the message/purpose of the action agenda.
7) Perhaps, since we are talking about research, (at least some of) the example science options should be put into the form of a scientifically addressable question.
8) Why 17? (as opposed to 10, 15, 20)?
9) Shouldn't the adaptive management tools (#13) match up with the areas identified in #1 – 12?

Page 2, Lines 12-16. This paragraph emphasizes what the Interim Science Action Agenda (Interim SAA) does not do, rather than what it proposes to do. I think the emphasis, particularly early in the document, should be on key attributes of the Interim SAA rather than highlighting what the document does not do. Consider moving this text to a section later in the document.

Page 2, Lines 25-26. This sentence states explicitly that success of the Interim SAA relies on the ability of programs and agencies to work together. It would be helpful if the document could provide a road map for how this will be done (e.g., what incentives and motivations will be provided for programs and agencies to work together; what structures can be put in place to ensure that agencies and program work together; are there models from other systems that could be adapted to Delta science?).

Page 2, Line 31. Typo. Revise to, "Delta Science Fellows".

Page 4, Lines 1-2. Describe what "Count of Individual Science Actions" means in the table caption. Is this the number of times that a particular action was mentioned by different agencies or entities in the Delta?

Page 4, Table 2. How was 17 used as the cut-off. I was surprised not to see any mention of the following:
- Understand the role of groundwater as a water resource and its function in the Delta ecosystem

- Understand the carbon cycle of the Delta. Identify the major sources of carbon and their role in supporting production and energy flow in the Delta.
- Identify regions of the Delta where food quantity and/or quality may be insufficient to support organisms.

How will important gaps in knowledge not mentioned through this process be handled?

Page 5, Line 3. Typo. Insert a space between "Area" and "1".

Page 5 and elsewhere. Identify what "Unique number ID" means.

Page 6, Lines 4-5. Could be rephrased to, "Research, monitoring, modeling and synthesis are needed to better understand the population level effects of entrainment."

Page 10, Lines 5-6. Could be revised to, "Decisions that affect the Delta economy rely on science that addresses knowledge gaps such as impacts to agriculture ….."

Page 11, Lines 7-8. Awkward writing here.
Consider omitting, "consists of research and monitoring actions".

Page 13, Line 15. Typo. Revise to, "and deciding how and when TO restore wetlands…."

Page 14, Line 6. Omit "their". Revise to, "efforts to improve data sharing…."

Page 14, Line 15-18. Consider adding "inter-calibration exercises". This could include inter-calibration between agencies/programs that make measurements using different methods. Inter-calibration would allow these measurements to be compared against one another over space and time.

Page 15. Table for Action Area 15.
Revise the third section to use parallel language (e.g., "EVALUATE the cost ….")

Page 15, Line 4. Revise to, "…related to water operations AND meet human and environmental needs."

Pages 17-18. The list of Source Documents doesn't seem complete. Consider adding an Appendix with a full list of the sources identified in the tables that are embedded within each Action Area. Provide a link to where each source can be found.

P ii line 4 The ISB's review will be conducted in September and October, mostly September

P ii lines 1-2 Recommend changing "this science is not always well organized and coordinated" to "this science is often not well organized etc". In no universe would science be always well organized and coordinated.

P iii, lines 34-35 Rather than a single roadmap, which sounds highly prescriptive, don't we instead want a process, or processes, guiding science investments that are public, and transparent, and regarded as either objective, or at least honest about their subjectivity?

Introduction There is a lot of repetition between the Exec Summary and the Introduction. It would be nice to eliminate that, I don't have specific suggestions just yet, I'll think about it more. One thing that comes out in the Intro that didn't in the ES, and that I think may be important in the ES, is that the ISAA uses existing lists of actions, and did not attempt to develop new ones, or a consensus about existing lists. That's important, but didn't come across very clearly. I think it's necessary to have the reader understand this, so that their expectations of what they will see in the ISAA are appropriate to the approach taken.

P2, lines 12-16 Could this paragraph just be deleted? It seems rather apologetic, and if the use of existing documents to form the basis for the ISAA is appropriately emphasized, then that should be enough.

