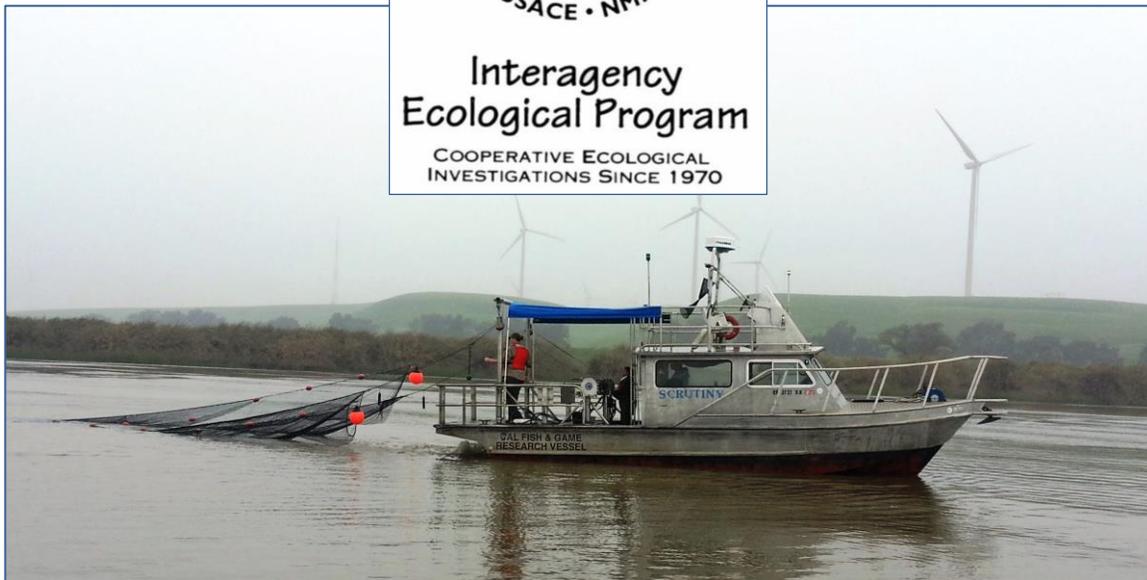
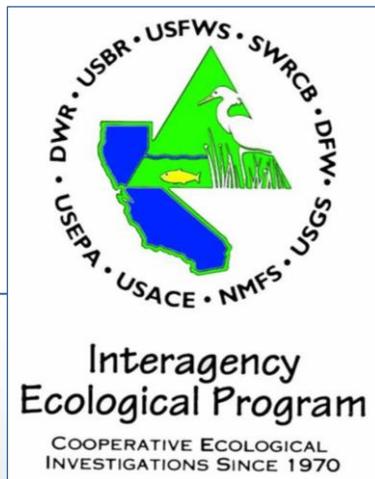


A Review of the
**Interagency Ecological Program's
Ability to Provide Science
Supporting Management of the Delta**



Delta Independent Science Board

November 2019



The Delta Independent Science Board provides oversight of the scientific research, monitoring, and assessment programs that support adaptive management of the Delta through periodic reviews.

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For assistance interpreting the content of this report, please contact the Delta Independent Science Board at disb@deltacouncil.gov.

The Delta Independent Science Board (Delta ISB) is a standing board of nationally and internationally prominent scientists with appropriate expertise to evaluate the broad range of scientific programs that support adaptive management of the Sacramento-San Joaquin Delta.

Created by the Delta Reform Act of 2009 and appointed by the Delta Stewardship Council, the Delta ISB provides oversight of the scientific research, monitoring, and assessment programs that support adaptive management of the Delta through periodic reviews.

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Acronyms

Acronym	Full Name
ASC	Aquatic Science Center
CAMT	Collaborative Adaptive Management Team
CBA	Chesapeake Bay Agreement
CBP	Chesapeake Bay Program
CDFW	California Department of Fish and Wildlife
CECs	Contaminants of emerging concern
CSAMP	Collaborative Science and Adaptive Management Program
CVSALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
Delta ISB	Delta Independent Science Board
Delta RMP	Delta Regional Monitoring Program
DPIIC	Delta Plan Interagency Implementation Committee
DOSS	Delta Operations for Salmonids and Sturgeon
DWR	Department of Water Resources
FLASH	Fall Low-Salinity Habitat
IEP	Interagency Ecological Program
LTER	National Science Foundation's Long-Term Ecological Research Program
MAST	Management, Analysis, and Synthesis Team
MER	Monitoring Enterprise Review
MOU	Memorandum of Understanding
NEON	National Ecological Observatory Network
NGOs	Non-governmental organizations
NMFS	National Marine Fisheries Service
Partnership	Puget Sound Partnership
PSEMP	Puget Sound Ecosystem Monitoring Program
PSP	Proposal Solicitation Package
RFP	Request for Proposal
SAIL	Salmon and Sturgeon Assessment of Indicators by Life-stage
SCCWRP	Southern California Coastal Water Research Program
SFEI	San Francisco Estuary Institute
STAC	Scientific and Technical Advisory Committee for the Chesapeake Bay Program
SWRCB	California State Water Resources Control Board
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

I. Overview and Recommendations

a) Delta ISB Mandate and Scope of this Review

By legislative mandate, the Delta Independent Science Board (Delta ISB) reviews the adequacy of the science in support of adaptive management for the Sacramento-San Joaquin Delta (the Delta). Our prior reviews covered habitat restoration, water quality, fish and flows, Delta as place, levees, and adaptive management, and other reviews are currently underway. Because the Interagency Ecological Program (IEP) is a central hub of ecological science in the Delta, a major coordinator of monitoring, and provides an extensive database, much of the science reviewed within these topical areas took place under or was dependent on the IEP. This is the first Delta ISB review to address a research program managed under a multi-agency organizational structure and as such looks into organizational and programmatic issues as they relate to the science. This review complements the Delta ISB's ongoing Monitoring Enterprise Review (MER) that will look at specific monitoring details, such as potential redundancies and gaps in ongoing sampling efforts, sites, and methods.¹ This review of IEP takes a broader overview of Delta ecological science than the MER does, while also giving more attention to IEP as a research program with its own organizational structure.

The findings and recommendations of this review stem from the Delta ISB members' interpretation of what they have found through: a) interaction with IEP and regular attendance at the annual IEP workshop, b) consideration of prior reviews of IEP, c) the experiences of the Delta ISB members in science organizations, d) a brief review of how science is organized in across other large ecosystems including participation in the Delta Science Enterprise Workshop, e) a review of IEP documents such as the Governance Structure and Strategic Plan, and f) insights reached through responses and perceptions to a questionnaire and in-depth interviews with IEP participants and other stakeholders.

The 25 interviewees included scientists/managers with decades of experience with IEP, those currently involved in IEP, and those using IEP products. They included state and federal scientists and managers, consultants, and representatives of academic institutions and non-governmental organizations. These interviews provided broad perspectives and played an important role in the development of our recommendations. Each interview began with a series of questions that were sent to interviewees in advance and were used as the basis for the discussions (Appendix D). Detailed notes were taken at each interview. Most interviews were done in person although a few were done as conference calls.

¹ [Delta ISB MER Prospectus](http://deltacouncil.ca.gov/pdf/isb/products/2017-04-06-isb-mer-prospectus.pdf): <http://deltacouncil.ca.gov/pdf/isb/products/2017-04-06-isb-mer-prospectus.pdf>.

We conclude that the IEP has had and continues to have high value to Delta science and management but is not living up to its full potential. Overall, the Delta ISB and most people working in the Delta with whom we interacted recognize the value of the IEP, agree that its core functions are essential for adaptive management in the Delta, and recommend continuation of its efforts. We believe that the value of IEP to its members, Delta management, and stakeholders could be significantly improved by adopting the recommendations below that focus on the operational elements of IEP's ability to provide science supporting management in the Delta. The rationale for our recommendations is provided in Section III on Key Findings.

b) Recommendations

Our recommendations fall into two broad categories:

On What IEP Does

1. To support adaptive management of the Delta both now and in the future, **the core monitoring and reporting functions of IEP must be continued.**
2. To sustain the decades-long dataset developed by IEP, **the value of long-term data in coping with rapid environmental changes should be promoted through powerful and consistent statements, examples, and analyses.**
3. To broaden the constituency of IEP, **data management should be improved by enhancing the accessibility of the IEP website and data portals and assessing stakeholder needs and uses of information.**
4. To integrate improved monitoring technologies into existing programs, **a standing committee within IEP should continually assess new monitoring methods, phasing out those that are no longer appropriate while taking care to cross-calibrate data from former and revised methodologies.**
5. To provide the mechanistic understanding needed to address the Delta's environmental problems, **additional resources should be obtained to augment monitoring with the experimentation and synthesis needed for effective adaptive management and to guide short- and long-term management and decision-making in the Delta.**

On How IEP Works

6. To ensure that IEP continues to serve its multiple partners and stakeholders, **IEP should undertake a formal, transparent assessment to develop a consistent set of goals that define its mission and activities in addressing the diverse management needs of the Delta.**
7. To develop a new and clear sense of direction, **IEP Directors, staff, funders, and stakeholders should engage in in-depth discussions of IEP's organization and operations, including alternative organizational structures.**
8. To be strategic, efficient, and effective, **IEP should prioritize its activities to justify additional funding and partnerships and/or reallocate resources among existing activities.**

II. Background: Overview of IEP and the Delta ISB Process

a) The IEP

For nearly 50 years, IEP has been the hub for ecological science in the Delta, where it has a central role in planning and coordinating ecological monitoring and research. It strives to provide “Science, Synthesis, and Service” to Delta policymakers and managers. It also maintains a database of research conducted over the years to inform Delta scientists. IEP originated through a Memorandum of Understanding (MOU) between four agencies in 1970 that has been periodically expanded and updated.² It currently brings together the science and scientists of nine state and federal agencies and includes linkages to non-governmental organizations and university scientists.³ IEP is primarily funded by the partner agencies with the Department of Water Resources (DWR) and the United States Bureau of Reclamation (USBR) providing a large proportion of the funding. Participating agency directors, or designated representatives, oversee the program, meeting quarterly to discuss research findings and funding priorities.

Nine agencies, six federal and three state, are part of the IEP MOU: DWR; California Department of Fish and Wildlife (CDFW); California State Water Resources Control Board (SWRCB); USBR; United States Fish and Wildlife Service (USFWS); United States Army Corps of Engineers (USACE); United States Geological Survey (USGS); United States Environmental Protection Agency (USEPA); and National Marine Fisheries Service (NMFS).

² For a [history of IEP from its beginnings through 2012](https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Environmental-Services/Interagency-Ecological-Program/Files/A-Historical-Perspective-of-the-Interagency-Ecological-Program.pdf?la=en&hash=EF9674BB8A0912EC73F9B44850C93BCD77FE653), see: <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Environmental-Services/Interagency-Ecological-Program/Files/A-Historical-Perspective-of-the-Interagency-Ecological-Program.pdf?la=en&hash=EF9674BB8A0912EC73F9B44850C93BCD77FE653>.

³ [IEP website](https://water.ca.gov/Programs/Environmental-Services/Interagency-Ecological-Program): <https://water.ca.gov/Programs/Environmental-Services/Interagency-Ecological-Program>.

In addition, there are many agencies that IEP coordinates with outside of the nine member agencies, including: Delta Science Program; Central Valley Regional Water Quality Control Board; San Francisco Bay Regional Water Quality Control Board; Regional San; and a variety of Public Water Agencies. Non-governmental organizations (NGOs) that IEP participates with or are sometimes partners in studies, include Trout Unlimited and the San Francisco Estuary Institute (SFEI).

IEP's structure and processes were made more explicit in 2013, partly in response to the first Science Plan of the Delta Plan. IEP's organization chart appears as *Figure 1* on page 11. The agency directors set the broad vision and approve steps taken to meet the vision through quarterly meetings. The Coordinators Team works at the strategic level on research work plans, their implementation, and communication with stakeholders. The Stakeholders Group, which is comprised of entities that use IEP science and have an interest in the latest research findings, meets at least twice a year with IEP scientists to share research findings of the IEP scientists. A Regulatory and Operations Advisory Group advises on the science needed to meet regulations.

At the next level, a Science Management Team coordinates specific science programs, and a Program Support Team provides administrative services and oversight. Under the Science Management Team are individual science Project Work Teams and special technical teams, such as the Science Advisory Group, the Data Utilization Workgroup, and the Management, Analysis and Synthesis Team. This organizational structure chart is complete with lines of duty, chains of command, and reporting requirements, and the plans, tasks of teams, and responsibilities of participants within each team are also explicit.⁴

The IEP's mission is "to provide and integrate relevant and timely ecological information for management of the Bay-Delta ecosystem and the water that flows through it. This is accomplished through collaborative and scientifically sound monitoring, research, modeling, and synthesis efforts for various aspects of the aquatic ecosystem." Although all of these IEP functions are important, we feel that more attention must be placed on the synthesis efforts. Challenges in meeting these important and ambitious goals range from responsibilities such as scheduling the use of a multi-agency boat fleet to complex undertakings such as working with government agencies, NGOs, the water contractors, and other stakeholders. These groups each have different needs, goals, and agendas, all of which make the IEP a unique entity in the Delta. Consequently, the overall goal of our IEP review is a review of the structure, production, and use of science by IEP.

⁴ [IEP Organizational Structure Chart](https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Environmental-Services/Interagency-Ecological-Program/Files/Organization-Structure.pdf?la=en&hash=39C4B15DD20E5C21E0430BBAF2B48D3A0105CF8E): https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Environmental-Services/Interagency-Ecological-Program/Files/Organization-Structure.pdf?la=en&hash=39C4B15DD20E5C21E0430BBAF2B48D3A0105CF8E.

A Review of IEP's Ability to Provide Science Supporting Management of the Delta

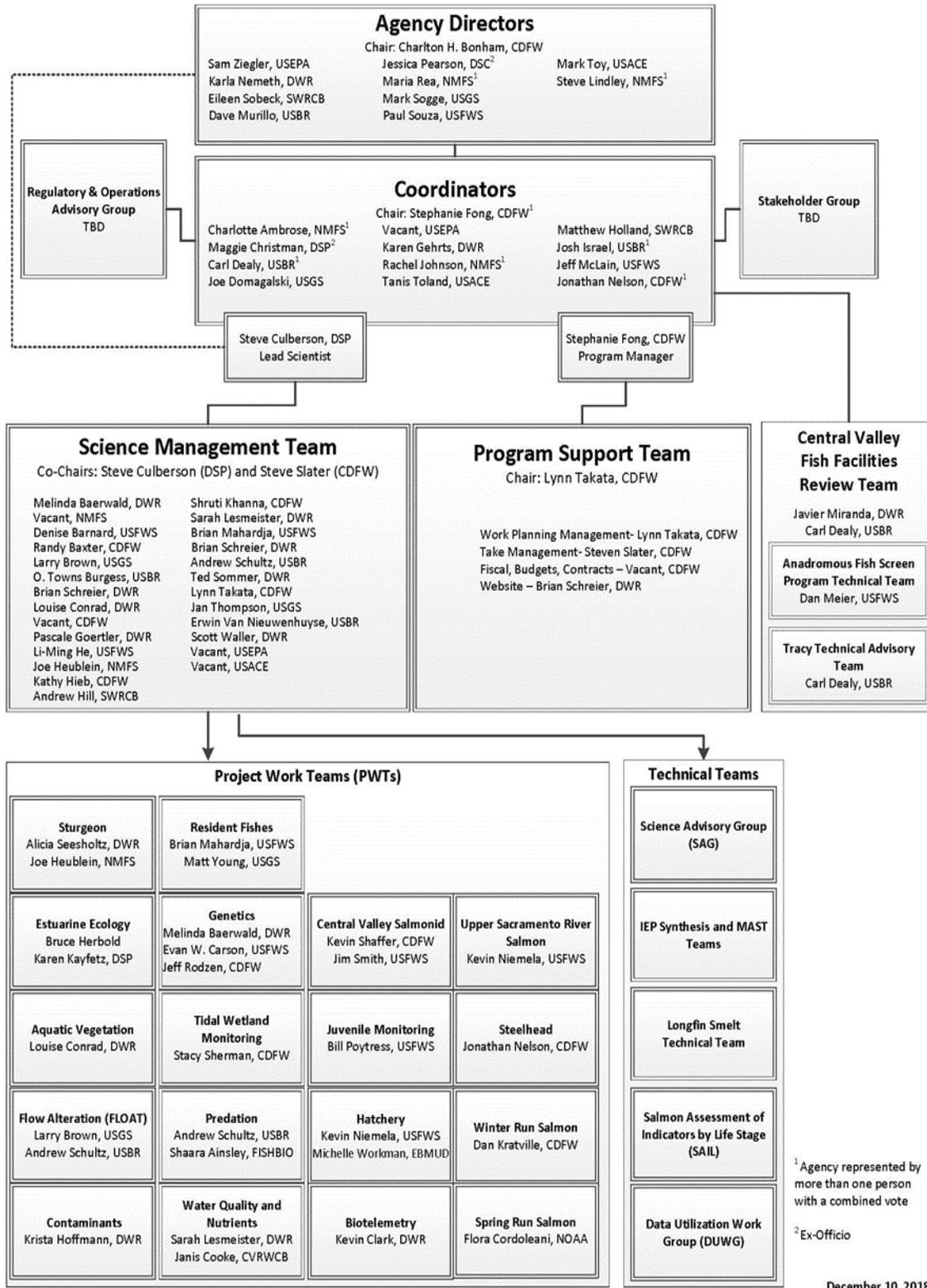


Figure 1. Organization chart of the IEP as of December 10, 2018 (also see Footnote 4).

b) Findings of Prior Reviews

The Delta has been at the center of much of California's political conflicts over water for the past century.⁵ Policy and management decisions are supposed to be, and are frequently mandated to be, science driven. When these decisions are especially contentious, Delta research programs and scientists inevitably end up in the middle of the fray. IEP has not been an exception, and thus there has been contention over how well IEP's research, synthesis, and outreach serve policy and management from the different perspectives of stakeholders. A variety of factors led to formal external reviews of IEP and less formal review efforts by individual scientists, with the hope of creating a more responsive organization that might better satisfy multiple parties. Perry Herrgesell's 2012 history of the IEP (cited in footnote 2) documents the history of review efforts. There was rarely contention over the quality of the science. Most of the contention was with respect to whose interests the choice of research questions served and how well managers and policymakers were paying attention to research findings.

In 2013, ongoing disagreements among stakeholders over IEP's monitoring and research priorities, decision-making transparency, and efforts to transmit research findings led the IEP Coordinators Team to seek an external review of its business practices. Ronald Muller and Lorraine White of GEI Consultants submitted a concise review and list of recommendations in June 2015.⁶ The GEI team recommended that the IEP:

- Standardize governance policies and procedures to make decision-making of the IEP more transparent and accountable.
- Clearly define roles and responsibilities to support more efficient implementation of the Program and better distribution of effort among the participants.
- Standardize and make transparent selection processes for identifying what projects are to be recommended for funding; insure no conflict of interest; establish and maintain information on the criteria for selection/performance measures; support diversifying program participation while maintaining high quality research; provide for an appeals process; and clearly define deliverables/publication requirements.
- Identify a process to support a centralized financial information management system that provides for various levels of access, clearly tracks contracts and interagency agreements/Budget Change Proposals, and supports record keeping for accountability.

