NSW Aquaculture Research Advisory Committee (ARAC)

- ARAC was established in October 2006.
- ARAC is a statutory committee that advises the NSW Minister on the amount of contributions payable by the NSW aquaculture sectors into trust accounts for aquaculture research, development and extension (RD&E) and the expenditure of those trust funds.

ARAC shares the NSW DPI vision:
‘Innovative primary industries in strong regional communities’

About this Plan

- This plan provides guidance for the development and implementation of RD&E in support of the NSW aquaculture industry.
- This RD&E plan was developed at an ARAC workshop on the 3rd May 2017 taking into account:
  - advice from aquaculture permit holders and other stakeholders, NSW DPI staff and Mr Peter Dundas-Smith AM;
  - the need for evidence based aquaculture policy development in NSW;
  - NSW Department of Primary Industries (NSW DPI) Corporate Plan;
  - Fisheries Research Strategic Plan 2014-2018;
  - National RD&E Strategy for Fishing and Aquaculture 2015-20;
  - Fisheries Research and Development Corporation RD&E Plan 2015-20;
  - other relevant plans or RD&E reviews; and
  - completed, current and planned RD&E and related activities
- At the workshop a number of topics were raised that did not require the creation of new knowledge, processes or technology but rather the extension of same to end-users. These topics have been included under the Adoption program.
- Highlighted in the plan are the RD&E priorities for each aquaculture sector.
- The plan will be used collaboratively by industry sectors and enterprises, research organisations, relevant government agencies and others working in support of the aquaculture industry.
- The plan recognises the competitive advantages held by NSW.
- The ARAC will review the plan each year (latest revision May 2017).
- Copies of this plan are available from NSW DPI, Port Stephens Fisheries Institute, ☏: 02 4916 3901, email: jo.pickles@dpi.nsw.gov.au or the website www.dpi.nsw.gov.au.
- During the consultative and development processes a number of priorities were identified that were not RD&E by nature, but rather related to activities that would nevertheless enhance the resilience and performance of the aquaculture industry, and importantly, better enable it to participate in the planning and execution of RD&E and the adoption of results. These ‘enabling’ priorities have, therefore, been included in this plan.
Plan framework

The framework is based on the ‘input – output - outcome’ model of investment. In this context:

- Inputs are the resources – in the form of people, expertise, materials, energy, facilities and funds – that research organisations and their partners use in activities to produce outputs.
- Outputs are the goods and services – mainly knowledge, processes and technology – that research organisations and their partners produce for end-users.
- Outcomes are the results, impacts or consequences flowing from the adoption of outputs by end-uses.

RD&E investment performance

The ability to measure RD&E investment performance depends on the quantity and quality of available data. Further, it depends on the nature of the activity. For example, the performance of an activity with a strong public good component would be more difficult to measure (usually qualitative) than one with a strong private benefit component (usually quantitative). The key performance indicators (KPI) described below are a guide only to how performance could be measured. Ideally, such indicators with targets should be detailed in individual projects.

As indicated in the program framework below, the balance between the public good and private benefit components of RD&E varies between programs and priorities. As a general rule public good RD&E attracts a higher government investment than private benefit. Therefore, for RD&E with strong private benefit components to attract government investment, there needs to be evidence of market, institutional, technical, policy or political failure.

NSW competitive advantages

NSW is well placed to further develop an aquaculture industry that is domestically and internationally competitive. Its competitive advantages are:

- a subtropical-temperate climate that enables the selection from a wide range of species those that can compete in the marketplace;
- world class research capabilities including those that can be drawn from other states and territories and from overseas;
- Australia’s highest seafood consumption that enables near-to-market production;
- coastal infrastructure to support aquaculture;
- a Government policy platform that supports the sustainable development of aquaculture; and
- the foremost Australian state for seafood sales and transport infrastructure.
## Primary Production

Program outcome: Substantial increase in the sustainable production and value of selected aquaculture species.