P2 lines 17-35 It seems to me that the first paragraph here is a more realistic description of what ISAA success would be—the 2nd paragraph, I think, promises too much—isn't that more what will be achieved by a fully vetted SAA, not the ISAA? I suggest you consider eliminating the heading of the 2nd paragraph, and the 2nd paragraph except for its last sentence, and go from the first paragraph to the list of 8 measures. Or some variant of that.

I read through the Action Areas text, but didn't comment on it, trying at this point to keep comments to a fairly high level. You will likely get a lot of comments from the regional science community and others. I did read Appendix A more closely, as that will be important to get regional buy-in. It says there were 'about' 22 agencies and organizations represented at the public workshop in May, why isn't that a precise number? Then later it says 21 agencies and organizations were actually interviewed, representing 81% of those invited to interviews. So that means (I think) that 26 agencies and organizations were invited to interviews. Were those the 22 plus 4 others? How were the others identified? Why is DWR represented in 3 separate interviews, but other large organizations (USEPA, CDFW) only had one interview? How many interviews had multiple individuals representing the agency? These questions aren't meant to be exhaustive, but rather to point out that there could be more specificity provided about how this important information was collected. The information collected is the foundation of the ISAA, it probably wasn't collected perfectly, largely due to time constraints, but this is a good place to show an example of open and public process.

The NOAA interview was with the Southwest Fisheries Science Center.

The Interim Science Action Agenda is a precursor to the Science Action Agenda, and focuses on critical science needs and possible actions for the next two years toward One Delta, One Science vision of California. The Agenda was developed based on scientific, operational and planning information provided by relevant agencies and organizations (e.g., BSCP, DSP), individual interviews with agency personnel and information analyses conducted by DSP. A performance

matrix for evaluation is proposed. The overall document is organized into two thematic areas (knowledge gaps and infrastructure development) and seventeen science action areas that contain 315 individual action items. Since it is an interim document, no policy issues are addressed. The following are some comments/suggestions on the draft. Overall, this is well thought out and organized document in the framework of complex delta water resources management and policy arena, undergirded by attention to environmental and scientific uncertainties and engineering challenges.

Page V, Table 1; or page 5, Action Area 1 In addition to identifying watershed and water management issues, emphases should be placed on current critical bottlenecks that stymie addressing such issues. Agencies have decades of experience working under conflicting demands and constraints, and identification of barriers will help address challenging issues head on and collaboratively. This is imperative for developing a sound science roadmap

Page 4, line 2 (et. seq.) Action Area 2
…
identify opportunities to reduce greenhouse gas emissions..

Page A2, line 21 (Table A- 1. Agencies and Organizations Interviewed.) While climate change is identified as a key originator of stressors, a boarder treatment of it is required. California is the 12th largest CO2 emitter in the world, and power generation models in CA can have significant impacts on CO2 emissions, which include proposed changes to hydropower capacity. Therefore, in addressing water quality and quantity objectives, future emission changes need to be considered in consultation with Bay Area Air Quality Management District or California Air Resources Board. It appears that they have not been consulted in preparing the document. CARB has been working years on a (controversial) cap-and-trade system that affects the boarder delta community.

Page 3, line 15Information learned from Interim Science Action agenda will be captured in State of the Bay Delta Science updates. Such improvements can be effectively used for continuous improvement (adaptive management). Shouldn't there be a robust framework to capture/glean progress of Science Action Agenda, overseen by some agency or DSB? This aspect can be built in to 'Actions that Build the Science Infrastructure and Capacity…..', page V, Table 1.

Page 4, Action Area 3.
"factors affecting entrainment of native fishes….."
While this is an important specific issue, there are broader umbrella issues that drive fish entrainment, for example, penetration of salt wedge, mixing as well as location of pumping stations. May be it is better to say "affecting the fish habitats, such as entrainment, salt water intrusions, temperature…"

Several action items address the broader issues of fish protection (pages 5, line 9-12 and page 6, lines 17-19), so why the specific issue of entrainment becomes an Action Area rather than an Action Item?