⁵ See: Norris Hundley, Jr. 2001. *The Great Thirst: Californians and Water History*. Revised Edition. University of California Press. 1977 Report on History of Delta Policy by W. Turrentine Jackson and A.M. Paterson.

⁶ The review titled *Business Practices Review: Interagency Ecological Program* dated June 2015 and undertaken by GEI Consultants is not posted on the web.

- Develop and implement an interagency computerized database as called for in the 1990 IEP MOU for IEP related data, research projects, and other activities by member agencies in the Delta.
- Define: accountability and transparency goals and strategies; processes for the revision to and maintenance of MOUs; and processes for measuring Program performance and success.
- Develop uniform procedures with associated instructions for reporting and communicating within the Program and with external stakeholders to ensure consistent messaging and supports better recognition of IEP related accomplishments and products.
- Identify processes for uniform and regular training across all teams and agencies involved in IEP to ensure everyone understands the purpose and requirements of the Program, its relationship to other activities in the Delta, and how business is to be conducted within the Program.
- Increase and make more effective engagement with interdisciplinary and interagency groups, stakeholders, and members of the public. This will include the development of dynamic tools to facilitate and support enhanced communication within IEP, among member agencies, and with stakeholders. Recommendations may include providing more opportunities for stakeholders to engage more directly with various levels of the IEP.
- Reassess the resource requirements of the IEP to ensure it meets the requirements specified in the MOUs and future science needs expected to be fulfilled by IEP. Based on the results of the assessment, take action to appropriately resource and staff the Program, provide for needed support systems and tools to equip management activities and processes needed for effective engagement.⁷

Since the review, IEP has striven to further clarify and elaborate the documentation of its procedures and participants' responsibilities as well as taken steps to increase communication and transparency. The recently released IEP Science Strategy 2020 to 2024: Investment Priorities for Interagency Collaborative Science document is a good example of recent efforts to respond to these recommendations. The annual workshop is another example of an effective way that IEP engages with the community. This workshop is highly valued and attendance in recent years has increased to the point where an alternative meeting site may need to be considered. Nevertheless, at the time of our review, there was still contention among stakeholders.

These earlier recommendations are not all that different from the ones proposed by the Delta ISB above. We have examined the Business Practices Review and found that many of the procedural recommendations in that document have been carried out. However, similarities in the recommendations provided in the two reports indicate ongoing problems that we believe emphasize the need for action by the IEP leadership and Directors.

⁷ Pages 13 and 14 of 2015 Business Practices Review.

c) Putting IEP in the Context of Other Interagency Research Programs

Research programs supported by multiple agencies exist across the country. Their mandates, organizational structures, and governance processes differ, and from these differences the Delta ISB gained insights into IEP. The Delta ISB looked into three organizations in particular. The Southern California Coastal Water Research Program (SCCWRP) is a joint powers agency set up to do the research of wastewater management, storm water control, and regulatory agencies. The Puget Sound Partnership (the Partnership), which includes the Puget Sound Ecosystem Monitoring Program (PSEMP), collaborates with hundreds of entities to improve the quality of the Sound in part by coordinating monitoring and funding science. The Chesapeake Bay Program (CBP) was initiated by multiple states and the USEPA to reduce nutrients and sediments going into the Bay and also coordinates monitoring and the funding of science. Appendix A contains descriptions of these programs. Consideration of these programs and their structure may provide some insights, but we are not advocating that any of these be considered as replacement for the current structure of IEP.

The Delta ISB did find that there were common elements that contributed to the success of the above programs, and also to other programs that we have examined. These elements include effective leadership in addition to a well-coordinated organizational structure, sufficient and reliable long-term funding, and effective communication.⁸

III. Key Findings Supporting Recommendations

The recommendations above were developed in response to what the Delta ISB found to be consistent themes that emerged during our review. They address practical and logistical concerns as well as high-level issues pertaining to organizational structure, communication, and funding. The findings described below were developed using a range of resources: the members of the Delta ISB's experience with the IEP; seminars presented through the Delta Science Program Brown Bag Series;⁹ interviews with over 25 people with IEP experience (including follow-up discussions); responses to the questionnaire on IEP (Section IV); and comments received based on that questionnaire. The tabulated responses in Section IV and the extensive quotes in Appendix B represent perceptions of IEP by scientists and managers that answered the questionnaire. These sections of the Report contain important suggestions and observations on the IEP.

⁸ Nelitz, M., C. Semmens, N. Tamburello, J. Singh, and H. MacInnes. 2019. Monitoring Enterprise Review: Lessons and Methodology Report. Final report prepared by ESSA Technologies Ltd., CBEC eco engineering, and PAX Environmental, Inc. for the Delta Independent Science Board.

⁹ [IEP Brown Bag Seminar Series:](#)

<https://www.youtube.com/playlist?list=PLqTHClIW1HhpDRc2LLTh8SVPUXNBfFxzR>.

a) The Value of Long-term Data Collection

The Delta ISB recognizes that the long-term data collected by IEP is a critical asset and a unique resource for the San Francisco Bay-Delta's scientific and management communities. In fact, if a program like IEP was not already in place, the first recommendation of this Delta ISB report would be to create such an organization, although perhaps with a different structure and funding mechanism. This view is evident in responses to the questionnaire by members of the Delta science and management agencies (e.g., see responses to Q1, Q2, and Q4 in Section IV and quotes in Appendix B).

Two recent journal articles based on IEP long-term datasets are consistent with these responses.¹⁰ These publications point out that long-term ecological research and monitoring is critical, especially in light of rapid changes occurring in the Delta. The appreciation of long-term data is consistent with views held by the broader science community where there is widespread recognition of the power of long-term data for understanding ecosystem change and for predicting the responses and resiliency of ecosystems to climate and environmental change. In a recent publication, for example, Gene Likens (President Emeritus of the Cary Institute of Ecosystem Studies) recognized the power of long-term monitoring efforts by stating, "Monitoring programs throughout the US keep a finger on the pulse of shifting environmental conditions. They help us track the effectiveness of pollution reduction policies, and they provide the data needed to recalibrate strategies if they are not working."¹¹

At the national level, programs such as the National Science Foundation's Long-Term Ecological Research Program (LTER) and National Ecological Observatory Network (NEON) have been established specifically for collecting long-term data and acknowledge that long-term study is essential for providing an integrated understanding of ecosystems.¹² The LTER program emphasizes the importance of long-term study by designating sites throughout the US and overseas for special studies that integrate across disciplines, through cross-site comparisons, and over broad spatial and temporal scales. LTER sites are reconsidered for renewal at 5- to 10-year timeframes and are evaluated through the peer review process during each cycle.

¹⁰ See: (1) Cloern, J. E. 2018. [Patterns, pace, and processes of water-quality variability in a long-studied estuary](https://doi.org/10.1002/lno.10958). *Limnology and Oceanography* 64: S192-S208. <https://doi.org/10.1002/lno.10958>. (2) Enright, C. and S.D. Culbertson. 2009. [Salinity trends, variability, and control in the northern reach of the San Francisco Estuary](https://escholarship.org/uc/item/0d52737t). *San Francisco Estuary and Watershed Science*. <https://escholarship.org/uc/item/0d52737t>

¹¹ [Cary Institute of Ecosystem Studies article](https://www.eurekalert.org/pub_releases/2018-03/cioe-lmi031518.php): https://www.eurekalert.org/pub_releases/2018-03/cioe-lmi031518.php.

¹² [LTER Program](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=7671): https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=7671. [NEON](https://www.neonscience.org/): <https://www.neonscience.org/>.

This renewal process enables each program to maintain elements over time and to evolve as science develops. NEON is a continental-scale observation facility designed to collect and provide open data that characterize and quantify complex, rapidly changing ecological processes across the US.

We agree with many of our respondents and interviewees that improvements are needed to enhance this unique and valuable repository of information. The IEP, like other long-term programs, is vulnerable to becoming static that is fixed in its ways of doing things, whether from not updating to more appropriate sampling devices, moving locations for better coordination with other programs, or even re-evaluating the reason behind monitoring specifics. Periodic re-evaluation of all IEP programs is necessary, as is the ability to incorporate new measurements and themes and to discontinue those that are no longer valuable. An ongoing standard practice of regular re-evaluation both within IEP and with its partners and stakeholders could help IEP, particularly if done by or with an independent body.

Another concern is that existing long-term data may be under-used in synthesis activities. New positions or funding opportunities for synthesis activities could offer tremendous benefit for scientific and management purposes (more below). Clearly, recent efforts to synthesize IEP data are laudable, but efforts at synthesis and integration need to be expanded and considered a formal part of IEP products. Moreover, synthesis and integration need to be considered sooner in the design and execution of IEP's work. Guidance is needed on how best to enhance synthesis and integration efforts and to incorporate synthesis into study designs. Paths to consider include:

1. enhanced allocation of resources to IEP activities,
2. increased collaboration among IEP and other entities to foster synthesis,
3. consideration of sharing or possibly transferring synthesis efforts to other entities,
4. obtain additional resources devoted to technical integration in planning and execution of studies, and
5. increased prioritization of synthesis and integration as a core activity of IEP.

Monitoring alone can only provide some answers to management decisions. The use of experimental results has been repeatedly shown to provide mechanistic understanding that can lead to more effective management solutions. Therefore, besides monitoring activities, IEP should have a research arm, which could be a component of a science strategy that does go beyond monitoring. Research is a needed component in the Delta, and these activities should be done by IEP or should be taken over by another agency to supplement IEP's activities. This recommendation was repeatedly made in the interviews and the written responses to the questionnaire.

We also found that the original justifications for continuing various aspects of IEP monitoring in some of their programs are based on anecdotes, and that some original source documents are no longer available. IEP should make sure that original justification documents are available, whenever possible, on the revamped website that we recommend. There has clearly been an “evolution of thought” in the design of long-term monitoring programs over time, and any changes in IEP’s designs should be documented.

While the value of long-term datasets is acknowledged, some datasets collected in the Delta overlap, are possibly duplicative, and may not be used by more than a few people or organizations. All current data collection efforts by IEP should be:

1. documented by standardized criteria;
2. evaluated for usefulness and overlap with other IEP and non-IEP data collections; and
3. recommended for continuation, discontinuation, or consolidation with other efforts.

A clear process for prioritization of needs and objectives should be developed as well. Likewise, quality assessment and quality control procedures must be rigorously maintained in all programs.

A detailed review of the specifics of the monitoring by the IEP and other programs in the Delta will be a major effort of the Delta ISB’s MER. Contractors assisting in that review will provide a detailed analysis of the Delta’s monitoring programs and will provide that analysis to the Delta ISB. We intend that the Delta ISB’s MER evaluation will have specific recommendations on individual monitoring programs, gaps in present monitoring efforts, duplication of effort and other redundancies across programs, and potential for increased efficiencies, synergies, and improvements. We also expect that review to strongly endorse the need to continue IEP or an IEP-type program to coordinate monitoring efforts.

b) IEP Mission

Many interviewees indicated that the overall goals of the IEP are not clear, well-articulated, up-to-date or even readily available. Given that the origins of IEP were quite different than its current activities, the need for change is not unexpected. Other programs in the Delta, such as the Delta Science Program, now perform several activities similar to those of the IEP. Moreover, some respondents suggested that IEP is no longer the best program to carry out their current range of activities. Some suggested that IEP should be limited to compliance monitoring; others think that it should be a research program; and still others that the Delta Science Program should take over research and special studies as their purview. IEP and other agencies should meet to clearly delineate the basic functions, overlap or complementarity of these entities.

The institutional arrangements supporting interagency investment in IEP work are perceived differently by different groups, but based on our interviews and the questionnaire respondents, perceptions generally are negative. These perceptions may indicate a need to reconsider the present arrangements. For example, based on the questionnaire responses (Section IV and Appendix B), especially to question 8 (the institutional arrangements supporting interagency investment in IEP work), users of data and research and those in the “other” (e.g., non-IEP scientists, interested public) had the most negative responses about institutional arrangements. Moreover, responses for this question were more negative than for the other questions asked. In general, the Science Management Team, those in the monitoring program, the technical teams, and the IEP stakeholders had more positive responses whereas users of data and research and those in the “other” (e.g., non-IEP scientists, interested public) had the most negative responses. State IEP employees generally held more positive views than academic, consulting, and federal employees.

IEP should clarify its mission and vision in light of its unique contributions to the Delta science and management communities as well as the development of new structures to enhance interagency collaborations in the Delta (e.g., the Delta Science Program’s Science Action Agenda and the DPIIC/Delta Plan Interagency Implementation Committee). We believe that IEP Directors and leadership need to provide a more explicit vision of their future roles that include aspirations and plans for how IEP could increase its value in the science and management decisions affecting the Delta with, perhaps a clearer delineation of the respective roles and formal linkages with the Delta Science Program and DPIIC, and other cross-agency entities. The Delta Science Program and other groups should also consider their mission statements and vision in consultation with IEP to reduce redundancies in their stated mission and recognize the different niches that organizations fill in the Delta system. This exercise could foster greater integration among IEP and their cooperating agencies.

c) IEP Organizational Structure

As Dr. Steve Culberson, the IEP Lead Scientist, noted in his brown bag seminar on IEP to the Delta ISB (Appendix C), complex organizations such as IEP and those described in Appendix A can (and we believe should) create synergies between agencies and their partners, enhance collaboration, and offer opportunities to leverage resources. However, and as he noted, misunderstanding and misalignment can arise when the needs and priorities of individual partners differ from those that benefit from the shared enterprise. This potential tension between the goals of individual partners and the shared IEP enterprise are likely the origin of many current criticisms we received about IEP. Establishment and public agreement on specific overarching goals that transcend the goals of any single agency would help to alleviate any perception of conflicting goals or conflicting commitments. Clearly, the value of IEP is in the integration and cooperation of a diverse set of entities towards common goals that are best, and perhaps only, achieved through this formal collaboration.

Reconsideration of institutional arrangements that facilitate the ability to track and explain IEP activities in the context of these goals may be needed as IEP continues to serve a rapidly changing Delta. Moreover, relationships with IEP stakeholders should be strengthened. IEP should improve its use of the IEP Stakeholder Group, increase engagement with other stakeholder groups, and perhaps add stakeholders that are not currently represented. This issue of better communication by IEP of both its contributions and the issues it faces was raised repeatedly in our interviews.

The Delta ISB also observed the key role of the Directors in advancing and communicating the value of the IEP and its products. The Directors have the leadership skills, power, and responsibility to advance this shared partnership towards Delta-wide goals. We repeatedly received comments that IEP could work much more efficiently and effectively if its Directors maintained more direct involvement in the program. Other programs in the Delta, such as the Collaborative Science and Adaptive Management Program (CSAMP), were proposed as models of how IEP Directors could be more engaged in IEP.

To some extent, it may be easier to criticize efforts of large, complex organizations than efforts of individual researchers or programs because of the impersonal and diffuse nature of organizations. However, when evidence to counter these criticisms is available, the Directors and administrators of IEP are obligated to present counter-arguments and to have a consistent and repeated message about the value of IEP. This is not meant to counter all criticisms, because some are undoubtedly justified and worthy of consideration and even implementation. In the responses of scientists noted in Appendix B, several respondents to the questionnaire noted a lack of enthusiasm/effort among the IEP Directors in terms of pointing out IEP's accomplishments. This was repeated often in our interviews and was attributed to a lack of the Directors' direct involvement.

Overall, the Delta ISB and most people working in the Delta with whom we interacted recognize the value of the IEP, agree that its core functions are essential for adaptive management in the Delta, and recommend continuation of its efforts. However, the way in which environmental monitoring and scientific research are organized and prioritized can affect what monitoring and research gets done, how findings are made accessible, as well as how and to whom they are communicated effectively. Therefore, IEP should consider ways to either enhance the present structures to be more effective or consider alternative models that increase the value of its products and efforts.

For interagency monitoring and research programs, the organizational structure can be important. We also found that the agreements and commitments made between agencies have built trust and support for the program. Sometimes the most important contribution of considering an organizational change is the recommitment to strongly shared common goals. Through this review and the ongoing MER, Delta ISB members are examining how other estuaries and coastal areas organize their monitoring, research, and communication.

The Delta ISB recommends that the IEP review its organizational structure in the context of successful models of multi-agency environmental organizations (see Appendix A for examples). This might help reinvigorate commitments.

d) Need for More Transparency

Transparency is a hallmark of effective collaborative programs and is a top priority for many businesses and non-profit organizations.¹³ Transparency helps build trust with both external and internal partners as well as stakeholders. Transparent organizations tend to remain open and informative about key points of information, including their goals, history, performance, and operations. Internal transparency on decision-making processes and priorities increases lines of communication with employees and correlates with higher employee morale (and productivity).

The perception of many of the interviewees and questionnaire respondents was that IEP was not adequately transparent about its operations and priorities. There was a general feeling that transparency at IEP could and should be improved and that greater transparency on major decisions by IEP at the higher levels is needed. This would significantly improve trust and support for IEP and the work that it currently does and perhaps more importantly, what it can expand to do in the future.

e) Data Availability and Products

IEP data have contributed to a high level of scientific productivity as measured in publications (e.g., ~ 50 manuscripts were produced using IEP data in 2017). However, research publications do not fully serve the information and management needs of all IEP partners. IEP should consider additional high-level products that enhance science communication and facilitate the translation of science to stakeholders, the public, and policy makers. We recommend that IEP continue synthesis efforts through scientific journal articles but also develop a range of products that enhance science communication, produce non-technical narratives about scientific findings in the Delta, and facilitate the communication of science for stakeholders, the public, and policy makers. We also recommend that IEP consider producing 1- to 2-page summaries of IEP products similar to the recent approach for our reports and articles,¹⁴ the white papers of the Delta Stewardship Council,¹⁵ and consider dissemination of results through social media outlets.

¹³ See [article on transparency](https://www.entrepreneur.com/article/295739): <https://www.entrepreneur.com/article/295739>.

¹⁴ [Summary Sheet Example](http://deltacouncil.ca.gov/docs/final-summary-sheet-delta-isb-s-adaptive-management-review-january-2018): <http://deltacouncil.ca.gov/docs/final-summary-sheet-delta-isb-s-adaptive-management-review-january-2018>.

¹⁵ [Delta Stewardship Council White Papers](http://deltacouncil.ca.gov/issue-papers): <http://deltacouncil.ca.gov/issue-papers>.

New positions or funding opportunities for synthesis activities could offer tremendous benefits for the scientific and management community. Data collected by IEP should be in a format readily amenable to synthesis efforts and these data should include appropriate metadata format, quality control/quality assurance procedures, details of how data were collected, use of standards and calibrations, etc. We understand that a “synthesis guidance document” has been prepared and this could be valuable for promoting more synthesis activities and providing guidelines for attribution to IEP data.¹⁶

Improvements are needed to enhance IEP's ability to store, share, and synthesize its substantial repository of information. The IEP website could serve much of this purpose if IEP material was made more available and easier to find. It is our understanding that DWR has revised its website but, as described above, many IEP source documents have been “lost” and apparently are either irretrievable or not easily retrievable. Moreover, the Business Practices Review, critical for understanding operations of IEP, and other documents were not posted on the website. This is a common problem mentioned in interviews and the questionnaire. We understand that IEP is aware of and working on this problem. In the future, CDFW has been suggested as an appropriate host for the website under a non-CDFW link.