<table>
<thead>
<tr>
<th>Outputs Knowledge, processes and technology relating to:</th>
<th>Sectoral Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molluscs (edible oysters, pearls, clams, abalone)</td>
<td>Freshwater Finfish (Murray Cod, Silver Perch and salmonids)</td>
</tr>
<tr>
<td><strong>Aquaculture sites</strong></td>
<td>1. Increase utilisation and protection of existing sites 2. Develop new sites (including for hatcheries)</td>
</tr>
<tr>
<td><strong>Production efficiency</strong></td>
<td>1. Develop lease and estuary management tools 2. Improve grading technology 3. Develop new site specific growing techniques 4. Promote concept trials of improved stock.</td>
</tr>
<tr>
<td><strong>Seed/fingerling supply</strong></td>
<td>Increase hatchery capacity and efficiency</td>
</tr>
<tr>
<td><strong>Breeding</strong></td>
<td>Improve genetics for disease resistance, faster growth, marketability and other traits</td>
</tr>
<tr>
<td><strong>Feed</strong></td>
<td>Improve broodstock feed</td>
</tr>
<tr>
<td><strong>Biosecurity</strong></td>
<td>Further develop stock movement protocols</td>
</tr>
<tr>
<td><strong>Aquatic animal health and welfare</strong></td>
<td>Improve aquatic animal health incident reporting and facilitate emergency preparedness</td>
</tr>
</tbody>
</table>

- **Encourage breeding technology development**
- **Improve broodstock feed**
- **Further develop stock movement protocols**
- **Improve aquatic animal health incident reporting and facilitate emergency preparedness**
- **Improve the process for ensuring APVMA approval for aquaculture chemicals**
- **Improve the management of threats to crustacea including whitespot virus and APHND-like virus**
### Sectoral Priorities

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Molluscs (edible oysters, pearls, clams, abalone)</th>
<th>Freshwater Finfish (Murray Cod, Silver Perch and salmonids)</th>
<th>Marine Finfish (Yellowtail Kingfish and Mulloway)</th>
<th>Other (crustaceans, echinoderms, polychaetes, algae)</th>
</tr>
</thead>
</table>
| Environment | 1. Reduce adverse impacts of aquaculture on the environment  
2. Mitigate adverse impacts of external influences (including climate change) on aquaculture  
3. Further develop Environmental Management Systems for all sectors | Determine the quality of discharge water from cage production and recirculation aquaculture systems | 1. Determine the environmental impacts of cage culture on surrounding environment  
2. Determine the impacts of cage culture on other wild populations (sharks, etc) | |
| Emerging species | 1. Investigate and develop polyculture opportunities  
2. Assess alternate species (risk management strategy) | Further develop offshore cage culture | Develop seaweed culture systems technology (including offshore systems) | |

RD&E under this program would be expected to have a strong public good component.

**Investment target:** 45%

**Key performance indicators:**

- Production. This relates to the level of increase in sustainable aquaculture production.
- Value. This relates to the level of increase in the gross value of aquaculture production.
**Post-harvest and Market Development**

Program outcome: Increased demand and access to premium markets for Australian aquaculture seafood; fulfilment of consumer demands for safe, high-quality, nutritious seafood products; and increased profitability throughout the value chain.

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Sectoral Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge, processes and technology relating to:</td>
<td></td>
</tr>
<tr>
<td><strong>Product development</strong></td>
<td>1. Develop market opportunities for low grade/value products</td>
</tr>
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<td></td>
<td>2. Develop uses for production and processing waste</td>
</tr>
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<td></td>
<td>3. Develop value added ready to use products that meet consumer demand</td>
</tr>
<tr>
<td></td>
<td>4. Improve product handling throughout the supply chain</td>
</tr>
<tr>
<td><strong>Market development</strong></td>
<td>1. Improve consumer knowledge and expectations</td>
</tr>
<tr>
<td></td>
<td>2. Develop market opportunities</td>
</tr>
<tr>
<td></td>
<td>Develop a toolbox of oyster provenance marketing</td>
</tr>
<tr>
<td><strong>Retailer and food services sector knowledge and skills</strong></td>
<td>Improve retailer and food services knowledge and skills</td>
</tr>
<tr>
<td><strong>Supply chain efficiency (and profitability)</strong></td>
<td>Improve supply chain processes and technology</td>
</tr>
<tr>
<td></td>
<td>Improve equitable value sharing throughout the supply chain</td>
</tr>
</tbody>
</table>

*high priority*
RD&E under this program would be expected to have a strong private benefit component.