Page 14, line 1 "Building the Infrastructure for Science…"

An Action Area could be the development of a comprehensive review based on other major large deltas in the world, encouraging extrapolation of previous scientific knowledge and lessons learnt to CA Delta

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iii, 28: I understand why the actions are not prioritized at this point, but it does make the document sound more like a wish list than an agenda. The Executive Summary should also indicate how priorities will be established in the Science Action Agenda. And somewhere there should be a discussion of the principles that will be used to establish priorities, not just who will establish them.

Iii, 32: I think success will be a prioritized list of actions. Agreeing on a prioritized list of actions would be a significant sign of a science community willing to work together.

Table 1: Interesting that levees are not mentioned specifically, although I guess they would be included under Action Area 12. I am impressed by the action areas identified; based on my understanding of the system, the significant gaps in understanding have been identified.

3, 1-14: Congratulations on giving yourself some performance measures!!!! But as I mentioned above, developing a prioritized list of actions seems to me to be a critical measure of success. A time frame for the development of that prioritized list should also be mentioned.

3, 32: It is not clear from this where one can find the 315 actions. Is it on the website listed earlier? If so, it would be good to state that again here, just for clarity.

5, 1-12: When I saw the term “watershed” in this action area (1), I assumed there would be something dealing with upstream diversions and reservoir management, but there is no mention of this. Also, “understanding the effects of lower or minimum outflows on species of concern” is a HUGE and contentious issue. It is surprising to me that this is not one of the example actions included. (I guess some of the specific studies are included under action area 4.)

6, 1: Based on a recollection from our fish and flows interviews, I think that there still is not a reliable measure of entrainment. If this is the case, it would seem that a more accurate measure of entrainment would be a necessary prerequisite for this action area (3).

6, 13: My concern with this action area (4) is that it still reflects a species by species approach. Where is the more holistic thinking on these issues, e.g. the approach Bennett and Moyle used, identifying groups of species based on similar life history traits.

Action area 10, specific action #3: This description makes little sense as written. Changes to what?

Action Area 11: Is there adequate understanding of the sources of N and P?

13, 15: “how and when TO restore”

Action Area 17: One of the things we have heard about for many years is the inability of state scientists to easily access the scientific literature and their ability to attend scientific meetings. It seems that an action addressing that concern belongs in this action area. Similarly, we have heard how difficult it is to attract and retain the best scientists, and how promotion usually means going into an administrative/managerial position. We have heard suggestions for development of a science track within state agencies, which could help solve this problem, i.e. be promoted as a scientist (as is done in USGS) without adding on administrative and managerial responsibilities.

The methods used are clearly described in the appendix; an excellent example of the kind of transparency needed for the Science Plan to succeed.

Overall, it is an impressive beginning, but one that is hard to judge because the action items identified are all pretty vague. It is impossible to say whether the experiments or monitoring proposed as part of those action items will be adequate. I did not have access to the internet while reviewing this, so I couldn't look at the DSP website for further information on the specific actions listed; perhaps the descriptions there are less vague.

Our review should emphasize the need for a clear statement of how priorities will be established for the full agenda – who will do it and the principles that will be used to establish those priorities. This is an interim agenda, and as such it is critical that it state how the full Science Action Agenda will be developed because that is the crucial next step, and it needs to be a transparent one.

General comments

1. The DISAA provides a list of topics for Delta science to address in support of the goals of the Delta Plan and potentially the BDCP, and this is important. But it should also address scientific issues underlying the difficulties of understanding the Delta as a whole, complex socio-ecological dynamic system, i.e. as the vision of "One Delta, One Science" (in the Anthropocene) suggests.

a. The big systemic question can be elaborated a little more: How might formal and conceptual models be built and adapted so as to facilitate a shared learning process across Delta scientists to support a more systematic understanding of the Delta? This is sort of addressed in Action Areas 13-17, especially AA16 (more on this later), but it should be upfront rather than at the back, even though it is a long-term goal.

b. There is a wealth of existing "bits" of knowledge, or potential wealth, if the Delta science community can learn how to synthesize the bits into a larger whole. Acknowledging this more explicitly and making efforts to work with it more deliberately could make the ISSA a more inclusive and less threatening process.

c. More specific, but systemic, scientific issues should probably include how we can understand the tradeoffs between more effectively getting Delta services in the short and medium

run versus assuring that the Delta system is sufficiently resilient to future perturbations as well as the expected greater variation in weather with climate change.