There is little documentation of who uses IEP information within the context of broad and specific stakeholder needs and this may lead to an undervaluing of IEP's work. IEP should do an analysis of who uses their information and then independently do a stakeholder needs-assessment to assess what information is really desired. The lack of documentation may be a reason why some feel that the data produced is not valuable or does not fit their needs. Metrics to document how IEP information is used will help increase the value of IEP's work.

New data repositories also need to be considered for IEP data. The Delta ISB expected that much of the IEP data would be available on the California Water Quality Monitoring Council website, but it is not. The IEP should review and consider methods used by other data repositories to track use of data products (e.g., analytics for data downloads, DOI numbers for data products to enable citation and tracking). Recently, IEP has started using the Environmental Data Initiative site to disseminate data collected. Even if IEP decides to stay on this site permanently, they should consider using approaches provided by other programs to improve data formats, which may improve usability. If this is not already required, the IEP should consider adopting the requirement that any project in the IEP Work Plan must include a data management plan and make the data available at the end of the grant/contract period, and perhaps in multiple formats to enhance communication as mentioned above. This practice is common in individual agencies.

¹⁶ [IEP Synthesis Guidance Document](https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Environmental-Services/Interagency-Ecological-Program/Files/GUIDING-FRAMEWORK-FOR-CONDUCTING-IEP-SYNTHESIS-WORK.pdf?la=en&hash=3DB9D0DD7F3EA227810993639A71D2DF2FF914C6): https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Environmental-Services/Interagency-Ecological-Program/Files/GUIDING-FRAMEWORK-FOR-CONDUCTING-IEP-SYNTHESIS-WORK.pdf?la=en&hash=3DB9D0DD7F3EA227810993639A71D2DF2FF914C6.

f) IEP Leadership and Staff

The Delta ISB recognizes the important role of the Lead Scientist for IEP. As with the Delta Science Program, the Lead Scientist has the responsibility to 'provide scientific strategic leadership, advice and guidance at all levels.' However, the IEP Lead Scientist has many numerous other responsibilities that detract from their ability to focus on science. Moreover, much of the Lead Scientist's time seems to be spent explaining IEP and its activities. Strategic and effective IEP management needs the IEP Lead Scientist to devote more effort to leading science, with other non-science activities assigned to supporting personnel where possible.

Although the collaborative nature of IEP is positive, it leads to many meetings and heavy demands on IEP staff. In addition, part of the perceived reduction of science activities within the IEP may derive from personnel movement away from the IEP. Interviewees repeatedly stated that co-location of agency personnel involved in IEP (such as the proposed common office and laboratory facility in Rio Vista, California) is needed. Perhaps more co-location of field sites and stations would assist in coordinating efforts between partner agencies and IEP.

We also noticed that IEP has high staff turnover. The voluntary commitments of staff from a variety of agencies contribute to this problem. Consequently, efficiency decreases and costs rise from re-staffing and re-training. Success and promotion of individuals involved with IEP comes from within their specific agency rather than from activities supporting the IEP collective. We suggest that specific IEP responsibilities and time commitment be specified in position descriptions so that institutional commitments are formalized and documented. The reward system for individuals involved in IEP should be re-evaluated so that reward and promotion can consider contributions to both their home agency and the IEP collective. Additionally, new resources are needed to replace positions lost over time and compensate staff adequately. Adequacy of dedicated staff time for IEP needs to be evaluated vis-à-vis the work load.

g) Resources

It is clear from the questionnaire and interviews that IEP has been a creative and sometimes nimble organization. It has risen to the challenge of addressing new and evolving areas of research and monitoring needs in the Bay-Delta throughout its history, but its resources are limited and a common vision of the organization's goals and priorities needs to be developed. Mechanisms for meeting information needs from an expanded enterprise require regular re-evaluation, prioritization, and commitment of resources.

Throughout its 40+ year history, IEP has benefited from the contribution of resources and perspectives from its partners and stakeholders. However, as mentioned in discussions of previous recommendations, the current institutional arrangement is fragile. New and existing commitments must be nurtured and strengthened to ensure that IEP continues to be effective and can evolve to serve its partners and the collective enterprise. Efforts should be made to restore the camaraderie that was fostered in the past.

The Delta ISB found a general feeling of pessimism about the future of IEP because of the changing political landscape in California and the Delta, and the lack of base funding for IEP. Several respondents mentioned that past conflicts within the Delta and unforeseen changes from the Delta Conveyance Project (formerly, California WaterFix) and other activities could precipitate changes in the amount and stability of IEP's funding. In an earlier review, Herrgesell (2012) noted that IEP's funding model would likely be an ongoing issue because of agency needs (or priorities) to maintain their own staff, competition for resources, and the consequent need for trust among agencies, stakeholders, and participants. We found that this situation persists. IEP Directors and partners need to work more closely to identify and agree on priorities, set reasonable expectations, establish metrics for measuring success, and report successes. Goals can be developed that foster all agencies' missions and, when done collectively, will be more valuable than "the sum of its parts."

Research vessels, for example, are a key asset to IEP activities and need to be considered a priority for joint funding by participating agencies. Several IEP participants stated that scheduling maintenance and repairs has become a substantial challenge. On occasion, monitoring programs have needed to borrow time on other research vessels used by non-IEP agencies. The latter is valuable in establishing collaborations but is not feasible in the long run, and long-term budgeting and coordination of vessel use with support from multiple agencies is needed.

h) Coordination and Prioritization

Duplication of efforts in IEP is costly and inefficient, and better coordination of IEP's sampling sites with those used by other agencies/programs should be considered to capitalize on information collected from other studies and improve prospects for research synergies. This is especially true if resources decrease and there is need for additional monitoring, whether for new issues or regulatory compliance. There may be concern about discontinuing some types of data collection, for example, because of the possibility of future legal proceedings, but calibration among different sampling and analytical regimes can be done to support changes.

IEP also would benefit from an effort, possibly through a standing committee, to continually assess the use of new methods and technology. When new methods are deemed to be warranted, appropriately link existing and new monitoring methods. Environmental sensors, tagging and tracking systems, along with advances in molecular methods are being developed more rapidly than IEP can upgrade its devices and sampling designs. Although scientists are aware of these issues, budgeting for system upgrades and coordination among the agencies using and collecting the data to adopt these approaches is critical. Coordination of funding for these improvements is a major issue. Longer-term planning is needed for these expenses, as is calibration with existing tools and sampling. Related to this issue, status and trends in visualization approaches need to be updated and made more user friendly whenever possible.

This addition is widely being considered in the Delta, and IEP should be in the forefront of these activities. Mechanisms developed here can aid each IEP member.

IV. Questionnaire Sent to IEP Participants

a) Questionnaire Methods

The questionnaire was developed by the Delta ISB and was distributed to over 1,000 individuals on the IEP listserv, which included registrants for the 2018 IEP Annual Workshop (March 6 to 8, 2018), along with others involved and interested in IEP products, information and activities.¹⁷ The goal of the questionnaire was to provide an overview of the respondent's perceptions about how well IEP works to produce science and deliver results to management. The questionnaire was focused on the following themes:

1. IEP as a synthesizer of information
2. IEP as a nexus for the analysis, synthesis, and translations of science
3. IEP products that inform decision making and adaptive management
4. IEP's facilitation of relevant scientific information that support water supply management and key ecosystem components
5. IEP's coordination within its agencies/programs
6. IEP's coordination with non-IEP agencies
7. IEP's different organizational components to produce and use science
8. How the institutional arrangements supporting interagency investment in IEP work

One hundred and eleven individuals responded to the questionnaire, representing a range of state and federal agencies, consultants, stakeholders, academics, and others involved in science programs in the Delta. We attempted to apply a series of filters to the responses received based on: the length of involvement of the respondents with IEP; their self-identified role within IEP; and the professional affiliation of the respondent. However, the sample size was often too small to infer more than general patterns.

The respondents represented agencies that acquire data through research and monitoring activities as well as users of data acquired by the IEP. Respondents were asked to answer as individuals rather than as representatives of their respective entities. However, respondents had the option to respond on behalf of their entity. A portion of the questions in the questionnaire asked participants to rate how well IEP or IEP products work in different ways. Respondents were asked to select a score from 1 to 5 indicating "works poorly/not useful" to "works well/useful."

¹⁷ A copy of the [questionnaire for this review](https://docs.google.com/forms/d/e/1FAIpQLScqM4R24ITopjDSrZw3_hHLLNkgOYJYQ8nfTNYojEKLdJD4fQ/viewform) can be found at https://docs.google.com/forms/d/e/1FAIpQLScqM4R24ITopjDSrZw3_hHLLNkgOYJYQ8nfTNYojEKLdJD4fQ/viewform.

At the suggestion of specialists who use questionnaires in social science research and to enable us to better distinguish between “positive” and “negative” views of IEP, we eliminated the neutral score (3), and combined scores 1 and 2, and scores 4 and 5. Responses to the questionnaire were diverse, and we appreciate the willingness of many people that provided a wide range of perspectives about the nature of ongoing IEP activities in the Delta as well as future needs. We have used some of the responses, written comments, and insights provided by the respondents to the questionnaire in developing our recommendations (Section I of the Report) and have included selected comments provided for each question in Appendix B.

b) Questionnaire Results

Overall Responses

Respondents to the questionnaire had a wide range of experience participating and interacting with the IEP (*Figure 2*). The median length of interaction time was in the 5- to 10-year range and nearly 10% had more than 20 years of experience with IEP (*Figure 3*).

The percentage of total respondents indicating that they “didn’t know” the answer to the questions asked ranged from less than 15% for questions 1 and 2 to 65% for question 8. Forty-one percent of responses to Questions 6 and 7 indicated that they did not know whether to agree or disagree.

Whether the category of “don’t know” represents whether the respondent were unaware, had no opinion, or other reasons for their answer is not known. However, it does indicate that there are areas of IEP and groups of participants that require better communication or explanation for the points raised in the questionnaire.

Perceptions of IEP by Questionnaire Respondents

This section presents qualitative results from the questionnaire’s 111 respondents. Graphs of all responses are presented, following the written summary below in Section VI. Appendix B included some of the over 400 individual written comments received. We selected responses that reflect a variety of views on what the respondents indicated IEP did well in relation to the question being asked, what should be improved, recommendations about how these shortcomings could be improved, and comments on other aspects of the program.

Question 1. How well does IEP work as a synthesizer of information?

A large proportion of the respondents felt that IEP worked well as a synthesizer of information about the Delta and its ecosystem (68% felt it worked well compared to 20% that felt it worked poorly, and 12% that did not know). Still, a range of opinions was expressed by the respondents in their written comments (see Appendix B).

Question 2. IEP serves as a nexus for the analysis, synthesis, and translation of science

As in Question 1, there was strong agreement with this statement in terms of how well it worked (62% felt it worked well, 26% felt it worked poorly, and 12% did not know). Respondents noted that there is a need to broaden the scope of IEP activities (see Appendix B).

Respondents generally felt that IEP achieves its monitoring function very well. However, there is strong disagreement whether the compliance monitoring should be the major role of IEP and while compliance monitoring is the majority of IEP's support, it does not constitute the science support that is needed to fund the basic science that will assure the future of an ecologically viable Delta. Some of this disagreement lies in the changing goals of IEP over time. The Collaborative Adaptive Management Team (CAMT) and the CSAMP models may provide good examples of ways that IEP could evolve in terms of information provided in their presentations and implementation strategies. The roles of the Delta Science Program and IEP are complementary and more effort should be made to develop partnerships that bring the efforts of these programs closer together. The Delta Science Program, working closely with the IEP, could be a bridge for future discussions on better coordinating and enhancing the basic and translational aspects of Delta research.

Question 3. IEP products

There was strong agreement that IEP's products are useful to inform management decisions, with 57% finding it very useful, 24% finding it not very useful, and 19% not knowing.

Question 4. IEP structure

There is general agreement that the structure of IEP facilitates the ability to provide credible and relevant scientific information for water supply management and key ecosystem components of the Delta (52% felt it worked well, 21% felt it worked poorly, but 27% replied that they did not know). However, how IEP actually functions is not clear to many of the respondents (see Appendix B).

The Delta ISB discussed IEP's successes and in terms of it being a "bottom-up" or "top-down" organization. We concluded that compliance monitoring and the Directors do make it a top-down organization; however, it is also a "middle-down" because the coordinators drive so many of its activities. However, the "bottom up" approach has produced excellent science, but it has not led to effective communication of science or the importance of IEP.

Question 5. IEP coordination with its agencies and programs

How well IEP coordinates with its agencies and programs to meet science and management needs in the Delta produced less of a strong support than previous questions with 40% saying it works well, 30% saying it works poorly, and 29% replied "don't know."

IEP's mission has evolved in positive ways in that it now has a broader geographic scope, serves broader agencies' needs and, given the present nature of the organization, respondents generally felt that IEP is working about as well as could be expected. However, issues surrounding the power of the IEP Directors, the role of the Lead Scientist, funding models, and the lack of a "group vision" all affect IEP's ability to best fulfill a mission that has clearly changed and will certainly evolve in the future.

Although the IEP work plan is key to developing and implementing management strategies, it is viewed by many as a patchwork of activities and is not as effective as it could be. We repeatedly heard that the work plan is closely tied to the smelt "take permits." It is also apparent that IEP, like all agency programs, needs to be able to respond more quickly to new scientific developments and needs that arise. Respondents suggest that the technical evaluation of projects needs to be done earlier in the process of developing the work plan. Although this may be difficult because of the way projects are decided and funding allocated prior to this plan being developed, adjustments could lead to better scientific input into all IEP activities.

As reported in past reviews of IEP, there are still issues in terms of how effective IEP is in communicating its findings and providing syntheses.

Question 6. IEP's coordination with non-IEP agencies

This question specifically asked about coordination between the IEP and non-IEP agencies in meeting science and management needs in the Delta. The answers and comments to this question were highly variable: 30% felt coordination worked well, 28% felt that coordination worked poorly, and 41% replied "don't know." Individual responses on this issue were strong in terms of both support and criticisms of IEP (Appendix B).

Question 7. IEP organizational components and production and use of science

Only 40% of questionnaire respondents felt that the different organizational components of IEP worked well, while 41% indicated that they did not know and only 19% felt the organizational components worked poorly. Some respondents were positive about the structure, often among those with a long involvement in IEP (Appendix B).

Question 8. Institutional arrangements supporting interagency investment

Most respondents either responded "don't know" or did not agree that the institutional arrangements of IEP support the interagency investment in the work of IEP (14% felt it worked well, 22% felt it worked poorly, 65% did not know). Various reasons were given for this (see Appendix B) as well as for the high percentage of "don't know" responses to this question. Several comments related these results to issues surrounding funding, transparency, organizational structure, and communication.

Question 9. Awareness of Business Practices Review

The Business Practices Review, which is an essential part of IEP operations, was only known by 21% of respondents. As this is a fundamental document, this was troubling to us and perhaps reflects a lack of availability of this document.

c) Filters of IEP Roles and Experience Showed Different Responses

In terms of the frequency of responses and the role of respondents in IEP (and multiple roles could be indicated), members of the Project Work Team were most common, followed by those with a study element in the work plan, participants in a monitoring program, and members of the technical team (*Figure 2*).

In general, the Science Management Team, those in a monitoring program, the technical teams, and the IEP stakeholders had more overall positive responses. Users of data and research and those in the “other” categories (e.g., non-IEP scientists, interested public) had the most negative responses. However, for question 8 (institutional arrangements) most scores were more negative than for the other questions asked.

Most respondents were affiliated with state (54%) and federal (20%) agencies. State respondents were divided into IEP/non-IEP based on their self-identified roles. Those designated “State IEP” included directors, coordinators, members of the Science Management Team, and those who were part of a monitoring program or the IEP work plan. State IEP employees generally held more positive views compared with academia, consultants, and federal employees, especially for questions 5 to 8.

For the filtered results, sample sizes were smaller, but responses differed from the results when all of the responses were considered together. Unsurprisingly, there were fewer responses of “don’t know” with increasing years of experience with IEP. When different groups were examined, again often with small sample sizes for each, the Project Work Teams and the IEP stakeholders had higher percentages of “don’t know” than other groups, but for question 8 the “don’t know” choice was high for all groups.

When responses were filtered by length of experience or roles in IEP, most questionnaire respondents (62%) had been involved in IEP activities for more than five years. Although similar trends in opinions were observed across groups, respondents with 2 to 10 years of experience with IEP generally had more positive views (i.e., selected higher scores) than those with more or less experience with the program.

d) IEP and Adaptive Management

Many of the questions elicited responses related to IEP's effective use of adaptive management for the Delta. The application of adaptive management has been a key concern of the Delta ISB and the Delta Plan itself, as was detailed in the adaptive management review by the Delta ISB. This also will be a major topic considered in the MER. Selected responses concerning adaptive management and IEP are presented in Appendix B.

V. IEP and the Future of Delta Science

The IEP has been and continues to be the Delta's most important and sustained interagency science program. IEP has been a valuable presence and has made significant contributions to science in the Delta, despite funding constraints, structural issues, and the lack of permanent positions assigned to it. Despite these hindrances, the IEP coalition of agencies engaged in environmental monitoring and science for the Delta coordinated and reduced overlap in monitoring efforts and sponsored specific science syntheses. However, we believe that it has been less successful in organizing scientific knowledge in ways that would enhance Delta management. Historically, the composition and emphasis of IEP activities has changed, and will continue to evolve. Consequently, IEP must continue to evolve, adapt, and prepare for future issues. This must involve more proactive approaches than are currently being done.

The identification of evolving issues and the integration of them into IEP's activities will create new challenges and potentially require major changes to IEP's current activities and expectations. IEP and the agencies involved in it should have ongoing discussions about how to prepare IEP for the major changes occurring in the Delta resulting from a changing climate, arrival of new invasive species, altered water management, as well as other factors, both anticipated and unanticipated.

IEP might better prepare for these changes by increasing the involvement of expertise outside of the current IEP framework in terms of new technologies and ideas, regular external reviews of monitoring methods, quality control, data management, and assessment of strategic directions for their activities. Increased engagement with regulators and stakeholders may make mandated monitoring and special studies more closely track the evolving understanding of management issues and environmental objectives.

IEP does many things well and any changes to the structure and operation of this organization should concentrate on maintaining these successful activities. We believe that our recommendations, which agree with many of those from past reviews, can strengthen both the relevance and effectiveness of IEP in the future as the Delta and its management needs face future challenges. We suggest that a strategy to follow in implementation of our (and previous reviews') recommendations could be for IEP, including its funders, stakeholders, and leadership, to: (1) reconsider and recommit to a set of shared goals and mission for IEP; (2) provide transparent direction and encourage open participation toward reaching those goals; (3) consider a possible realignment of IEP's activities that are appropriate given the above goals; and (4) to include a commitment to steady funding, transparency, and effective leadership to help IEP function more effectively as a monitoring and research organization.