Investment target: 20%

Key performance indicators:

- Consumption. This relates to the level of increase in consumption of aquaculture products.
- Consumer knowledge. This relates to the level of consumer knowledge of aquaculture products.
- Consumer satisfaction. This relates to the level of consumer satisfaction with aquaculture products.
- Market access. This relates to the level and effectiveness of access to domestic and international markets.
- Retailer knowledge. This relates to the level of retailer knowledge of aquaculture products.
- Profitability. This relates to the level of profitability throughout the value chain.
Communities

Program outcome: The community is knowledgeable and supportive of the aquaculture industry, the natural resources on which it depends and its economic and social benefits to Australia.

<table>
<thead>
<tr>
<th>Outputs Knowledge, processes and technology relating to:</th>
<th>Sectoral Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing community knowledge of the aquaculture industry and related natural resources</td>
<td>Molluscs (edible oysters, pearls, clams, abalone)</td>
</tr>
<tr>
<td>1. Utilise the results of study on the social and economic benefits of aquaculture to NSW</td>
<td>2. Continue to build-on the evaluation of the social and economic benefits of aquaculture to NSW</td>
</tr>
<tr>
<td>Inform the community of the positive role that oysters play in local ecology</td>
<td>Inform the community on the research results from the Marine Aquaculture Research Lease</td>
</tr>
<tr>
<td>Community involvement in ways that will benefit the aquaculture industry and related natural resources</td>
<td>Develop opportunities for the community to participate in a stewardship role with respect to the natural resources on which the industry depends</td>
</tr>
</tbody>
</table>
RD&E under this program would be expected to have a balance of public good and private benefit.

Investment target: 15%

Key performance indicators:

- Community Support. This relates to the level and effectiveness of community support for the aquaculture industry and the natural resources on which it depends.
- Community Involvement. This relates to the level and effectiveness of community involvement in the aquaculture industry and in protecting and rehabilitating the natural resources on which it depends.
People

Program outcome: The knowledge and skills of people in and supporting the aquaculture industry are developed and used to derive maximum economic, environmental, and social benefits for the industry and Australia.

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Molluscs (edible oysters, pearls, clams, abalone)</th>
<th>Freshwater Finfish</th>
<th>Marine Finfish</th>
<th>Other (crustaceans, echinoderms, polychaetes, algae)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership development among people in and supporting the aquaculture industry</td>
<td>1. Identify and support potential leaders and promote training opportunities eg. the Seafood Industry Leadership Program and afford them opportunities to become members of industry related entities and participate in industry meetings, forums, etc</td>
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<td>2. Encourage industry enterprises to undertake business management, media and other relevant training</td>
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<td></td>
<td>3. Encourage succession planning within industry enterprises</td>
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<tr>
<td>Vocational competence of people in and supporting the aquaculture industry</td>
<td>1. Encourage industry enterprises to ensure an appropriately trained and qualified workforce</td>
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<td>2. Encourage industry people to attend relevant conferences and to undertake study tours</td>
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<tr>
<td>Enhancing Academic Skills</td>
<td>Encourage education institution interest in aquaculture and foster educational opportunities for industry participants</td>
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</tbody>
</table>
RD&E under this program would be expected to have a balance of public good and private benefit.

Investment target: 10%  

Key performance indicators:

- People Development. This relates to the number and quality of people whose capabilities have been improved.
- People Advancement. This relates to the number of people who have succeeded in gaining leadership and other important positions in and supporting the aquaculture industry.
## Adoption

Program outcome: RD&E outputs are used in a way to derive maximum benefit from RD&E investment.