2. The findings reported in the DISB's review on the adequacy of the science reflected in BDCP and its EIR should be worked into the next draft of the ISAA.

3. Norgaard noted in the June 2014 meeting of the DISB that lists, especially prioritized lists, are in juxtaposition with systems thinking and should be banned from use within the DSP. Individual problems arise in a confluence of interactive causes, while problems themselves interact to form a Delta system that is not functioning as well as it could for present and future people and nature. So, hopefully, as the SSA evolves through better systems understanding, the way "problems" are described will also become more systematic. But there is reason to be concerned that the seeds to a more systematic understanding are not being sown when emphasis is put on prioritized lists.

4. The ISSA might better argue that the process of collectively working toward an ISSA is probably more important than the "prioritized lists" that might come out of the process. It is a part of the process of working together toward understanding the Delta as a whole and being able to communicate that understanding.

More specific comments

Introduction refers to Appendix D, but this was not included.

What does success … look like: stress here the importance of the process itself in building a Delta science community.

Comments by Action Area

Action Area 2 clearly addresses a key issue raised by the DISB with respect to BDCP and its EIR, though the DISSA is bent toward greenhouse gas mitigation and carbon trading.

Action Area 4: hopefully we want to understand all of the needs of native species, not simply enough to "conserve" them at some minimally viable levels but also whatever it takes for them to thrive in the event that this might be possible. Delete "conservation" from the title

Action Area 9 stresses the point that we need to understand how natural factors and their modification affect the Delta economy. The emphasis in on the natural science links to the economy to inform better economic decisions and decisions where there are tradeoffs between a healthy economy and habitat restoration or water reliability and economic tradeoffs. Economics, being a social science (sort of) and hence understanding of the Delta economy, per se, are not included. While it is understandable why the emphasis is on the natural linkages, not the economy per se, there are also natural system linkages to non-economic values, i.e. cultural values and the Delta generally as an evolving place that should receive parallel emphasis.

Action Area 12, risk can also be reduced by improving conditions affecting evacuation, greater resilience to disasters, etc.

Action Area 14 should also note that information sharing is a socio-cultural phenomena and that it requires time to share, especially knowledge that is more experiential in nature.

Action Area 16, not all models will be interactive, some will simply be really different, indeed it is the really different models that provide new insights. While it is "nice" to have interactive models, it could be dangerous, especially in a complex, highly dynamic, and hence uncertain world, to select against models that are not interactive. It would be highly valuable to avoid becoming locked in to one big interactive model. Along similar lines, it would be desirable to promote the ability to hold multiple hypotheses in mind and test across them. While "One Delta, One Science" is a good motto for now, it has the potential to prove disastrous. The Bureau of Reclamation had a unified vision of water development for six decades that proved disastrous by the 7th.

A document such as the ISAA is by its nature complicated by the difference between the idealism of what it wants to accomplish and the reality of it actually can accomplish. The document generally combines these approaches well. Moreover, because it is based on an excellent accumulation of information about the scientific needs of the Delta and the planned activities there, it can incorporated appropriate suggestions and changes to improve the plan and, where needed, better highlight both what the plan would like to do and what it actually can do.

The Executive summary should be reworked. As written, it repeats almost verbatim what is in the Introduction to the document.
Specific points:
--line 4 (also line 34 on page iii, line 6 on page 1 and line 28 on page 2, etc.)—"establishing a collaborative road map…". From the first time I heard the ISAA described, this phrase was used. I didn't understand the applicability of this description and I still don't. A road map doesn't give direction—it just presents a series of routes. If the Delta Science Program wants to use an analogy, this draft plan is more like a blueprint—it provides an outline of what should be done but can be changed to fit circumstances that come along.
--Table 1 is important to have in the Executive Summary.