VI. Questionnaire Response Graphics

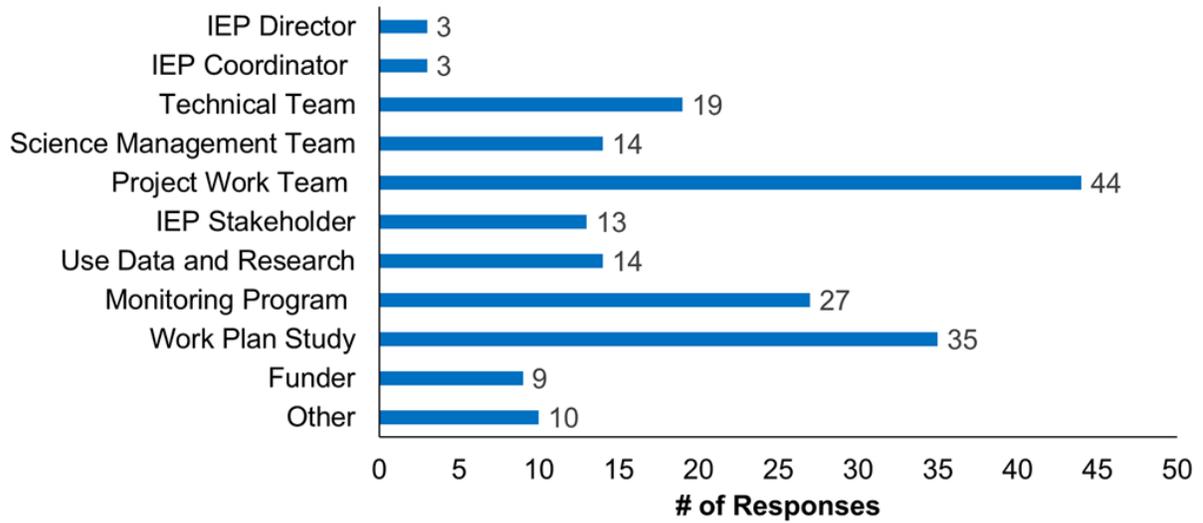


Figure 2. Respondents' involvement with IEP. Some respondents are involved in IEP in multiple ways, so respondents had the option to mark multiple categories.

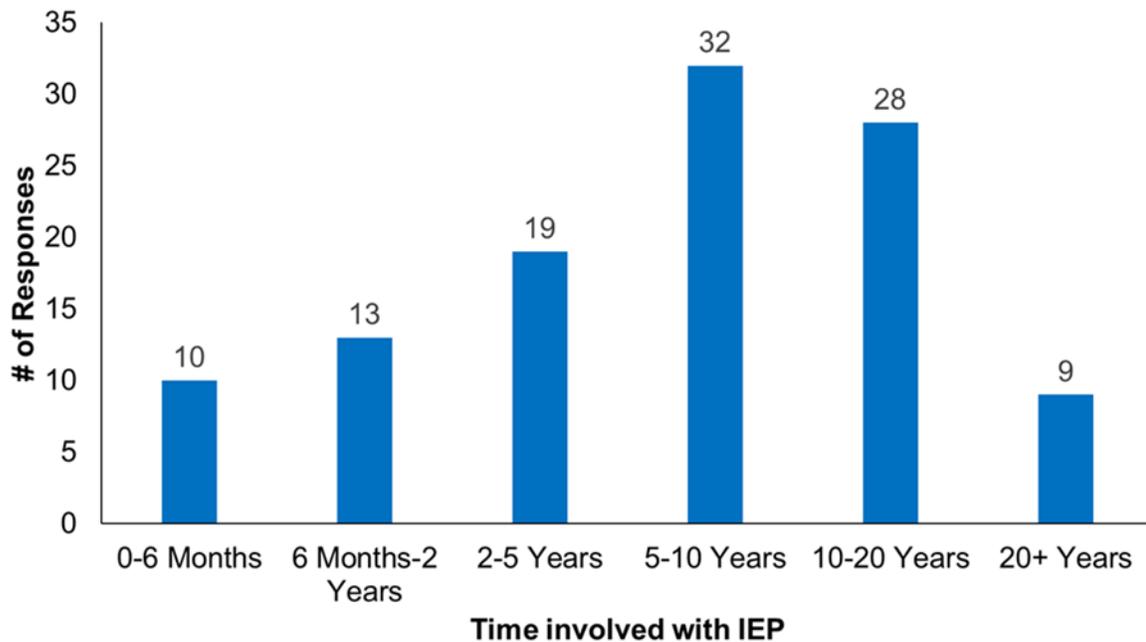
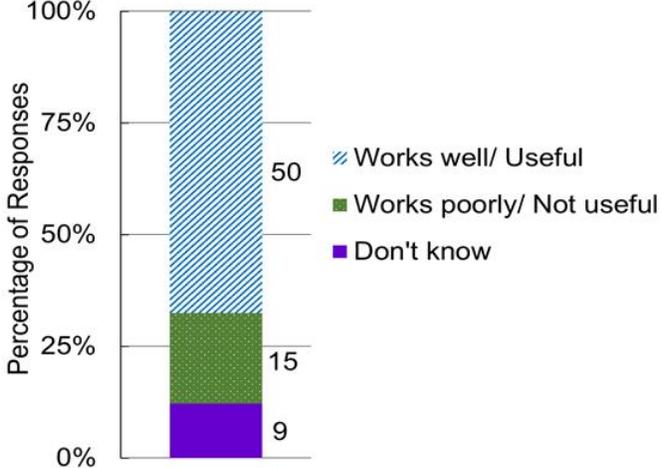
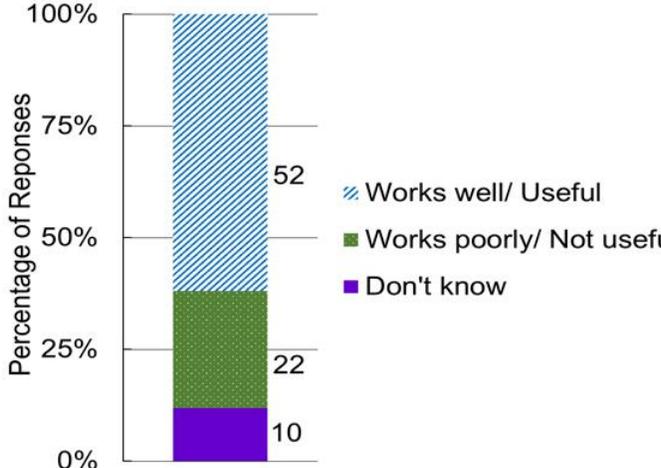
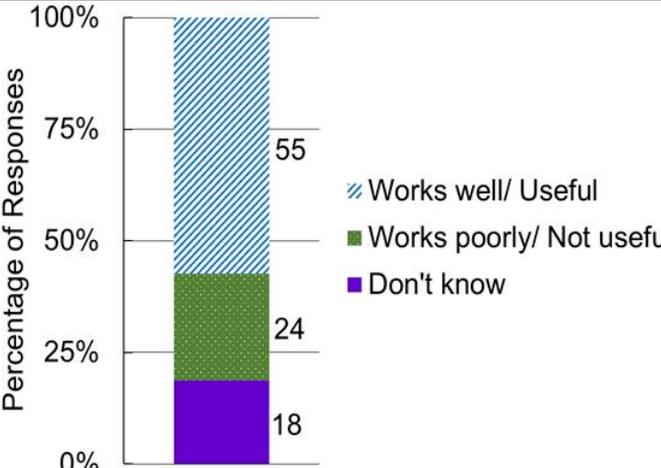
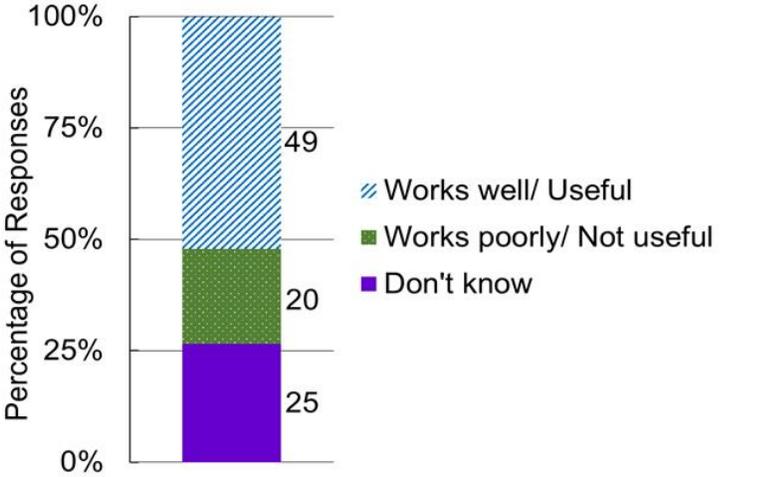
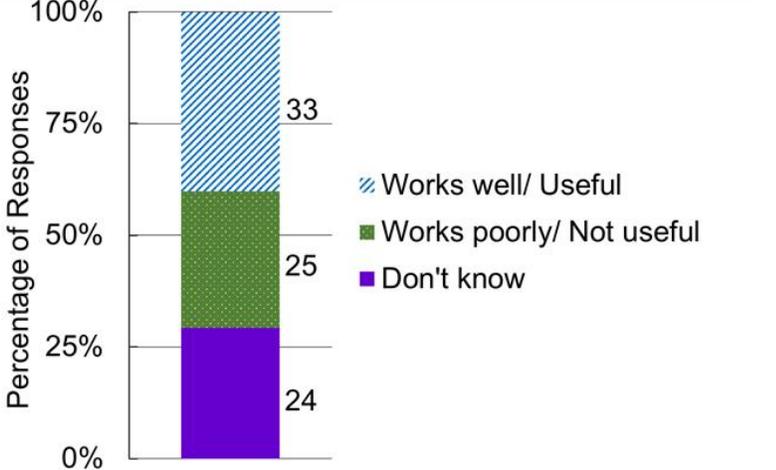
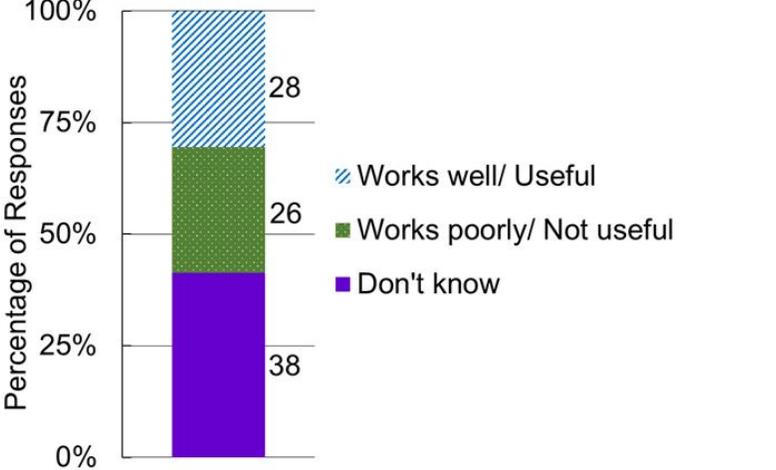
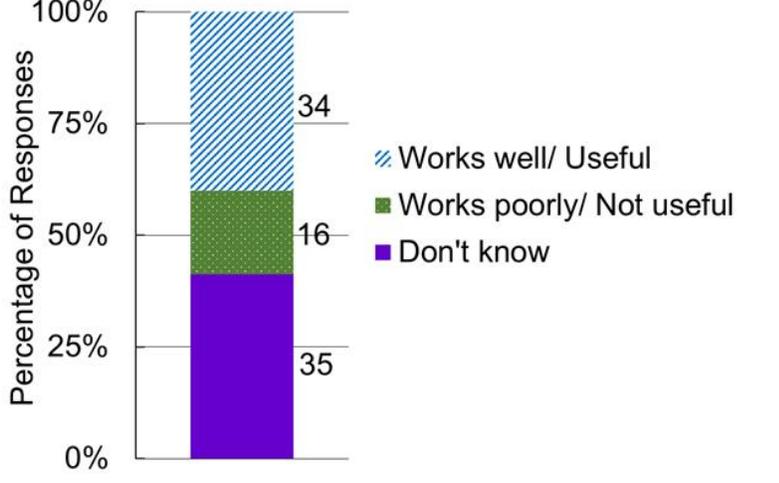
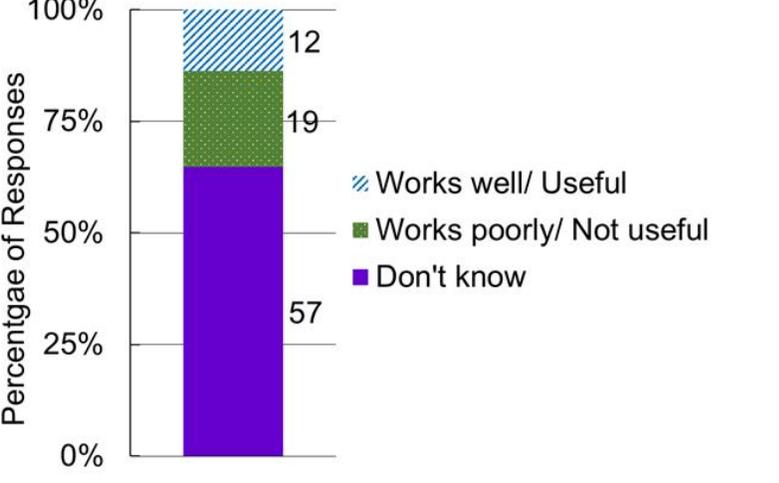


Figure 3. Length of involvement with IEP.

Table 1. Graphical summaries for each question in the questionnaire.

Question	Responses								
<p>Q1: Rate how well IEP works as a synthesizer of information about the Delta and its ecosystem on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>A stacked bar chart showing the distribution of responses for Q1. The y-axis is labeled 'Percentage of Responses' and ranges from 0% to 100% in 25% increments. The bar is divided into three segments: a bottom purple segment for 'Don't know' (9%), a middle green segment for 'Works poorly/ Not useful' (15%), and a top blue hatched segment for 'Works well/ Useful' (50%). A legend to the right of the chart identifies the colors: blue hatched for 'Works well/ Useful', green for 'Works poorly/ Not useful', and purple for 'Don't know'.</p> <table border="1"> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Works well/ Useful</td> <td>50%</td> </tr> <tr> <td>Works poorly/ Not useful</td> <td>15%</td> </tr> <tr> <td>Don't know</td> <td>9%</td> </tr> </tbody> </table>	Response Category	Percentage	Works well/ Useful	50%	Works poorly/ Not useful	15%	Don't know	9%
Response Category	Percentage								
Works well/ Useful	50%								
Works poorly/ Not useful	15%								
Don't know	9%								
<p>Q2: Rate how well IEP serves as a nexus for the analysis, synthesis, and translation of science on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>A stacked bar chart showing the distribution of responses for Q2. The y-axis is labeled 'Percentage of Responses' and ranges from 0% to 100% in 25% increments. The bar is divided into three segments: a bottom purple segment for 'Don't know' (10%), a middle green segment for 'Works poorly/ Not useful' (22%), and a top blue hatched segment for 'Works well/ Useful' (52%). A legend to the right of the chart identifies the colors: blue hatched for 'Works well/ Useful', green for 'Works poorly/ Not useful', and purple for 'Don't know'.</p> <table border="1"> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Works well/ Useful</td> <td>52%</td> </tr> <tr> <td>Works poorly/ Not useful</td> <td>22%</td> </tr> <tr> <td>Don't know</td> <td>10%</td> </tr> </tbody> </table>	Response Category	Percentage	Works well/ Useful	52%	Works poorly/ Not useful	22%	Don't know	10%
Response Category	Percentage								
Works well/ Useful	52%								
Works poorly/ Not useful	22%								
Don't know	10%								
<p>Q3: Rate how useful IEP's current products and efforts are to inform decision making and adaptive management on a scale of 1 (not useful) to 5 (very useful).</p>	 <p>A stacked bar chart showing the distribution of responses for Q3. The y-axis is labeled 'Percentage of Responses' and ranges from 0% to 100% in 25% increments. The bar is divided into three segments: a bottom purple segment for 'Don't know' (18%), a middle green segment for 'Works poorly/ Not useful' (24%), and a top blue hatched segment for 'Works well/ Useful' (55%). A legend to the right of the chart identifies the colors: blue hatched for 'Works well/ Useful', green for 'Works poorly/ Not useful', and purple for 'Don't know'.</p> <table border="1"> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Works well/ Useful</td> <td>55%</td> </tr> <tr> <td>Works poorly/ Not useful</td> <td>24%</td> </tr> <tr> <td>Don't know</td> <td>18%</td> </tr> </tbody> </table>	Response Category	Percentage	Works well/ Useful	55%	Works poorly/ Not useful	24%	Don't know	18%
Response Category	Percentage								
Works well/ Useful	55%								
Works poorly/ Not useful	24%								
Don't know	18%								

Question	Responses
<p>Q4: Rate how well IEP facilitates the provision of credible and relevant scientific information that supports management of the water supply and key ecosystem components in the Delta on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>Percentage of Responses</p> <ul style="list-style-type: none"> Works well/ Useful: 49 Works poorly/ Not useful: 20 Don't know: 25
<p>Q5: Rate how well IEP coordinates with its agencies/ programs to meet science and management needs in the Delta on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>Percentage of Responses</p> <ul style="list-style-type: none"> Works well/ Useful: 33 Works poorly/ Not useful: 25 Don't know: 24
<p>Q6: Rate how well IEP coordinates with other (non-IEP) agencies/ programs to meet science and management needs in the Delta on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>Percentage of Responses</p> <ul style="list-style-type: none"> Works well/ Useful: 28 Works poorly/ Not useful: 26 Don't know: 38

Question	Responses
<p>Q7: Rate how well the different organizational components of IEP work to produce and use science on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>Percentage of Responses</p> <ul style="list-style-type: none"> Works well/ Useful: 34 Works poorly/ Not useful: 16 Don't know: 35
<p>Q8: Rate how well institutional arrangements that support the interagency investment in IEP work on a scale of 1 (works poorly) to 5 (works well).</p>	 <p>Percentage of Responses</p> <ul style="list-style-type: none"> Works well/ Useful: 12 Works poorly/ Not useful: 19 Don't know: 57

VII. Acknowledgements

We thank the many people that we interviewed in the course of this review, those who completed the questionnaire, and especially those who provided detailed comments on their experiences with IEP. We also thank Dr. Steve Culberson and Ms. Stephanie Fong who were helpful throughout the many stages of this review and responsive to our requests for background information. Dr. Sakura Evans assisted with the design and analysis of the questionnaire. Catarina Pien and Madison Thomas, fellows from California Sea Grant, helped with the data analysis and visualization. We also thank Edmund Yu and the staff of the Delta Science Program for their assistance throughout the review process and for their help in putting together the final document. We also thank Dr. Steve Culberson and the State Water Contractors for their comments on the public draft.