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Molluscs (edible oysters, pearls, clams, abalone)</th>
<th>Freshwater Finfish</th>
<th>Marine Finfish</th>
<th>Other (crustaceans, echinoderms, polychaetes, algae)</th>
</tr>
</thead>
</table>
| Extension of RD&E outputs | | | | 1. Provide advice on all relevant research outputs  
2. Provide advice on where to obtain information on completed, current and planned RD&E  
3. Provide advice on where to obtain advice of a non RD&E nature  
4. Undertake field days (Q&A) for aquaculture  
5. Develop a ‘one-stop-shop’ for knowledge brokering  |
| Facilitation of the adoption and (if appropriate) commercialisation of RD&E outputs | Continue the role of the OceanWatch oyster industry extension officer | | | Investigate the need for sectoral extension officers |
RD&E under this program would be expected to have a balance of public good and private benefit.

Investment target: 10 %

Key performance indicators:

- Extension. This relates to the level and effectiveness of the extension of R&D outputs.
- Adoption. This relates to the level and effectiveness of influence over the adoption of R&D outputs.
## Total production over past 12 years

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<tbody>
<tr>
<td><strong>Crustaceans</strong></td>
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</tr>
<tr>
<td></td>
<td>black tiger prawn</td>
<td>294</td>
<td>241</td>
<td>199</td>
<td>202</td>
<td>164</td>
<td>165</td>
<td>148</td>
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<td>287</td>
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<td></td>
<td>yabby (bait)</td>
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<tr>
<td><strong>Freshwater fish</strong></td>
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<td>112</td>
<td>104</td>
<td>114</td>
<td>111</td>
<td>111</td>
<td>86</td>
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<td>50</td>
<td>59</td>
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<td>68</td>
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<tr>
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<td>barramundi</td>
<td>26</td>
<td>13</td>
<td>16</td>
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<td>8</td>
<td>3</td>
<td>5</td>
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<td>19</td>
<td>85</td>
<td>177</td>
<td>205</td>
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<tr>
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<td>golden perch</td>
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<td>1</td>
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<tr>
<td><strong>Marine fish</strong></td>
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<tr>
<td></td>
<td>Murray cod</td>
<td>26</td>
<td>13</td>
<td>16</td>
<td>9</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>14</td>
<td>19</td>
<td>85</td>
<td>177</td>
<td>205</td>
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<tr>
<td></td>
<td>rainbow trout</td>
<td>218</td>
<td>196</td>
<td>217</td>
<td>130</td>
<td>144</td>
<td>149</td>
<td>168</td>
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<td>198</td>
<td>253</td>
<td>277</td>
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<td>silver perch</td>
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<td>301</td>
<td>232</td>
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<td>180</td>
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<td>240</td>
<td>190</td>
<td>149</td>
<td>195</td>
<td>246</td>
<td>254</td>
</tr>
<tr>
<td><strong>Marine fish</strong></td>
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<td></td>
<td>eel-long finned</td>
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<td>8</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>22</td>
<td>12</td>
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<td></td>
<td>mulloway</td>
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<td>81</td>
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<td><strong>Hatchery</strong></td>
<td>Fish &amp; crustaceans</td>
<td>7,186,420</td>
<td>6,576,493</td>
<td>6,524,467</td>
<td>6,350,078</td>
<td>6,539,286</td>
<td>5,812,934</td>
<td>5,243,234</td>
<td>4,558,873</td>
<td>4,675,770</td>
<td>4,786,802</td>
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<tr>
<td></td>
<td>Sydney rock oyster</td>
<td>doz</td>
<td>doz</td>
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<tr>
<td></td>
<td>Pacific oyster</td>
<td>384,409</td>
<td>285,043</td>
<td>192,827</td>
<td>215,675</td>
<td>201,328</td>
<td>250,467</td>
<td>178,443</td>
<td>283,854</td>
<td>208,646</td>
<td>101,514</td>
<td>372,935</td>
<td>468,294</td>
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<td></td>
<td>Triploid Pacific oyster</td>
<td>264,794 doz</td>
<td>362,086 doz</td>
<td>352,549 doz</td>
<td>333,545 doz</td>
<td>262,398 doz</td>
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<td>blue mussel</td>
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*Quantity not recorded here due to the range of lifecycles ie. fish fry, fish fingerlings, juveniles etc.*
## Total Value over Past 12 Years