In the main text, the vision of "One Delta, One Science" is key and shouldn't be buried in middle of the first paragraph. I would modify lines 10-11 on page 1 to make that the topic sentence of a new paragraph. This term should stand out where it is first described.

In "How the ….Action Agenda was developed" I would bring lines 12-16 on page and incorporate it in to the first paragraph on page 1 line 5. This is an important concept that should be mentioned earlier. Likewise, The sentence on line 5 "An Excel…" could be its own paragraph as it is a self-contained item of the Plan development.

The general headings for the binary arrangement into "Science Action Areas Designed to Address Knowledge Gaps" and "Science Action that build the Science Infrastructure…." is really useful but although it's used in the Executive Summary the headings are lacking in Table 2 (they are in the text in line 21-24).I think that they are useful and should be added directly to the

Table. I'd also change the heading of Table 2 to be "Action items of the Interim Science Action Agenda and the number of individual action recommendations that were summarized into the current 17 action areas".

In "What does success….look like?" The first one on the list on the top of page 3 should be something like "Consensus is achieved on the meaning of the science underlying particular areas of concern among the generators and users of the science". This certainly doesn't have to be on all issues but if it's not achieved on at least some, the Plan's objectives aren't fulfilled. Attribute 1 is to so general a statement--how is it tested? Attribute 3 should be "Agency or program science efforts…incorporate the Plan into their activities. "are informed by" is too weak a goal. The rest of the attributes are fine.

The action items and the specific science actions range from the very specific to the very broad. Perhaps this was intentional but some of the latter are so broad that they are unattainable. This is the issue I opened my comments with—" the difference between the idealism of what the Plan wants to accomplish and the reality of it actually can accomplish". For example,

Action Item 1. "A more reliable water supply for California" certainly makes sense as part of a "Science Action Areas Designed to Address Knowledge Gaps" however I don't see how Area 1 fits into this, nor does the text description help. To me the research need, and Action Area, should first be to examine and develop criteria to determine what a reliable water supply is? Current Action Area 1 is part of this but the statement needs to be stronger. The specific science actions under this are fine, as is Action Area 2.

In terms of Action Area 3, isn't it also time for a detailed synthesis of existing information on entrainment? It's been studied for decades. Science Action 1 could do this but I would be more specific in wording of it.

Action Area 5 deals with Habitat Restoration. The DISB made specific recommendations that went far beyond the science actions here. If the DISB are to do these reviews, shouldn't they be included in Plans like these? The DISB report is listed as a source document.

Action Area 13. Adaptive Management should go beyond habitat restoration, given the mandate of the Delta Reform Act, and the examples in the text should be broadened.

To summarize, it's an excellent draft and I see it as a highly useful "blueprint". However, it needs to be more forceful in certain areas. I'll provide additional comments later.

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p. 3, line 14: 8 measures of success are listed. These need to be operationalized at some point into actual performance measures, against which progress can be gauged. This is an essential feature of adaptive management, which applies to implementing the agenda just as much as it does to on-the-ground management.
p. 5, line 12: here, or somewhere, there should be consideration given to developing ways to treat the Delta and its watershed as an integrated system, recognizing that actions taken at one place (e.g., upstream) will affect what can be done in other places (e.g., downstream). We've