VIII. Appendices

Appendix A. Description of Selected Interagency Research Programs

Appendix B. Comments Received from Questionnaire

Appendix C. Brown Bag Seminar on IEP by Lead Scientist and Panel

Appendix D. Interview Questions

Appendix A. Description of Selected Interagency Research Programs

Research programs supported by multiple agencies exist across the country. Their mandates, organizational structures, and governance processes differ, and from these differences the Delta ISB gained insights into IEP. Much of this type of material was also examined in the Science Enterprise Workshop conducted by the Delta Stewardship Council and USGS with input from Delta ISB. We approached this comparison with the underlying consideration that when multiple agencies agree to undertake research together through a formal administrative structure, that at least six things need to come together for the program to get underway and stay reasonably together for it to operate:

First, the agencies need to be in sufficient agreement on the environmental conditions that need to be scientifically better understood or monitored. An understanding of what needs to be done can change over time and the program can still stay together so long as sufficient agreement is formally maintained.

Second, the agencies need to come to sufficient agreement on the organizational structure that is appropriate to do the science. Organizational adjustments can be made so long as it is done as an agreement among the parties. The logic of the change and the agreement needs to be formal in nature. Too much informal organizational shifting can lead to later problems.

Third, the parties need to agree sufficiently on the processes that will determine which science gets done and how the organization is managed and decisions are made between board meetings.

Fourth, the agencies must sufficiently agree on how the costs of the interagency science effort should be shared. These are complex things to agree upon, complete agreement is never possible, and changes will occur without formal documentation.

Fifth, sufficient trust among the agencies is needed to make an interagency research program possible.

Finally, strong and effective leadership is needed for any organization to succeed that has a complex and broad mandate.

Over time, overarching goals can change and evolve and the agreements to meet these six conditions will need to co-evolve as well. New requirements for environmental monitoring have affected the earlier IEP agreements. Individual agency commitments can change with changes in local administrators or due to changes in national policies and missions. Trust waxes and wanes. Change is natural, and at various times interagency research program agreements need to be adjusted a little or changed dramatically to keep all, or at least a sufficient number of, agencies on board.

How the processes of doing collaborative science are organized can change under such circumstances, not because the existing organization was doing bad science or even the wrong science, but because a new structure will bring the above points together again that make interagency programs work more efficiently. The Delta ISB looked into the structures of other interagency research programs, but we did not do a formal analysis of whether or to what extent other programs have been able to maintain these five conditions.

Interagency Programs Examined

Southern California Water Resources Program (SCCWRP)

SCCWRP was formed in 1969 as a Joint Powers Agreement among the five largest metropolitan waste treatment agencies.¹⁸ Its purpose is “to enhance the scientific foundation for management of southern California’s ocean and coastal watersheds.” The original agreement has been expanded over the years to include additional waste treatment agencies, storm water management agencies, and regional, state, and federal regulatory agencies. There are now 14 member agencies supporting SCCWRP and providing representatives to serve on its governing board.

There are several key differences between SCCWRP and IEP. First, IEP exists simply as an interagency MOU from which any individual agency can easily exit, pulling its funds and scientists out of the program. SCCWRP was organized through a Joint Powers Agreement to be a separate Joint Powers Agency, a new governmental entity. While a Joint Power Agency can be dissolved by the agencies that agreed to it, the process is much more complicated. As a Joint Powers Agency, SCCWRP can hire scientists and direct science, purchase facilities, enter into agreements with other entities, and even sell bonds under its own authority. The agency member directors still have oversight, but they see SCCWRP as a separate entity.¹⁹ IEP’s lead scientist has little more than the authority of persuasive leadership. In short, SCCWRP member agencies found sufficient shared interest to make a long-term commitment to work together and transferred real authority in the process.

Puget Sound Ecosystem Monitoring Program (PSEMP)

PSEMP is the science advisory arm of the Puget Sound Partnership (the Partnership; see *Figure A-1*).²⁰ The Partnership is “the state agency leading the region’s collective effort to restore and protect Puget Sound. The Partnership brings together hundreds of partners to mobilize partner action around a common agenda, advance Sound investments, and advance priority actions by supporting partners.”

¹⁸ [SCCWRP website](http://www.sccwrp.org): <http://www.sccwrp.org>.

¹⁹ See: Cypher, Trish and Colin Grinnel. 2007. [Governments Working Together: A Citizen’s Guide to Joint Powers Agreements](#). Senate Local Governments Committee. California State Legislature. Sacramento, California. Available at: <https://sgf.senate.ca.gov/sites/sgf.senate.ca.gov/files/GWTFinalversion2.pdf>.

²⁰ [PSEMP website](https://www.psp.wa.gov/PSEMP-overview.php): <https://www.psp.wa.gov/PSEMP-overview.php>.



Figure A-1. An overview of the PSEMP network and coordinating bodies (also see link in Footnote 20). Image modified for accessibility.

The legislature established very broad goals of supporting human well-being through a healthy Puget Sound. The PESMP:

1. **Enhances coordination and promotes collaborative interactions** through a diverse network of monitoring partners and data users (including state, federal, tribal, local, academic, private, non-profit, and volunteer organizations). PSEMP provides a venue for communication, discussion, collaboration, and coordination across and between monitoring partners and data users.

2. **Provides collective guidance and recommendations related to monitoring** – to monitoring entities, management agencies and organizations, policy boards, and others. It does this primarily through collective discussion and deliberation, consensus building, coordination, and joint communication.
3. **Supports Assessment and Communication** – Compiling and evaluating datasets, reporting Vital Sign indicators, assessing effectiveness of actions, reporting and publishing monitoring results to improve understanding and inform decisions.
4. **Provides a service function** including publishing joint, multi-agency documents; compiling summary materials and technical assessments; identifying and seeking monitoring funding; as well as providing other technical resources and tools.

Decision Making Authority – The Steering Committee is composed of people nominated by others, or self-nominated, and approved by the Partnership. The Steering Committee creates its own by-laws, recommends revisions to its Charter (the Leadership Council endorses PSEMP's Charter), develops and approves its own work plans, and can provide non-binding guidance, findings, and recommendations to monitoring agencies/entities, technical and policy boards, the Science Panel, the Ecosystem Coordination Board and Leadership Council, technical work groups, and others.

Chesapeake Bay Program (CBP)

CBP was established by the US Congress in 1983 as part of the Chesapeake Bay Agreement (CBA), the first such national estuary program (*Figure A-2*).²¹ The Governors of Maryland, Virginia, and Pennsylvania, the Mayor of the District of Columbia, the Administrator of the USEPA, and the Chair of the Chesapeake Bay Commission signed the initial agreement which has been updated periodically and now includes Delaware, New York, and West Virginia. In 1987, parties to the CBA committed to a 40% reduction in nutrients going into the Bay. In response to an Executive Order in 2009, the USEPA in 2010 set maximum total daily loads for key nutrients and sediments. Agencies for each watershed to the Bay subsequently filed plans for meeting those limits. Congressional and Executive actions, and the possibility of additional ones, help keep the states working together.

²¹ [CBP website](https://www.chesapeakebay.net/discover): <https://www.chesapeakebay.net/discover>.

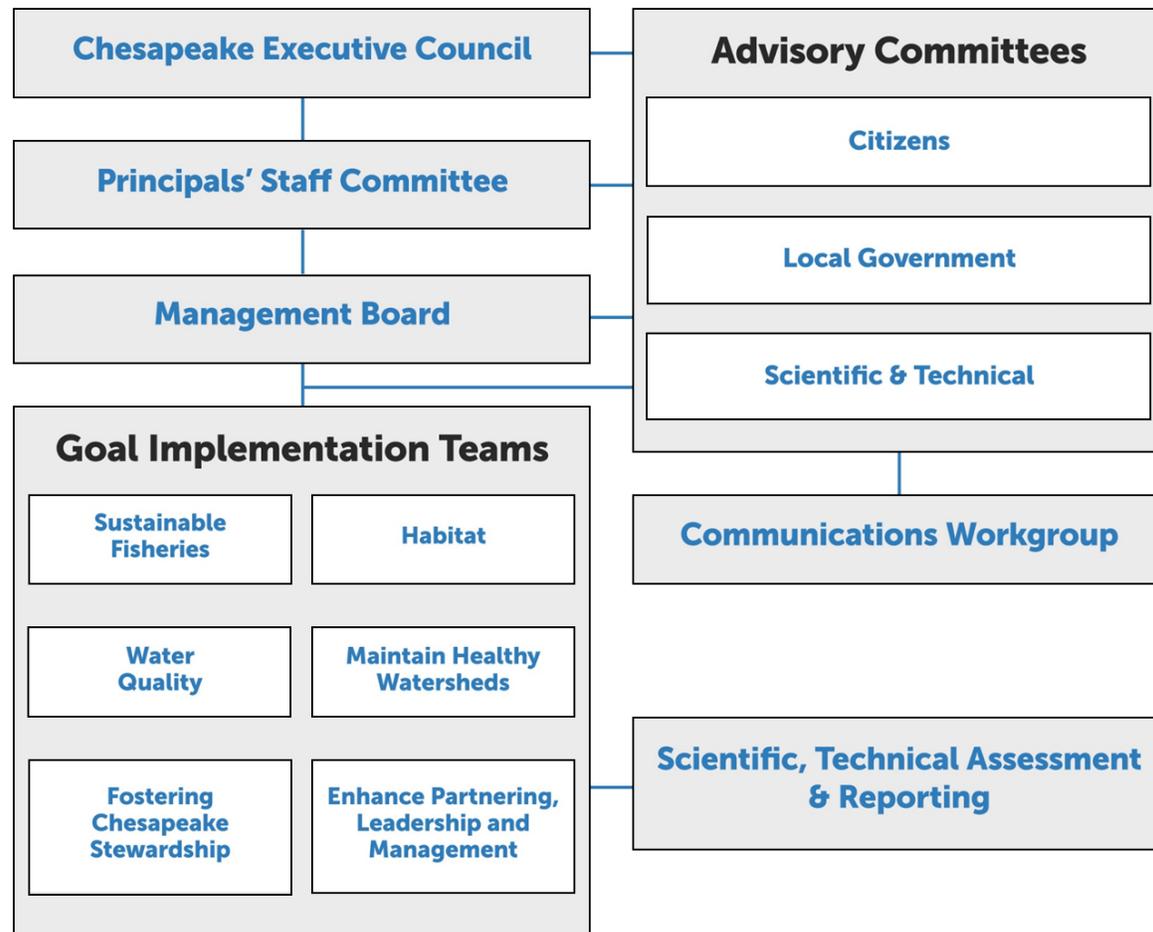


Figure A-2. Organizational chart for the CBP (also see link in Footnote 22). Image modified for accessibility.

The Chesapeake Executive Council consists of the governors to the agreement, the Mayor of the District of Columbia, the Administrator of the USEPA, and the Chair of the Chesapeake Bay Commission. Though it only meets annually, it has oversight and is accountable to the people to see that goals are met. The Principals' Staff Committee works between the Council and the Management Board, aiding the board in setting up the agenda of its meetings and helping see that the Management Board is fulfilling the Council's directives. The Management Board provides strategic planning and overall management of the Goal Implementation Teams. The organizational structure includes a Citizens Advisory Committee, a Local Government Advisory Committee, and a Scientific and Technical Advisory Committee (STAC).²² The STAC is surprisingly elaborate in its organization and operation (Figure A-3).²³

²² A clear rendition of the [CBP organizational chart and the responsibilities and meeting schedules](https://www.chesapeakebay.net/who/how_we_are_organized) of each group can be found at https://www.chesapeakebay.net/who/how_we_are_organized.

²³ [CBP STAC diagram](https://www.chesapeake.org/stac/who-we-are/): <https://www.chesapeake.org/stac/who-we-are/>.

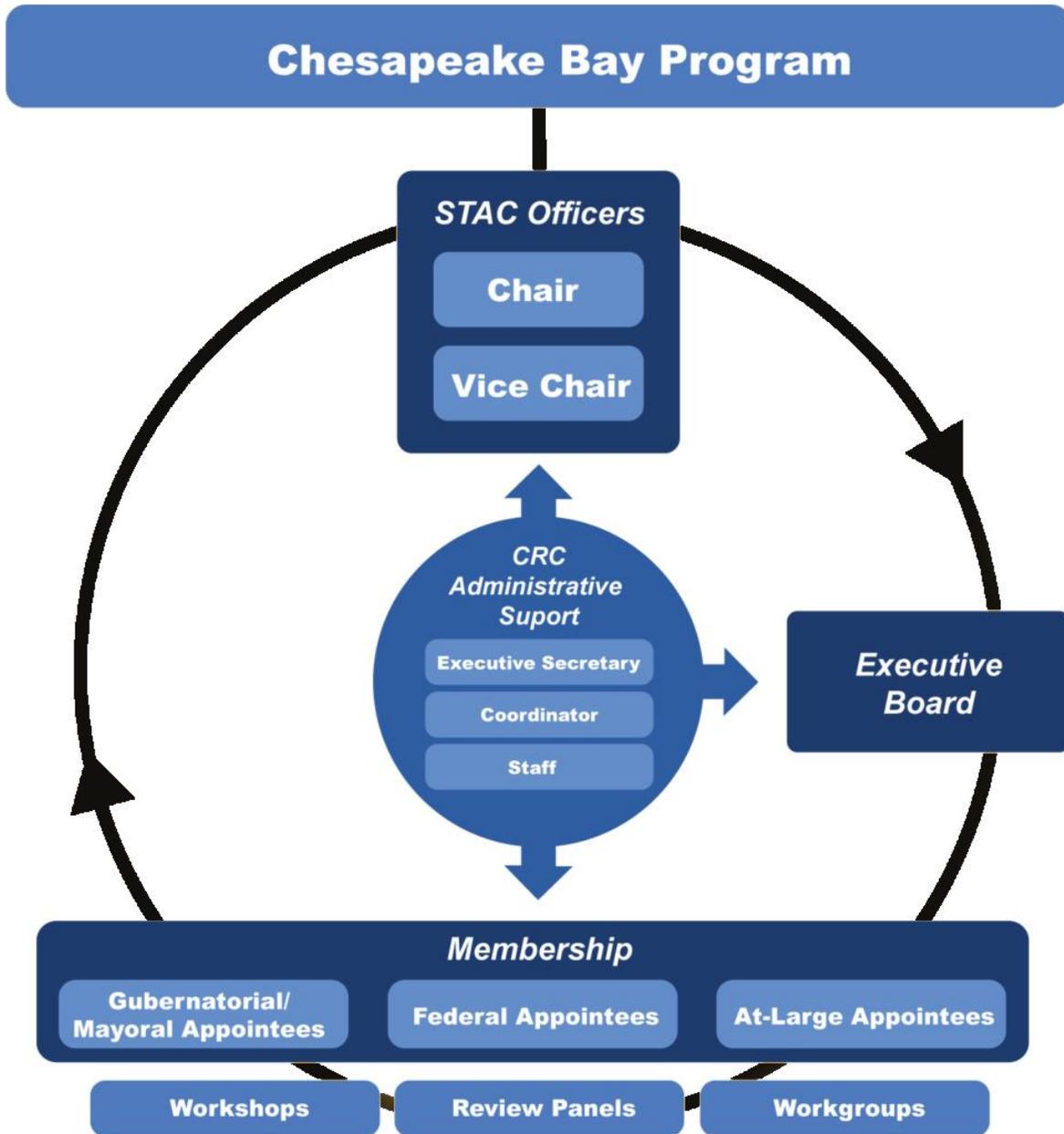


Figure A-3. Structural organization of the STAC for the CBP (also see link in Footnote 23). Image modified for accessibility.

CBP science is largely done through grants funded by a large number of agencies and NGOs. The Chesapeake Consortium of seven universities around the Bay undertakes research in the Bay and watershed, much of it funded through CBP. Numerous other agencies also participate in the science through the grant program. CBP provides leadership in coordinating and updating monitoring by various agencies. CBP also provides a forum and funding source for advancing improved modeling.

CBP has a “people’s” website that is written clearly, illustrated well, and easy to use. All the issues are nicely explained for laypeople, the public is encouraged to see the diverse sites of the Bay, and citizen-science is encouraged and facilitated.

The CBP is also different from IEP in clear ways. Reducing nutrients and sediments involves everyone in the basin. CBP works with citizens and local governments rather than brokering stakeholders. The Chesapeake Bay Consortium organizes seven research universities to work on the Bay.

Appendix B. Comments Received from Questionnaire

Below, we have included some of the over 400 individual written comments that we received in addition to the numerical scores in the questionnaire, according to the specific question asked. We have tried to select a variety of responses that reflect the breadth and depth of what the respondents indicated about IEP. We are including these because the Delta ISB feels strongly that they are valuable in terms of understanding the perceptions that scientists, managers, and stakeholders in the Delta have about IEP. We recommend that in addition to our findings and recommendations that these be given appropriate attention. Our topic descriptors are in italics and the responses are direct quotes in list format (bullets). Sub-bullets (open circles) refer to an additional comment by a responder to that question.

Question 1. How Well Does IEP Work as a Synthesizer of Information?

A diversity of opinions was expressed by the respondents in their written comments. For example,

- “IEP has done a good job increasing support for synthesis in the past few years, but we could always use more time and staff dedicated to analyzing and synthesizing existing data.”
- “The IEP has a long history of synthesizing data generated among state and federal agencies, and in partnership with academics and private industry. Evidence as recorded in IEP Technical Reports spanning decades, products from Project Work Teams, and materials generated for Water Board Hearings. The 2012 FLASH Report and 2014 Delta Smelt MAST Report are just recent examples of information synthesis. There is room for improvement and so the IEP has invested in synthesis teams, and pursuing open data and new data visualization tools.”
- “Some of the products that have come out of IEP synthesis efforts have been very effective: e.g., the SAIL effort, and the Delta Smelt MAST. Both have resulted in some valuable contributions.”
- “I see the IEP as a generator of data and scientific information. I don't necessarily see them as a synthesizer of science for the Delta. Individual scientists yes, but not the Program.”
- “While the IEP scientists would like to rank 5 on the scale, their agency priorities rarely allow for achieving their desires. In some years, they are more successful than in others, but generally, they are consumed by the emergencies of the day that prevent timely completion of synthesis products.”
- “IEP does an admirable job of synthesis despite poor support from stakeholder agencies.”

- “Past synthesis efforts have been largely descriptive/qualitative and have focused mainly on conceptual models. Although conceptual models are useful, I personally feel that its utility has been overstated within the IEP. I believe that having a more quantitative analyses in the synthesis effort would make the exercise more valuable and worthwhile, as you may be able to tease apart interactions and relative importance of habitat factors with higher confidence and precision.”
- “It's doing a great job in spite of lack of funds. Has had less of a presence over the past 4 to 5 years.”

There were also comments about how IEP needs to help decision-makers more.

- “Syntheses produced by the IEP are excellent for technical experts. The role of synthesis for decision makers seems non-existent.”
- “My experience on Project Work Teams is that researchers talk among themselves, which is useful, but that information is rarely if ever transmitted up the chain to inform decisions about monitoring programs or as a way to reflect on data gaps or if we are even collecting the information that is needed to answer relevant questions.”