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<tr>
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</thead>
<tbody>
<tr>
<td><strong>Crustaceans</strong></td>
<td>black tiger prawn</td>
<td>4,464</td>
<td>3,387</td>
<td>2,580</td>
<td>2,785</td>
<td>2,279</td>
<td>2,427</td>
<td>1,732</td>
<td>3,644</td>
<td>3,484</td>
<td>4,495</td>
<td>5,110</td>
<td>5,985</td>
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<tr>
<td></td>
<td>yabbly</td>
<td>362</td>
<td>214</td>
<td>133</td>
<td>130</td>
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<td>104</td>
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<tr>
<td><strong>Freshwater Fish</strong></td>
<td>barramundi</td>
<td>1,360</td>
<td>1,237</td>
<td>1,207</td>
<td>1,318</td>
<td>1,304</td>
<td>1,046</td>
<td>938</td>
<td>700</td>
<td>601</td>
<td>938</td>
<td>941</td>
<td>982</td>
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<tr>
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<td>golden perch</td>
<td>55</td>
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<td>5</td>
<td>12</td>
<td>4</td>
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</tr>
<tr>
<td><strong>Marine Fish</strong></td>
<td>murray cod</td>
<td>374</td>
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<td>331</td>
<td>173</td>
<td>142</td>
<td>61</td>
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<td>291</td>
<td>426</td>
<td>1,438</td>
<td>2,662</td>
<td>2,991</td>
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<tr>
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<td>rainbow trout</td>
<td>1,780</td>
<td>1,739</td>
<td>1,668</td>
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* Not available for confidentiality reasons (< 5 farms authorised to cultivate species). Species include: Australian Paraty (Paratya australiensis), Blue Mussel (Mytilus galloprovincialis), Brook Trout (Salvelinus fontinalis), Floodplain Mussel (Velesunio ambiguus), Moreton Bay Bug (Thenus australiensis), Mulloway (Argyrosomus japonicus), Pearl Oyster (Pinctada imbricata), Sea Lettuce (Ulva lactuca), Sydney Rock Oyster (Saccostrea glomerata; nursery cultivated) & Tube Worm (Diopatra aciculata).
Four leading species in total production over past 12 years

- Murray cod total production over past 12 years
- Silver perch total production over past 12 years
- Black tiger prawn total production over past 12 years
- Sydney rock oyster total production over past 12 years
Four leading species in total value of production over past 12 years

- **Murray cod total value of production over past 12 years**
- **Silver perch total value of production over past 12 years**
- **Black tiger prawn total value of production over past 12 years**
- **Sydney rock oyster total value of production over past 12 years**
Submit an RD&E idea to ARAC

Below is the one-page form giving you an opportunity to advise ARAC of the constraints on the growth of your business, sector or whole of industry and to convey your ideas on how these constraints may be addressed through RD&E. You can detach this page and email your submission to jo.pickles@dpi.nsw.gov.au or post to Jo Pickles, C/- ARAC, NSW Department of Primary Industries, Locked Bag 1, Nelson Bay, NSW, 2315.

<table>
<thead>
<tr>
<th>Proponent:</th>
<th>Provide your name and permit number (if applicable).</th>
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<tr>
<td>Need:</td>
<td>Describe the constraint(s) on the growth of your business, sector or the whole industry.</td>
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<td>Description:</td>
<td>Describe how your RD&amp;E idea would address the constraint(s).</td>
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<td>Outcome:</td>
<td>Describe the outcome you are seeking and, if possible, provide estimates of the potential difference it could make in terms of value or production.</td>
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<td>Scope of Impact:</td>
<td>Does your RD&amp;E idea have enterprise, sector, regional (eg. estuary), state or national significance?</td>
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<td>Level of Support:</td>
<td>Describe the level of support you have for your RD&amp;E idea.</td>
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