previously pointed this out with reference to habitat restoration projects, but it applies to any actions that relate to something being done or understood within the Delta. One can't understand parts of the Delta piecemeal.
p. 5, line 22: the list of potential actions related to climate change is impossibly large. Although the action agenda at this point is explicitly not about prioritizing actions, this will have to be done at some point. Taking on all of the potential consequences of climate change and sea-level rise runs the risk of spreading efforts so thinly that nothing of real substance will be done. At the same time, to do anything without considering the potential effects of climate change would, in my view, be foolishly short-sighted.
p. 7, line 2: this makes it sound as if the ecological requirements of native species are to be understood individually. But the species are linked, so this understanding must involve both an assessment of e.g., the life-cycle requirements of individual species and its important pathways of interactions and interrelations with other species. In addition to fostering broader understanding, this approach also offers the possibility of undertaking management actions that benefit multiple native species, increasing both efficiency and effectiveness.
p. 8, line 12: before taking any of the mentioned actions, it is necessary to conduct analyses to determine which invasive species pose the greatest threats, to what, and how. Not all "invasives" are necessarily bad. Moreover, as species shift about in response to climate change effects, local ecosystems will be subjected to an array of invaders; determining priorities for which ones to deal with and which to let be (at least for a while) is necessary at the outset.
p. 13, line 4: this raises the broader topic of risk analysis. Many of the action items would benefit by incorporating formal or informal risk analyses, aimed at determining both the risks they are intended to address and the risks (or probability of effectiveness) associated with the actions themselves. Risks, in turn, are central to any sensible prioritization approach, and since not all of these actions can be undertaken (at least initially), some prioritization is necessary.
p. 13, line 16: developing operational frameworks for actually doing adaptive management should be part of this. Having a 9-part circle is a good conceptual start but doesn't provide the guidance that managers and practitioners need.
p. 16, line 9: perhaps it is not the proper place to mention this, but ultimately developing a collaborative approach to science will need to involve sharing or detailing staff; the sooner the administrative barriers to doing this are broken down (or at least made permeable), the better.

Two other thoughts:
1. As climate change and sea-level rise play out, local and regional ecosystems in the Delta will be subjected to considerable change in species composition and abundance, leading to what are being called "novel ecosystems." Some of these changes can be predicted, or at least assigned probabilities. The effects of novelty in Delta ecosystems have not been studied and are certainly not understood. Any actions taken without considering them, however, may be due for surprises.
2. Surprises also happen when systems cross ecological thresholds into different states. This is likely to happen more frequently as consequences of both environmental changes and the implementation of management actions. So far I've seen nothing that considers the potential impacts of thresholds, or even of how to understand the vulnerability of Delta ecosystems to thresholds.

The overall document is quite a good step forward, trying to wrangle a diverse and typically diffuse set of research and technical areas into 17 activity areas. So far, this is mostly an aggregated inventory of science activities drawn from many sources. I like the structure and discussion overall. It makes the confusing range of scientific activities somewhat more comprehensible. (I revel in this delusion.) So I will focus on next steps.

Ultimately, each major area of scientific activity will need its own more detailed plan, with this science action agenda being more of a coordinating document, nicely called a roadmap in the current draft. To be effective, the more detailed plan for each area will need to have its own leadership and broader involvement in formulation, helping coordinate agency actions and make them somewhat more transparent – science planning today is hardly transparent, being buried in the bowels of individual programs buried deep within most agencies.

More importantly, these plans will specify particular agencies taking leadership for particular actions and areas, implying that these agencies are responsible for funding, productivity, and timely communications of results in each area. Timely accountability for science is desperately needed for the Delta, although taken to extremes it can undermine science fundamentals and exploratory work which is also needed. A wise research management saying holds that if everything you do "succeeds," then you are not being ambitious enough. (It is perhaps worse if nothing succeeds.) Nevertheless, too many agency science and technical programs are too slow, for unscientific reasons, in producing the kinds of scientific capabilities and insights needed for management. More specific plans will be useful here.

If this path goes well, the number of science action areas is likely to be reduced to 5-12, making oversight a little less intimidating, and increasing internal coordination. Most of the areas are pretty loose now, but good as a starting point as any. The important thing is to get started and then to move forward in an expeditionary way. It is important to make a science plan and agenda that will be useful, and will stick. This will require agencies stepping forward to take responsibility, and be held accountable for their individual and collective efforts.

It might be useful in this agenda to include for each activity area a couple of sentences on which agencies are active in this area, and which agencies have expressed interest in leading the development of research plans in each area.