Other helpful suggestions were made:

- “It seems to me the challenge with synthesizing information was described well by Louise Conrad at the 2018 IEP Workshop. She explained how many of these efforts to synthesize data by IEP (Delta Smelt MAST report, Drought Synthesis) are basically being done by agency scientists in their spare time because they do not have enough time to specifically allocate towards this effort.
 - It is not that I think there is a lack of desire to do more synthesis by IEP, but IEP could 'work better as a synthesizer' if there was a way to allocate more staff time towards this aspect of the work (in addition to the data collection). This would also help to speed up the learning process so that there is not such a lag between the events that inspire the synthesis and the lessons learned output for managers.”
- “With respect to Water Quality, the IEP should do a much better job of connecting with the Central Valley Water Board (e.g. Delta Nutrient Research Plan, Delta Methylmercury TMDL, CVSALTS, pesticides, CECs, dissolved oxygen) and the Delta RMP (nutrients, mercury, pesticides, pathogens, CECs).

- The IEP needs to more actively engage with regulated entities who are actively working to protect water quality. The IEP needs to move beyond its state and federal agency focus and more effectively integrate with other programs, especially those focused on management questions and regulatory policy development. The IEP should allow for public review and comment on their synthesis reports, to allow for broader scientific input and stakeholder inclusion.”
- “We have a number of positive efforts now that are supporting a growing synthesis program: Data Utilization Workgroup, dedicated synthesis staff, and a general recognition that synthesis is a key element of the program (in additional to long-term monitoring and research).”
- “IEP collects more data than it has staff and time to evaluate and publish. A lack of syntheses seems particularly true for data collected under different Project Work Teams (e.g., relationships between water quality, lower food web compartments, biogeochemistry, and habitats). Information produced by the MAST is likely great, but needs to reach a wider audience. Appropriately, IEP looks largely internally for information for its syntheses. The disadvantage of this approach is that information gathered by entities that are not part of the effort or known to the synthesis teams is not included.”
- “There are a number of elements that currently challenge us in achieving a more visible, active, and informative synthesis program that effectively communicates its findings to resource managers, stakeholders, and the general public:
 - Staff resources are still not enough. We have 4 positions. We need broader engagement in synthesis among the IEP agencies, and a clear (formal) synthesis leadership group that guides the program. The group needs to encompass dedicated positions for data stewardship, quantitative scientists capable of sophisticated statistical and predictive modeling, and staff dedicated to communication (IEP Lead Scientist is a key part of communications).
 - IEP needs a dedicated website: its own. Not one that is housed within another agency.
 - Synthesis efforts would benefit from staff having greater leeway to travel to conferences and travel out of state.

- I believe that synthesis efforts (which include scientific publications, reviews that compile existing information, short fact sheets summarizing IEP monitoring and research efforts, integrated and interactive data portals...synthesis takes many forms) are essential to many critical aspects of our science world within IEP, such as adaptive management and stakeholder engagement.
 - I think we have resources now to 1) plan and envision what a successful synthesis program for IEP would look like; 2) create a foundation for synthesis with integrated data platforms for melding datasets as necessary for specific synthesis topics; 3) tackle some discrete synthesis efforts. However, without additional staff we will have a hard time achieving the science communication efforts necessary to adequately inform management, and analyses will be difficult, if not impossible, to complete in a timely fashion for some adaptive management efforts.
 - Also, the IEP synthesis program will not be more broadly recognized (e.g. outside of the Delta system and California) without more targeted communication efforts.
 - I want to recognize that there are many highly skilled staff within the auspices of IEP. I think that if obtaining additional staff is not possible or can only be limited, another avenue for expanding the synthesis program is to leverage efforts and expertise of existing staff and (re)directing their efforts in a cohesive fashion towards enhancing synthesis and science communication, specifically. This would require a high degree of coordination among managers and supervisors across the program, under the guidance of the Lead Scientist.”
- “Synthesis to me would involve integrating diverse data across programs with models that answer questions about how a complex system works for the purpose of making decisions. Products such as the Delta Smelt MAST report provide some assistance for one way of looking at relationships conceptually. In general, the IEP does not stand up competing qualitative and quantitative models in a manner that might be useful in guiding actions and explaining outcomes.

- The IEP has not been able to address questions related to the Pelagic Organism Decline, the effects of clams, questions related to Delta Outflow, nor the relationship between water project operations versus other ecosystem drivers. Synthesis would require seeking to identify and monitor the mechanisms driving ecosystem dynamics.”

Question 2. IEP Serves as a Nexus for the Analysis, Synthesis and Translation of Science

Respondents noted that there is a need for broadening the scope of included activities (because)...

- “Delta issues are not only scientific, but also social, economic, and political issues. I don't think these latter considerations have been addressed adequately.”
- “IEP is a nexus of information generation informing management in multiple capacities, but only for what is included in its scope. The IEP is to inform management of the fisheries, water quality and hydrology impacts of the state and federal water project operations in the Delta. This includes a geographic scale of the Delta and downstream to San Francisco Bay. The IEP provides a framework for how the member agencies collaborate and how non-member agencies can participate.”
- “Regardless of the quality of the data, interpretation of it with respect to management goals always retains a certain amount of personal bias. I doubt there is any way to eliminate this. But one of the strong points of the IEP is that it has managed to retain the involvement of and input from a broad range of stakeholders with varied professional experience and allegiances that serve as a check-and-balance system on IEP's deliberations.”
- “IEP is really the sole collaborative conducting these type of analyses, and they do a reasonably good job of rigorously tackling pertinent questions in a timely manner.”
- “IEP does provide a venue for management to be exposed to relevant science if they so choose, however to my knowledge IEP does not actively engage with Management (or Policy) as much as it should.”
- “It works well as a nexus for science to inform decision making for fisheries and habitat management directly related to fisheries, but less well for other resource management decisions (e.g., water quality). It would also help if IEP were more cognizant of the wider range of management questions and information needs, in addition to the needs for flow and restoration that are related to Delta ecosystem protection and improvement.”

There are other opinions as well.

- “IEP does some of this, but IEP also acts as gatekeeper to control what studies get done and what gets reported. Again, protecting IEP "turf" often seems to be a higher priority than getting things right.”
- “The IEP communicates that sciences is occurring in the Delta, but the science conducted to date has been unable to guide management in a manner sufficient to inform policy (or IEP is poor at affecting policy that benefits native species).”
- “I agree strongly with IEP as a nexus for analysis & synthesis, but less agreement for ‘translation’ to managers. There is a need for dedicated staff for translation (communicator), but also need a connection to managers to understand what information is needed, in what format(s), on what timelines, etc. The transfer of knowledge needs to be more of a two-way conversation between IEP scientists and managers, rather than each party waiting for the other.”
- “IEP could improve translation by listening and developing a framework for addressing major issues for stakeholders and agencies, not be an institution for compliance science. IEP's nexus seems focused on the water projects, and there is considerably more programs, regulations, and stakeholders in the Delta than just the water projects.”

Several recommendations were provided.

- “The IEP needs to connect better with the Central Valley Water Board and the regulated community to provide an effective linkage to decision making and adaptive management, at least in the water quality arena.”
- “The IEP probably deserves a higher score for these if only considering its specific role. Suggest either clearly defining IEP's unique role/contribution, with clear depiction of other science/management/monitoring efforts and overlap (or not), or, expanding role to be comprehensive or at least significantly larger.
 - Consider wetland habitats, tidal marshes, floodplains, uplands including canals, creeks and associated riparian zones, and associated species and ecosystem functions - birds, reptiles, amphibians, invertebrates, transport, connectivity, nutrient supply, attenuation, contaminants, et cetera.
 - Are there others in the Delta and upstream/downstream that conduct science and management activities? Also consider explicit management needs.
 - For example, I looked at the word cloud in the science strategy but could not find the word management.

- Much of the time science is used to inform management, so having that transparent linkage, including what the managers are hoping to do with the information (e.g. generally the purpose of the science), would help plan, implement, synthesize, and translate the science for management action.”

One of the key issues facing IEP is the incorporation of adaptive management into their programs.

- “There is not an adaptive management plan for the Delta, or for IEP decision making. As noted above, MAST efforts to analyze and synthesize data are sporadic and ad hoc. Perhaps a closer look can be taken at the type, frequency, etc. of data collected to see if that can be scaled back or efficiencies in the collection of data so more resources can be used in the analysis and synthesis of the data.”

Question 3. IEP Products

Some comments were informative and provide good suggestions.

- “Monitoring efforts under IEP have certainly been useful. However, some of the most relevant questions cannot be answered with current monitoring. This issue has been discussed but there seems to be more importance placed on maintaining monitoring as it has been historically than change to something that might answer questions more directly but would not be comparable with previous methods.”
- “The IEP is very successful in conducting a broad monitoring program in the Delta, which produces critical data for decision making and adaptive management programs. However, IEP synthesis products could be structured in a manner that would more directly present adaptive management options for decision making and discuss the expected outcomes of different management strategies.”
- “The IEP has and continues to generate critically important information on the long-term trends of aquatic organisms and their habitat. The information generated is useful for management of the system, but management needs change and there can be delays in identifying new information. A big point to clarify is that science/monitoring provides information to management of the resource (e.g. outflow vs. exports), but managers contend with a suite of other challenges and inputs besides science (climate change, economics, politics, litigation, mandates, etc.) influencing resource management. In many cases, the information necessary has been generated, it just isn't used due to political pressure. There is a need for more predictive modeling. A complaint of the past is that our research includes retrospective analyses, but there needs to be more predictive modeling.”

There was also some criticism that the products provided are not useful for decision making.

- “IEP has, over the past few years, put a lot of effort into internal/programmatic reforms that have reduced resources for efforts that directly inform decision making. IEP has not directly funded studies since 2012 and this absence from the science funding realm has had a long term effect on IEP's role in the estuary.”
- “The data provided by the IEP is used in the absence of better information, but does not support decision making needs. Different monitoring programs are now used to provide information to assess fish populations and support water operations. In recent years, with USBR funding, the USFWS has implemented the Enhanced Delta Smelt Monitoring Program, the NMFS Science Center implemented SAIL, and water users have implemented Delta Outflow studies. The IEP processes have impeded implementation rather than assisted.”
- “I think the recent publication of the Tidal Wetland Monitoring Conceptual Models and Monitoring Frameworks, and progress on the Aquatic Vegetation Conceptual Model, has been useful. More product like these, as well as direct policy recommendations (via white papers?) may benefit the decision making process.”
- “IEP body of science is rigorous and defensible, but specific research could be focused on management needs with more guidance or connection with managers. What are management needs, and what are specific and/or critical science knowledge gaps? On what timelines is information needed? Specific position(s) dedicated to bridging the gap between scientists and management (e.g. IEP communicator and/or management-legislative liaison) across agencies would be helpful.”
- “The need of some key IEP products were pre-determined years in advance, then the MAST created a list of RFP topics to which only certain scientist applied due to expertise, thus rated high by the MAST, and funded. Sometimes the MAST members created the RFP list, applied for funding, and then funded their own or their staff's projects. Due to employee evaluation process, staff ensured that their results were looked upon favorably by upper management. There should be no bias in analyses or products.”

We received comments about the reduced rate of publications coming out of the program (e.g. in 2018 cf. 2017) and that other efforts are needed.

- “50 pubs per year don't make for a good story that those with their hands on the knobs can understand.”

We also received comments that a lack of research emphasis is not a problem, but that more funding would be needed to move into more basic research. The influence of the biological opinions on projects has also been emphasized as driving IEP into this direction. Some comments here and in later interviews suggested that the Delta Science Program may be a more appropriate agency to direct basic research through funding or establishing specific programs.

Question 4. IEP Structure

There is general agreement that the structure of IEP facilitates providing credible and relevant scientific information for water supply management and key ecosystem components of the Delta.

- “The IEP is a collaborative among state and federal agencies. It is the venue that agencies can come together and agree to the quality of science and management directives. I can't imagine a better way. The Pelagic Organism Decline is a case in point, for mobilization of effort and synthesis of information. And a point not well understood is that the IEP has evolved over time. Do look at Perry Herrgesell's "A Historical Perspective of the Interagency Ecological Program" and the MOUs over time. As to facilitation of information, it includes an organizational chart of scientists (Science Management Team), Coordinators, and agency Directors, Technical Teams (Smelt Working Group), along with engagement of the public in Project Work Teams, Stakeholder meetings, annual workshop, IEP Technical Reports and IEP Newsletter. Plus external reviews via the Science Advisory Group and panel reviews.”

But how IEP functions is often not clear to those not actively involved.

- “The complex structure of IEP may inhibit its ability to nimbly adjust to changing needs of managers and scientific advances.”
- “I think the structure and flow of information in IEP is pretty unclear to those that don't spend a lot of time in IEP. I'm not really sure there is a great solution. It is a collaborative organization but each member agency has different missions. This creates confusion.”

As with several of the questions asked, there were many comments about the role that the Directors of the IEP play.

- “The work performed by the IEP, and related discussions, do not reflect the primary issues that occupy a majority of the time spent by the Directors of the 5 water management and fisheries agencies. The IEP limits and isolates the participation by stakeholders and interested parties. The IEP responds poorly to the needs expressed by Directors and their representatives.

- A majority of the advancements are promoted from outside of the IEP and primarily use the IEP for coordination on permitting. IEP could potentially play a better role with more open and inclusive governance that solicits ideas and encourages participation by agencies, stakeholders, academia, private industry, and non-profits.”
- “The IEP Directors rarely act like a Board of Directors in the private or non-profit sectors would. More often than not, the Coordinators are not engaging the Directors in generative discussions and don't sufficiently translate the meaning of lots of individual publications in ways that enables the Directors to relate them to their decision-needs. I quote one Director: *We never know what ends up on the cutting room floor.*”
- “The structure of IEP (the Science Management Team, Coordinators, and Directors) gives a clear architecture for communicating science findings to decision-makers. I think more engagement from the Directors' level would improve the communication, though. From the Science Management Team perspective, there is a desire to communicate useful science to decision-makers but there is also the sense that the Directors don't always have enough time or bandwidth to engage. In that sense, the Science Management Team could also improve on its communication style to grab the attention of the decision-makers.”
- “The Directors have varied through time from uninvolved to domineering. Ideally, we would have more mutual education about what the science is uncovering and what long-term management issues are driving. The Pelagic Organism Decline analysis and response was one of the few times I saw this kind of science and management collaboration.”
- “We do pretty well, but we could stand to have more time for dialogue between the various groups of IEP, particularly between the Directors, Coordinators, and the Science Management Team. It does feel like there is a bit of a "disconnect" between managers working more "on the ground" and Directors, in terms of Directors understanding what the IEP monitoring and research program needs are and even what exactly programs do, and in terms of science managers understanding Director needs.”

Comments were also made on the role of the Lead Scientist in this regard.

- “I think this depends a bit on who is the Lead Scientist, and their perspective on what is ‘important.’ Turnover in this position in recent years has been significant, leading to changing emphases in the program.

- An alternative management structure might be one with a committee of senior personnel with the hat of "leader" being rotated on a regular basis (every 3 to 5 years)."
- "A significant proportion of IEP are old Delta hands that cling to old notions without questioning their validity, e.g., through delta conveyance. In addition, reports are structured to communicate within the IEP community rather than the general public. The reports are rife with jargon without definition."
- "USBR and DWR held the purse strings to CDFW and USFWS, so held inordinate influence. There is loss of institutional knowledge with turnover of personnel, consequently old battles are constantly being refought."

Question 5. IEP Coordination with its Agencies and Programs

Several comments were received about how well IEP coordinates with its agencies and programs to meet science and management needs in the Delta.

- "IEP is only as effective as its participants. There has been criticism of a smelt focus in recent years, to the exclusion of salmon and sturgeon issues. It is more the case that salmon and sturgeon agencies need to be encouraged to participate more. This is the waxing-waning of direction of a large and long-term program."
- "Coordination within IEP is pretty good, but I don't think it is meeting the science and management needs of the Delta well, because it is so Delta smelt centric and focused on entrainment instead of on recovery of listed species."
- "From the outside looking in, IEP seems less like a coordinated effort, and more like a balkanized collection of agencies with their own budgets, resources, interests, and focus."
- "Coordination within IEP for DWR, CDFW, and USBR seem to work for them but for other groups it does not seem to be well coordinated such as with efforts by USACE and SWRCB needing significant improvements in coordination."
- "Some arrangements work well, more recent and more emergent needs are still unmet. Occasionally, even basic infrastructure needs (fleet management, acoustic telemetry network) are woefully under-funded or -programmed."

Criticisms of IEP in this regard were mentioned as well.

- “IEP isn't really meeting the needs. I suspect that the organization has a fundamental conflict of interest that precludes adapting to meet science and management needs, but I don't really know. At face value, the investigators that rely on the IEP for permits are the same investigators that propose studies that compete for those same permits. Although an investigator may be recused on their specific study, the incentive remains to advocate against competing studies. It isn't clear what gate-keeping goes on to prevent studies from reaching the Director level and whether Directors would agree with the gate-keeping decisions.”
- “Upper IEP appears to be unresponsive and exclusionary.”
- “The IEP has successfully tracked and documented the slow death of the system over the last 40 years. So, perhaps it has met science needs, but the science certainly hasn't been used or hasn't been useable to prevent the step-wise decline of key ecosystem processes and functions through adaptive management actions.”
- “IEP seems to be led by a couple participants in the program. To improve coordination requires broader agency and program topics, regulations, and stakeholders. Improving internal coordination could occur through a broader Science Management Team, more emphasis on what framework synthesis and analysis occurs in (life cycle model, structured decision making, conceptual models), and clearer program and funding integration strategies among agencies.”

As reported in past reviews there are still issues in terms of how effective IEP is in communicating its findings and providing syntheses. Several respondents noted this and made comments, such as:

- “Production of relevant science is well established; communication of this is poor.”
- “There is a need for better communication across the agencies. From what I've seen as an outsider, this doesn't seem to be happening.”

Logistical issues also were mentioned as well.

- “IEP data among applicants and permitting personnel is considered the "go-to" source for current and nearly real-time data. The only drawback is that in recent years, due to equipment failure, surveys have been cancelled and that leaves a "gap" in available data and the confidence in the certainty of decisions based on that data.”

Question 6. IEP's Coordination with Non-IEP Agencies

Responses on this issue were strong in terms of both support for IEP and criticisms of IEP.

- “The IEP is one of the oldest functioning programs in the Delta. There are many places where the IEP engages others, such as workshops and Project Work Teams. Project Work Teams are open to the public. The IEP has become deft in generating processes to clarify its purpose and functions, but it cannot solve all issues for all problems. There must be clear scope, for IEP and others, then a Science Enterprise can include the IEP and other programs.”
- “Sometimes it does meet science and management needs, and more often it does not. It's difficult to do, since it takes intimate knowledge of and a high degree of "embeddedness" in each other's activities to be able to connect dots and create synergies. There are a few examples where it has worked (e.g. the benthic assessment program from the South Bay through the Delta), but there are generally insufficient human resources available to truly engage with non-IEP programs, and vice-versa.”
- “The level of engagement/coordination/partnership between the IEP and other programs (Central Valley Water Board, Delta RMP, CVSALTS, etc.) needs significant improvement. The IEP needs to revise its structure and processes to more effectively partner with other programs that have more diverse stakeholder representation at the non-state and non-federal agency levels. As previously noted for Question 1, the IEP should allow for public review and comment on their synthesis reports, to allow for broader scientific input and stakeholder inclusion.”
- “At this moment, I think IEP is very concerned and taking pains to ensure stakeholders are informed on our activities. While I think these efforts are important and need to continue, I think IEP would benefit more from increased effort in improving its own internal coordination than from working harder than it is now on stakeholder engagement.”
- “Better IEP coordination could help agencies and programs that have a small role in IEP (e.g., at the Project Work Team level) as well as those that are external. Suggestions for improved coordination: understand other programs' management questions that relate to protection of the Delta ecosystem. Also, share special study data more quickly (I'm particularly thinking of HAB data, because it is important in real time for human health).”
- “There is an on-going effort at better collaboration between IEP and other programs (e.g., CAMT/CSAMP), but this has been a weakness. There is overlap across programs and a need for better communication.

- For example, I don't know how much overlap there is between various IEP projects and Work Teams compared to the efforts that are now underway within CAMT or within other programs/organizations. It's not clear, how projects recently funded by Proposition 1 relate to ongoing IEP efforts. These are just examples where there probably could be better coordination.”

Recommendations made were often insightful.

- “First step would be to improve coordination of IEP participants with other parts of their own agencies. There also seem to be institutional barriers, such as the IEP decision-making process and funding mechanisms/cycle that might be incompatible with those of other groups.”
- “It's difficult to make a particular recommendation for IEP to improve external coordination because it's a two-way street and it seems that IEP has made more efforts on their end with the existence of Project Work Teams and IEP stakeholder meeting.”
- “Better organized meetings that seek stakeholder input earlier, instead of just telling stakeholders what was decided, would be useful. It seems this is not possible since it appears that within IEP, there is limited coordination...apparent balkanization of agencies within IEP.”

Question 7. IEP Organizational Components and Production and Use of Science

Some respondents were positive about the structure, often reflecting long involvement in the program.

- “I have been participating in the organization for many years. The structure is very sound, but only as effective as the participants. The IEP is extremely effective at the lower levels (Project Work Teams, Science Management Team), due in part to consistency in participation. Another point is that at lower levels, agency staff can “take off their agency hats” and be IEP. The turnover at higher levels (Coordinators, Directors), along with changes in State and Federal political directives, has reduced effectiveness at the higher levels. There are challenges to address, including “on-boarding” new participants.”
- “Some areas are strong. The Project Work Teams, for example have not had much impact/action in recent years and need to be strengthened/funded.”
- “I've worked with technical teams, Project Work Teams, as well as the Science Management Team; they all seem to work together well.”

There were some criticisms of the structure as well.

- “The structure of IEP has gotten a lot more rigid and hierarchical since I began participating in it in the early 90's. It seems to be working more smoothly now, but I also fear that it has lost some of the "no-holds-barred" aspect of the early years of the program.”
- “Because every step must move through so many different teams, it takes too long to get work plan elements in place. We cannot respond quickly to new opportunities.”
- “The filtering up from staff levels does not appear to work. The IEP should consider identifying and tracking priority issues from the Directors and then reporting back to Directors as a way of holding the IEP Coordinators, Science Management Team, Project Work Teams, and Principle Investigators accountable.”
- “It is not clear how decisions are ultimately made nor the responsible party or parties. In the recent Delta Outflow Study, decisions were made on the MAST team without input by the agency leads and to the exclusion of the agency responsible for the work.
 - It did not appear possible at the Director's meeting to direct inclusion of the Outflow study. There does not appear to be accountability or responsibility for or during a decision making process.”
- “I think the upper levels of IEP management aren't focused on the right questions. Generating science means you need to allocate some funds for new projects, not just projects that already have funding from monitoring. I also think DWR and USBR have more influence on what gets funded, than they should.”
- “Coordination and communication between the various IEP components often seems disjointed. As a result, IEP may not be as nimble as it should be.”
- “In theory, the structure exists to evaluate needs on the ground (Project Work Teams) and communicate those needs up the chain (Coordinators).
 - In practice, the Project Work Teams are fairly isolated and focus on the interests of those that attend. Some Project Work Teams have defined work products (e.g., winter-run Project Work Team), which makes performance evaluations easier.”

Once again, there were comments on the role of the Directors.

- “In the recent past, few of the truly difficult issues have been resolved by the Directors, and there is a perception that the IEP is too much of a Rube Goldberg contraption to work efficiently or be responsive in the time frame that is often needed.”
- “Monitoring, directed research, and synthesis staff have a very good working relationship that facilitates a lot of quality science. Often, if there is a disconnect, it occurs between the Directors/Coordinators and the Management Team.”
- “The higher management layers do not always see the value of their involvement and invest their time elsewhere often. The Project Work Teams attract people solely because they see value and so are often quite productive. The Science Management Team and Technical Teams are somewhere in between -- they see the value and do good work, but still get squeezed by more urgent or better defined responsibilities.”

Several useful recommendations were provided.

- “I suggest that an expert, or panel of experts on organizational structure/governance be brought in. Lots of moving parts within IEP, not sure it really is efficient, or that they really work together with a common vision/set of goals and objectives. Also, as noted above, the true Delta Science Plan, identifying the key uncertainties and management questions to be addressed, along with which agency is addressing that question and how, would be useful.”

Question 8. Institutional Arrangements Supporting Interagency Investment

Various reasons were given reflecting why most of the respondents didn't know or did not agree that the institutional arrangements of IEP support the interagency investment in the work of IEP.

- “The IEP is a confederation at best. Each contingent seems to be holding to their interests rather than acting with a common vision.”
- “Doesn't encourage collaborations outside IEP member agencies.”
- “USBR is responsible for most of the federal share of costs (about half), but most of the work is performed by other entities. The IEP is extremely costly and does not appear to have measures for regular review and improvements to cost effectiveness and efficiency. There does not appear to be a mechanism to evaluate legacy monitoring and to propose improvements or discontinue programs in order to free up resources for new efforts.”

- “The institutional arrangement for funding most of the work comes from water project operations (DWR and USBR), as they have authority to charge those that benefit from the resource (water contractors) and thus pay for the monitoring of impacts. The issue in recent years is that there is no general "IEP" funds. Individual agencies are pursuing directed studies, with little to no funds available for the "IEP" to direct. IEP in the past has had funds, but the last PSP was in 2012. This creates a situation of individual agencies pursuing their pet projects and mostly compliance monitoring. Long-term monitoring is extremely valuable, but additional research is also necessary. Additional funds are necessary for the IEP to engage agency staff, academics, and private researchers to pursue science to address management questions.”

Some reasons were given for the high percentage of “don’t know” responses to this question.

- “I have no idea how IEP requests funds, how those costs are evaluated, where the funds to support IEP are derived, and what deliverables are attached to those funds. I assume all or a majority of funds are derived from purveying of water.”

Several comments related these results to funding difficulties.

- “Other than staff time there does not appear to be any discretionary funds for IEP which greatly handicaps its ability to address new and developing management needs.”
- “The budgeting and accounting requirements behind the various pots of money are an absolute nightmare in my opinion. The strings attached to the multiple pots of money are a true impediment to effectively and efficiently managing interagency investments, compared to other interagency networks that have more formal governance structures (e.g., SCCWRP, SFEI-ASC) and actual budgets that are contained in, and allocated from, a common pool.”
- “IEP's funding is planned on generally short timelines (1 to 3 years), and investment in multi-year studies has decreased over the recent years. Often there is a lack of coordination among IEP's primary funders as well, with projects getting funded prior to IEP involvement.”
- “I think that the IEP should make the institutional arrangements that support the IEP transparent and clear to all because it isn't. Many folks think that there is a pool of IEP money to which various entities contribute funds, and that decision making around the expenditure of this pool of funds is done by the IEP Directors as a body, as informed by the IEP Coordinators and Science Management Team.

- This is not true. Funds are allocated and spent by individual entities to support IEP efforts through decisions made by the appropriate individual(s) at that entity. The IEP as a body, through the Science Management Team, Coordinators and Directors, makes decisions on what will be included in that year's IEP Work Plan and on take for listed species when authorized by the fish agencies, but does NOT make decisions on funding. My understanding is that an individual entity that provides funding to support IEP could decide on its own at any time to pull its funding."

Some recommendations related to funding were expressed as well.

- "The IEP should look to leverage its monitoring investments through coordination with the Delta Regional Monitoring Program (RMP). The IEP should consider funding portions of the Delta RMP monitoring plan that overlap with the mission of the IEP. This would be a good way for the IEP to connect with management questions and regulatory policy development."

Several comments related to IEP increasing transparency in this and other questions.

- "Also, there needs to be more transparency about where the funds that support IEP programs are coming from. The state and federal water contractor agencies fund much of the IEP activities."
- "I am generally aware that water contractors provide funding for monitoring and studies to comply with Water Rights and Biological Opinion decisions. It is not clear how detailed decisions about monitoring, special studies, and modeling are made each year to comply with the decisions. It is also not clear how much direction the regulatory agencies give on an annual basis for specific studies or data reviews."

Once again, communication was identified as an issue.

- "This seems to be a major challenge for IEP. The relationship among the various agencies is not strong and the communication seems to be pretty weak. They seem to avoid discussion of institutional issues and just try to keep things moving along rather than actually addressing this lack of communication and collaboration. Seems like there is a real need for some facilitated discussion to address these institutional issues. This is not to say that IEP should break apart -- on the contrary, it provides very valuable data collection and synthesis, and needs to be maintained/strengthened. There is a need to reassess how to improve communication within IEP and to link it more effectively to other programs."

- “IEP has been at the forefront of estuarine research and monitoring in the Bay Delta for 40+ years. IEP's continual growth, size, and complexity requires elaborate bureaucratic process that is confusing for member agencies and stakeholders. It would likely improve efficiency and transparency if IEP were separated into multiple smaller programs with clear objectives.”

An organizational comment was made as well.

- “Might the IEP function more efficiently with an empowered Executive Officer who answers directly to the Directors group?”

Question 9. Awareness of Business Practices Review

The Business Practices Review document was largely unknown by respondents, but some were aware.

- “It resulted in a suite of documents, including laying out governance framework, and is available online to the public.”
- “IEP has definitely become more transparent and is making improvements where needed. This was a tremendous step forward. The Review was resisted at many levels.”
- “Basic business practices have been achieved via appropriate program revision and response. Other multi-agency governance arrangements, cooperation and policy discussions are still dysfunctional.”

There were some positive responses to the review and some recommendations were made.

- “I feel IEP has incorporated most if not all of the recommendations from this review, as significant programmatic changes took place as a result from the review.”
- “Recommendations from reviews are healthy for bureaucratic organizations and IEP should conduct them on a regular basis.”

However, some negative comments were also received.

- “My impression is that IEP has made some changes for show (outreach, including stakeholders, etc.) but fundamental problems remain (insular, protecting turf, maintaining programs rather than making changes where needed, focused on protecting itself).”
- “I think IEP has made a good faith effort to improve business practices. Science Management Team now has schedules and written protocols for many of the things it does. Unfortunately, these get perceived as roadblocks when projects try to get on line quickly.”

Additional Comments Received

In addition to answers about the questions asked we received comments that were relevant to the IEP review. For example, in terms of the questionnaire, one respondent felt that the questions were not looking at IEP strengths and in response provided many good points.

- “This survey appears to be missing what I would consider as IEP strengths. The IEP appears to have reasonable performance and be well suited to serve as the implementation arm for monitoring and science priorities of the state and federal agencies. The over the shoulder review of experimental design has a lot of value to me. I could see the IEP coordinating study plans, boats, crews, and equipment. I could also see the IEP providing data as a service in making information broadly available in electronically accessible formats. The IEP appears weak when it comes to responding flexibly to the needs of managers in support of decision making. The IEP also appears weak when it comes to open processes that invite participation and investment by stakeholders. Maybe the IEP should not be trying to do collaborative synthesis nor set priorities for adaptive management. The structure of the IEP does not appear to have the modeling skill sets nor access to the perspectives necessary for institutional adaptive management and supporting decision making. This makes sense when thinking of the IEP structure as a bottom-up process of scientists setting priorities. Adaptive management and decision making on the scale, complexity, and politics of the Bay-Delta requires a top-down approach for policy maker to identify relevant priorities. I think it would be important to consider whether the IEP is really the right forum to tackle synthesis and adaptive management. There are alternatives better suited for this type of work, e.g. the CSAMP, the WaterFix Interagency Implementation Coordination Group, Central Valley Project Improvement Act Anadromous Fish Structured Decision Making, EcoRestore, and the Delta Science Program Structured Decision Making Pilot Project. These are all programs that have grown in the absence of IEP filling these adaptive management and decision support roles. A future IEP that focuses on its strengths in developing study plans and implementing data collection might be the best approach.”

Related to the above response,

- “The IEP includes some great scientists, and hosts long-term monitoring that are extremely useful. However, the IEP is not funding, soliciting, or coordinating scientific efforts to the degree necessary to be effective in managing the Delta. The member agencies tend not to coordinate well, as they remain in their own silos.

- In addition, different agencies have different agendas, resulting in tension and not working together enough to counter “combat science,” which remains a problem in Delta science.”
- “Although it is clear that the activities of IEP will always be needed in the Delta, and that some coordinating body will be needed, there was pessimism about the future of IEP related to current Delta activities. Past conflicts within the Delta and unforeseen changes resulting from WaterFix and other activities could precipitate changes to IEP funding in the future. However, we repeatedly heard that some group must coordinate activities, if not the IEP, because of the extensive compliance monitoring that is undertaken in the Delta. The continuation of collaborative efforts among personnel are clearly a key factor in the future of IEP.”

Some recommendations on increasing effectiveness were made.

- “To be truly effective, the IEP would have an independent review board, achieve consensus on science questions to pursue, and have sufficient money to deliver integrated work teams and pay them to work on selected questions. In addition, the IEP should be able to offer RFPs that solicit creative thinking from outside agencies, in such a way that other scientists from universities, consultants, or members can find new ways of working. The IEP also needs authority to develop, implement and follow both scientific projects and restoration efforts, in effect being able to use adaptive management: propose a hypothesis based on restoration ideas, implement the "experiment" (or restoration) and follow it to the results.”
- “Currently, the IEP is hamstrung by funding, authority and a truly integrative structure. They have done great things, and the community is better for their work; it is simply not sufficient to the task of restoring the Delta and greater SFE.”
- “IEP is a great idea, but is politically compromised by the water management agencies (USBR, DWR, and contractors), which should not be involved with contributing funding, submitting proposals, selecting studies, or influencing product outcomes.”

Again, the issue of the Director's involvement came up.

- “We don't see much engagement by the Directors in IEP. The processes and practices provide little opportunity for a feeling of agency ownership and interest in investment in IEP outside of permitting. The level of bureaucracy and process leads to a lack of flexibility and delays that is quite frustrating.

- I would be hesitant to invest more energy and responsibility into this entity given the bureaucratic inflexibility. At the same time, the individuals appear quite dedicated and work hard to do what they can within the confines of the IEP. I don't think the IEP is setup for success.”

Given that IEP has shifted from the original mission that it was started for (see Herrgesell 2012 in footnote 2 of main report), perhaps a reconsideration of its mission is necessary.

- “I think a revisit on the actual goals of the IEP would be beneficial. I think the IEP worked better years ago, when technical input on priorities was given to the Project Work Teams. Again, I think ecosystem health and recovery should be IEP's emphasis, not incidental take at the water projects. IEP's focus is too narrow in many cases.”

The question of Delta smelt take was also mentioned.

- “IEP appears to understand that permitting the take of species is a critical problem, but the IEP has not provided solutions. Information has to be developed from outside entities on alternative programs and approach that would provide similar information and would free both funding and take for science related activities relevant to decision making.”

IEP and its Role in Adaptive Management

Many of the questions elicited responses that were related to the role that IEP may play in the effective use of adaptive management in the Delta. The implementation of adaptive management has been a key concern of the Delta ISB and we have already prepared a report and a scientific article on this topic. Some concerns about how this may best be done included useful suggestions.

- “The IEP is very successful in conducting a broad monitoring program in the Delta, which produces critical data for decision making and adaptive management programs. However, IEP synthesis products could be structured in a manner that would more directly present adaptive management options for decision making and discuss the expected outcomes of different management strategies.”
- “There is not an adaptive management plan for the Delta, or for IEP decision making. As noted above, MAST efforts to analyze and synthesize data are sporadic and ad hoc. Perhaps a closer look can be taken at the type, frequency, etc. of data collected to see if that can be scaled back or efficiencies in the collection of data so more resources can be used in the analysis and synthesis of the data.”

- “Perhaps it has met science needs, but the science certainly hasn't been used or hasn't been useable to prevent the step-wise decline of key ecosystem processes and functions through adaptive management actions.”
- “IEP emphasis on compliance monitoring for water projects, but only for a segment of the Central Valley is a limitation to achieving holistic monitoring and research for adaptive management of species.”
- “The IEP also needs authority to develop, implement and follow both scientific projects and restoration efforts, in effect being able to use adaptive management: propose a hypothesis based on restoration ideas, implement the "experiment" (or restoration) and follow it to the results.”
- “Maybe the IEP should not be trying to do collaborative synthesis nor set priorities for adaptive management. The structure of the IEP does not appear to have the modeling skill sets nor access to the perspectives necessary for institutional adaptive management and supporting decision making. This makes sense when thinking of the IEP structure as a bottom-up process of scientists setting priorities.”

Synthesis could be of importance in improving adaptive management.

- “Adaptive management and decision making on the scale, complexity, and politics of the Bay-Delta requires a top-down approach for policy maker to identify relevant priorities. I think it would be important to consider whether the IEP is really the right forum to tackle synthesis and adaptive management. There are alternatives better suited for this type of work, e.g. the CSAMP, the WaterFix Interagency Implementation Coordination Group, Central Valley Project Improvement Act Anadromous Fish Structured Decision Making, EcoRestore, and the Delta Science Program Structured Decision Making Pilot Project. These are all programs that have grown in the absence of IEP filling these adaptive management and decision support roles. A future IEP that focuses on its strengths in developing study plans and implementing data collection might be the best approach.”

Several respondents mentioned that additional staff are needed for adaptive management to be effective.

- “IEP data constantly informs management -- e.g. Smelt Working Group, DOSS, Delta Cross Channel operations. As I mentioned above, we may have a harder time informing adaptive management efforts that have a specific turnaround time for synthesizing and analyzing a large amount of information (e.g. for restoration).”

- This is something we need more staff to do better...without additional staff we will have a hard time achieving the science communication efforts necessary to adequately inform management, and analyses will be difficult, if not impossible, to complete in a timely fashion for some adaptive management efforts.”
- “The long-term datasets are really great, but these datasets don't always get at the needs of decision making and adaptive management.”
- “The IEP needs to connect better with the Central Valley Water Board and the regulated community to provide an effective linkage to decision making and adaptive management, at least in the water quality arena.”
- “IEP products are sometimes criticized but they often still provide a solid basis for adaptive management. For example, IEP led synthesis efforts on Delta smelt and salmonids provided an important part of the foundation for the Resiliency Plans.”

Additional funding is needed for full incorporation of adaptive management as well.

- “Adaptive management has been difficult to get funding to keep the long-term historical monitoring and new monitoring going.”
- “To be truly effective, the IEP would have an independent review board, achieve consensus on science questions to pursue, and have sufficient money to deliver integrated work teams and pay them to work on selected questions. In addition, the IEP should be able to offer RFPs that solicit creative thinking from outside agencies, in such a way that other scientists from Universities, consultants, or members can find new ways of working.”

Better communication is important in establishing adaptive management as a regular practice in the Delta.

- “Providing meetings where data is synthesized and discussed with stakeholders, is helpful, especially in terms of making adaptive management decisions, as this is necessary to pass along the information to those who can use it appropriately.”
- “It has been rather difficult for rank-and-file scientists to recommend changes related to adaptive management to some long-term monitoring programs as they are held out of the conversations such as the IEP Science Management Team.”
- “Data dissemination can be improved to use in adaptive management.”

- “The new DWR-hosted IEP website has many issues, which IEP seems to be aware of. However, even the old website was missing a lot of information and updates. This makes it difficult for new hires and stakeholders to figure out the various organizational components of IEP and what they do. Project Work Team chairs that have left the positions for years were still listed on the old website, inactive Project Work Teams were still posted despite not having met for several years, minimal information on what the different aspects of IEP work with each other, etc.”
- “...without additional staff we will have a hard time achieving the science communication efforts necessary to adequately inform management, and analyses will be difficult, if not impossible, to complete in a timely fashion for some adaptive management efforts.”
- “The long-term datasets are really great, but these datasets don't always get at the needs of decision making and adaptive management.”

Appendix C. Brown Bag Seminar on IEP by Lead Scientist and Panel

Dr. Steve Culberson, the IEP Lead Scientist, provided a brief history and overview of IEP monitoring programs, and how they are coordinated to inform management on January 4, 2018.²⁴ His seminar provided historical context for the IEP and highlighted some of its accomplishments. He noted that the IEP has collected, analyzed, and synthesized environmental and ecological data from the San Francisco Estuary for more than 40 years with the goal of providing excellent science and more meaningful understanding of the San Francisco Estuary.

The IEP is comprised of six federal and three state agencies unified by a MOU to conduct and support collaborative science to inform water project operations. The nine agencies include: USACE, USEPA, USBR, USGS, USFWS, DWR, CDFW and the SWRCB. Funding for IEP is primarily provided by the following agencies: DWR (44%), USBR (34%) and CDFW (11%). Most of these funds are spent on compliance monitoring (50 to 60%), followed by directed studies (15 to 35%). The top investment areas for IEP in recent years are delta smelt (about 31% of funds), salmon (about 20% of funds) and water quality (about 18% of funds).

The multi-agency structure of IEP provides numerous opportunities for partners and stakeholders to participate in the process of identifying priorities and activities. IEP includes four tiers of advisors and a relatively complex governance structure:

1. Directors – responsible for identifying priorities and approval of the annual work plan
2. Coordinators Team – ensures that the work plan elements are relevant and coordinated
3. Program Support Team and Science Management Team – evaluates the plan for scientific rigor, efficiency, effectiveness and focus
4. Advisory groups, technical teams, project work teams – advise and implement the plan

Structures and policies are in place to engage the partner communities. For example, on an annual basis, IEP's work plan develops out of discussion with its partners. The process includes both the IEP Administrators as well as review by the Science Management Team. The IEP Coordinators ensure that the work plan elements are relevant and coordinated, followed by review and final approval by the IEP Directors.

²⁴ [Dr. Culberson's recorded seminar](https://www.youtube.com/watch?v=LTuaDabxtUI) can be found here:
<https://www.youtube.com/watch?v=LTuaDabxtUI>.

MOUs form the basis of IEP. These agreements brought IEP together initially and, at its core, IEP remains an entirely collaborative effort. It is collaborative in sharing space and data, as well as in the timely exchange of information. The effectiveness of the current institutional arrangement is based on the premise that the collective enterprise is worthy of investment. While there are many benefits afforded by this model, the arrangement also creates challenges resulting from different priorities and missions across the participating agencies.

The process used for developing the annual work plan offers opportunities for discussion and compromise but doesn't always satisfactorily address different expectations for IEP's mission and effectiveness across its agency partners. Differences in the levels of engagement and commitment across the partners create vulnerabilities for IEP and put its long-term stability and continuity at risk.

After the seminar, Dr. Culberson joined a panel with other key IEP personnel and stakeholders to discuss IEP science governance to help inform the Delta ISB's review on IEP. The panelists included: Steve Culberson (IEP Lead Scientist), Gregg Erickson (CDFW), Kaylee Allen (USFWS), Ted Sommer (DWR), Larry Brown (USGS – California Water Science Center), and Wim Kimmerer (San Francisco State University – Estuary and Ecosystem Center). The panelists were selected to represent different stakeholders and partners, including some who had familiarity with IEP over several decades.

Brown Bag Seminar/Panel Findings and Recommendations

Based on the seminar and panel discussion, the following findings and recommendations emerged, which were considered by the Delta ISB in its review:

1. **Finding:** Throughout its 40+ year history, IEP has benefited from the contribution of resources and broad perspectives from its partners and stakeholders. However, the current institutional arrangement is fragile.
 - **Recommendation:** New and existing commitments must be nurtured and strengthened to ensure that IEP continues to be effective and is able to evolve to meet the needs of its partners and the collective enterprise. Efforts should be made to restore the comradery that was fostered in the past by the IEP meetings held at Asilomar.
2. **Finding:** Complex organizations such as IEP create synergies between agencies and partners, enhance collaboration, and offer opportunities to leverage resources. However, misunderstanding and misalignment can arise when the needs and priorities of individual partners differs from those that benefit from the shared enterprise.
 - **Recommendation:** Effective communication and relationship building are essential for maintaining ongoing and future commitment from IEP's partners. Institutional arrangements that facilitate the ability to track and explain IEP activities are needed.

3. **Finding:** The collaborative nature of IEP results in an excessive number of meetings and demands on its staff.
 - **Recommendation:** Co-location of the agencies involved in IEP and/or co-location of field stations would assist in coordinating efforts between partner agencies and IEP.
4. **Finding:** IEP is a highly creative and nimble organization. It has risen to the challenge of addressing new and evolving areas of research and monitoring needs in the Bay-Delta throughout its history, but its resources are limited.
 - **Recommendation:** Mechanisms for meeting information needs from an expanded enterprise require regular re-evaluation, prioritization and commitment of resources.
5. **Finding:** The long-term data collected by IEP is a tremendous asset and a unique resource available to the scientific and management communities of the San Francisco Bay-Delta.
 - **Recommendation:** Improvements are needed to enhance IEP's ability to store, share, and synthesize this repository of information. New positions or funding opportunities aimed at synthesis activities could offer tremendous benefit to the scientific and management community.
6. **Finding:** IEP data have contributed to a high level of scientific productivity as measured in publications (e.g., ~ 50 manuscripts were produced using IEP data in 2017). However, publications don't serve all of IEP's partners.
 - **Recommendation:** IEP should consider additional products that enhance science communication and facilitate the translation of science to stakeholders, the public, and policy makers.
7. **Finding:** Relationships with IEP stakeholders should be strengthened.
 - **Recommendation:** IEP should improve its use of the IEP Stakeholder Group and increase engagement with stakeholder groups.
8. **Finding:** IEP experiences high turnover of staff and costs that arise from burnout and retraining. Success and promotion of individuals involved with IEP comes from within their specific agency rather than activities supporting the IEP collective.
 - **Recommendation:** The reward system for individuals involved in IEP should be re-evaluated so that reward and promotion consider contributions to both their home agency and the IEP collective. New resources are needed to replace positions that have been lost over time and to compensate staff adequately.

Appendix D. Interview Questions

Four sets of interview questions were used. Each was tailored to a specific individual's perceived knowledge and experience with IEP. As a result, there is overlap among different sets of questions.

Interview Questions #1

1. Please briefly describe your role and/or familiarity with IEP.
2. How well is IEP achieving its science, synthesis, service goal?
3. How well is IEP balancing academic and applied research to support management and decision needs?
4. Are IEP products and efforts meeting your expectations?
 - If not, how are they not meeting your expectations?
5. Would you agree that IEP's mission changed over the years? If so, in what ways?
6. Does IEP have a secure, long-term role in the future?
 - How can IEP maintain security and relevance?
7. How effective is IEP's communications and engagement plan for increasing coordination between participants, agency staff, and stakeholders?
 - If you are not familiar with this plan, how well does IEP coordinate with other agencies/ programs?
8. Would you agree that IEP's success is the result of being a bottom up organization?
9. To your knowledge, how well has IEP defined governance, and the roles and responsibilities of its participants?
10. How can IEP be more effective in the future?

Interview Questions #2

1. Please briefly describe your role and/or familiarity with IEP.
2. How well is IEP balancing academic and applied research to support management and decision needs?
3. Would you agree that IEP's mission changed over the years? If so, in what ways?
4. Is the IEP work plan an effective approach in achieving IEP's mission and goals?
5. Does IEP have a secure, long-term role in the future?
 - How can IEP maintain security and relevance?

6. How effective is IEP's communications and engagement plan for increasing coordination between participants, agency staff, and stakeholders?
 - If you are not familiar with this plan, how well does IEP coordinate with other agencies/ programs?
7. Would you agree that IEP's success is the result of being a bottom up organization?
8. How well has IEP defined governance, and the roles and responsibilities of its participants?
9. To your knowledge, how well has IEP prepared and documented specific business procedures and protocols for program activities?
10. Does IEP have a secure, long-term role in the future?
 - How can IEP maintain security and relevance?
11. How can IEP be more effective in the future?

Interview Questions #3

1. Please briefly describe your role and/or familiarity with IEP.
2. How well is IEP achieving its science, synthesis, service goal?
3. How well is IEP balancing academic and applied research to support management and decision needs?
4. Would you agree that IEP's mission changed over the years? If so, in what ways?
5. Is the IEP work plan an effective approach in achieving IEP's mission and goals?
6. Does IEP have a secure, long-term role in the future?
 - How can IEP maintain security and relevance?
7. How effective is IEP's communications and engagement plan for increasing coordination between participants, agency staff, and stakeholders?
 - If you are not familiar with this plan, how well does IEP coordinate with other agencies/ programs?
8. Would you agree that IEP's success is the result of being a bottom up organization?
9. To your knowledge, how well has IEP defined governance, and the roles and responsibilities of its participants?
10. From your past experience, how well has IEP prepared and documented specific business procedures and protocols for program activities?

11. How well has IEP implemented recommendations made from past IEP reviews, such as the reviews of IEP's Delta Juvenile Fish Monitoring Program and the Environmental Monitoring Program?
12. How can IEP be more effective in the future?

Interview Questions #4

1. Please briefly describe your role and/or familiarity with IEP.
2. Would you agree that IEP's mission changed over the years? If so, in what ways?
3. Is the IEP work plan an effective approach in achieving IEP's mission and goals?
4. How does the funding mechanism for IEP influence the achievement of its goals?
5. Is the 50-50 cost share for compliance matters between DWR and USBR an effective approach?
6. Does IEP have a secure, long-term role in the future?
 - How can IEP maintain security and relevance?
7. How effective is IEP's communications and engagement plan for increasing coordination between participants, agency staff, and stakeholders?
 - If you are not familiar with this plan, how well does IEP coordinate with other agencies/ programs?
8. Would you agree that IEP's success is the result of being a bottom up organization?
9. To your knowledge, how well has IEP defined governance, and the roles and responsibilities of its participants?
10. How well has IEP prepared and documented specific business procedures and protocols for program activities?
11. Are you aware of the Business Practices Review completed in 2015?
 - To what extent do you feel the IEP has followed the recommendations of the Business Practices Review?
12. How well has IEP implemented recommendations made from past IEP reviews, such as the reviews of IEP's Delta Juvenile Fish Monitoring Program and the Environmental Monitoring Program?
13. How can IEP be more effective in the future?

IX. Other Delta ISB Reviews

A review of IEP is just one of the programs or themes/topic areas that the Delta ISB has reviewed to meet its legislative mandate of providing oversight of the scientific research, monitoring, and assessment programs that support adaptive management in the Delta. Completed reviews are below and can be found on the [Delta ISB's products web page](http://deltacouncil.ca.gov/delta-isb/products): <http://deltacouncil.ca.gov/delta-isb/products>.

Restoration

Delta Independent Science Board. 2013. [Habitat Restoration in the Sacramento-San Joaquin Delta and Suisun Marsh: A Review of Science Programs](http://deltacouncil.ca.gov/docs/delta-isb-isb-products/delta-independent-science-board-final-report-habitat-restoration). Sacramento, CA. Available at <http://deltacouncil.ca.gov/docs/delta-isb-isb-products/delta-independent-science-board-final-report-habitat-restoration>

Flows and Fishes

Delta Independent Science Board. 2015. [Flows and Fishes in the Sacramento-San Joaquin Delta](http://deltacouncil.ca.gov/docs/delta-isb-s-final-report-flows-and-fishes-sacramento-san-joaquin-delta-research-needs-support). Research Needs in Support of Adaptive Management. Sacramento, CA. Available at <http://deltacouncil.ca.gov/docs/delta-isb-s-final-report-flows-and-fishes-sacramento-san-joaquin-delta-research-needs-support>

Adaptive Management

Delta Independent Science Board. 2016. [Improving Adaptive Management in the Sacramento-San Joaquin Delta](http://deltacouncil.ca.gov/docs/final-delta-isb-adaptive-management-review-report). Sacramento, CA. Available at <http://deltacouncil.ca.gov/docs/final-delta-isb-adaptive-management-review-report>

Wiens, J.A., J.B. Zedler, V.H. Resh, T.K. Collier, S.B. Brandt, R.B. Norgaard, J.R. Lund, B. Atwater, E. Canuel, and H.J. Fernando. 2017. [Facilitating Adaptive Management in California's Sacramento-San Joaquin Delta](https://doi.org/10.15447/sfew.2017v15iss2art3). San Francisco Estuary and Watershed Science 15(2). Available at <https://doi.org/10.15447/sfew.2017v15iss2art3>

Levees

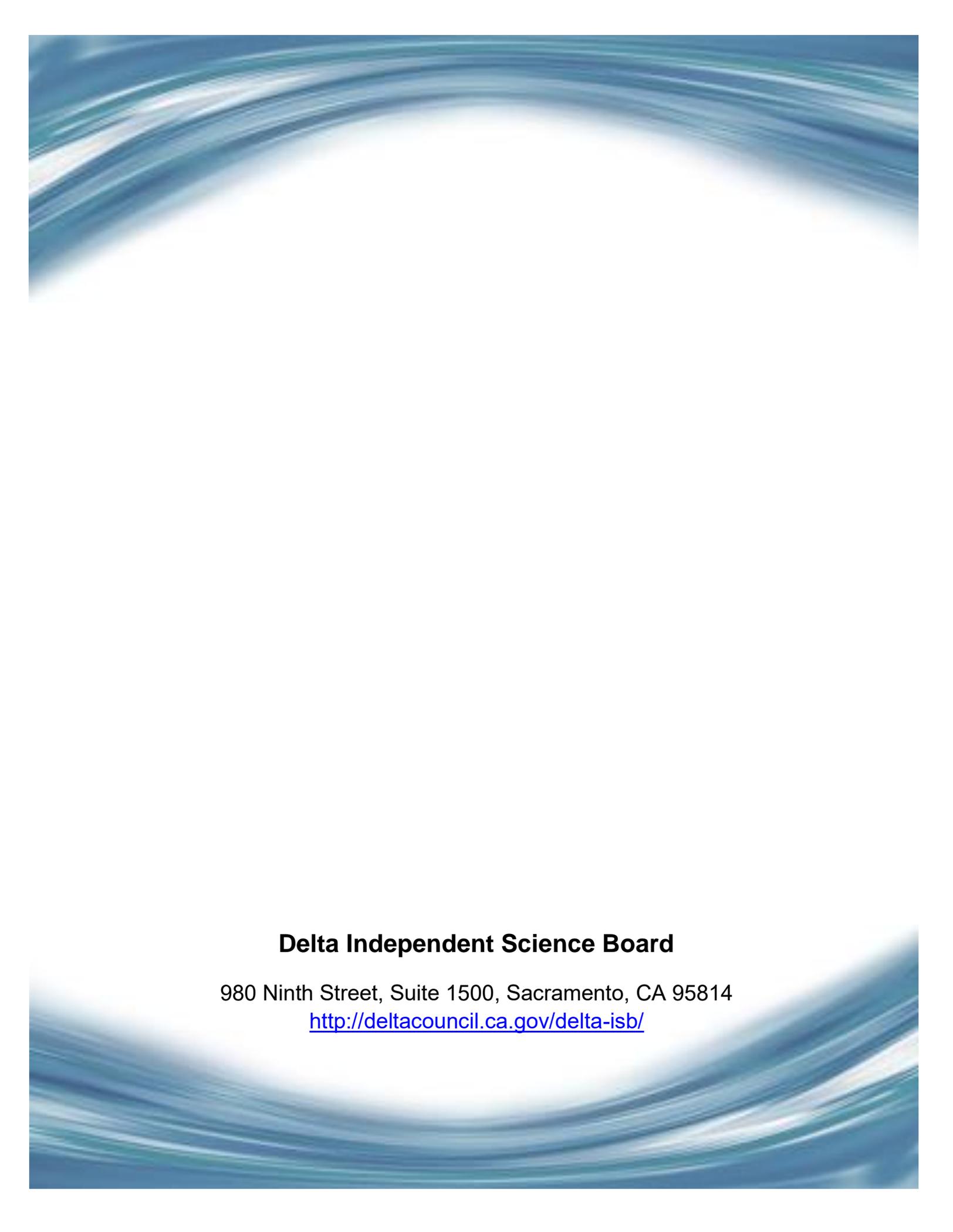
Delta Independent Science Board. 2016. [Workshop Report – Earthquakes and High Water as Levee Hazards in the Sacramento-San Joaquin Delta](http://deltacouncil.ca.gov/docs/delta-isb-isb-products-levee-levees-products/final-levee-workshop-meeting-report-v9-30-16). Sacramento, CA. Available at <http://deltacouncil.ca.gov/docs/delta-isb-isb-products-levee-levees-products/final-levee-workshop-meeting-report-v9-30-16>

Delta as an Evolving Place

Delta Independent Science Board. 2017. [Review of Research on the Sacramento-San Joaquin Delta as an Evolving Place](http://deltacouncil.ca.gov/docs/delta-evolving-place-final-v2). Sacramento, CA. Available at <http://deltacouncil.ca.gov/docs/delta-evolving-place-final-v2>



Delta Juvenile Fish Monitoring Program biologists count, measure, and collect tissue samples from juvenile salmon outmigrating from the San Francisco Bay-Delta. The tissue sample will be analyzed in a genetic laboratory to determine whether juveniles are winter, spring or fall/late-fall Chinook salmon. The program is funded and coordinated through the Interagency Ecological Program.



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