Foresighting to guide scientific investment and preparation for a disrupted future

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Why foresighting? Why strategic planning?

- Strategic planning
  - Planning by organisations or sectors aimed at improving the long-term effectiveness of operations. Commonly based on some form of macro-environmental analysis of social, technological and political trends, or scenarios which narrate internal and external drivers for future development

  - Quantitative – model-based, including forecasts
  - Qualitative – for complex systems
    - Visioning
    - Narratives
    - **Foresights**

Value of foresighting

- People
  - Training staff to be forward looking, nimble, proactive
  - Encourage wide reading and out of box thinking
- Organisation
  - Responsive to emerging trends
- Society
  - Is this the future you want?

Strategic Foresighting

‘a structured process for exploring alternative future states’
(Cook et al. 2014)

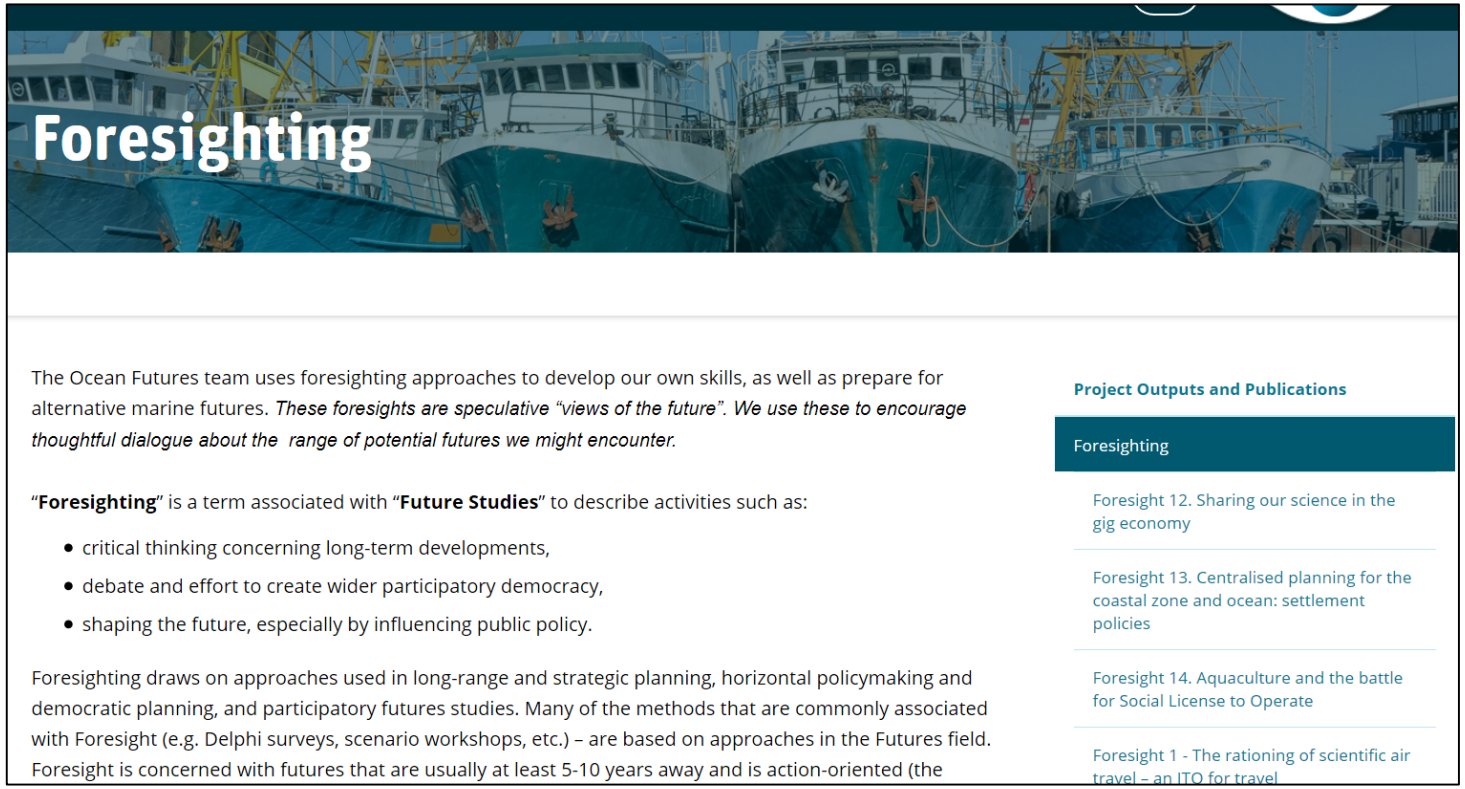
“**Foresighting**” is a term associated with “**Future Studies**” to describe activities such as:

- critical thinking concerning long-term developments,
- debate and effort to create wider participatory democracy,
- shaping the future, especially by influencing public policy.

Our method

- Repeatable approach, iterated in face-to-face discussion

- Recipe (3-4 pages)
  - Background info
  - Scenario(s)
  - Indicators (5-10)
  - Outcomes
    - Individuals
    - Science
    - Policy
    - Society



Two groups of foresights

Science in the 21st century

- relevant to the wider context of the scientific research endeavour

1. Rationing of air travel
2. Privatization of science
3. Trans-disciplinarity and participatory governance
4. Advances in automation & Artificial Intelligence (AI)
5. Social media as truth
6. Rise of populism
7. Sharing science in a ‘gig’ economy

Marine Resource Management

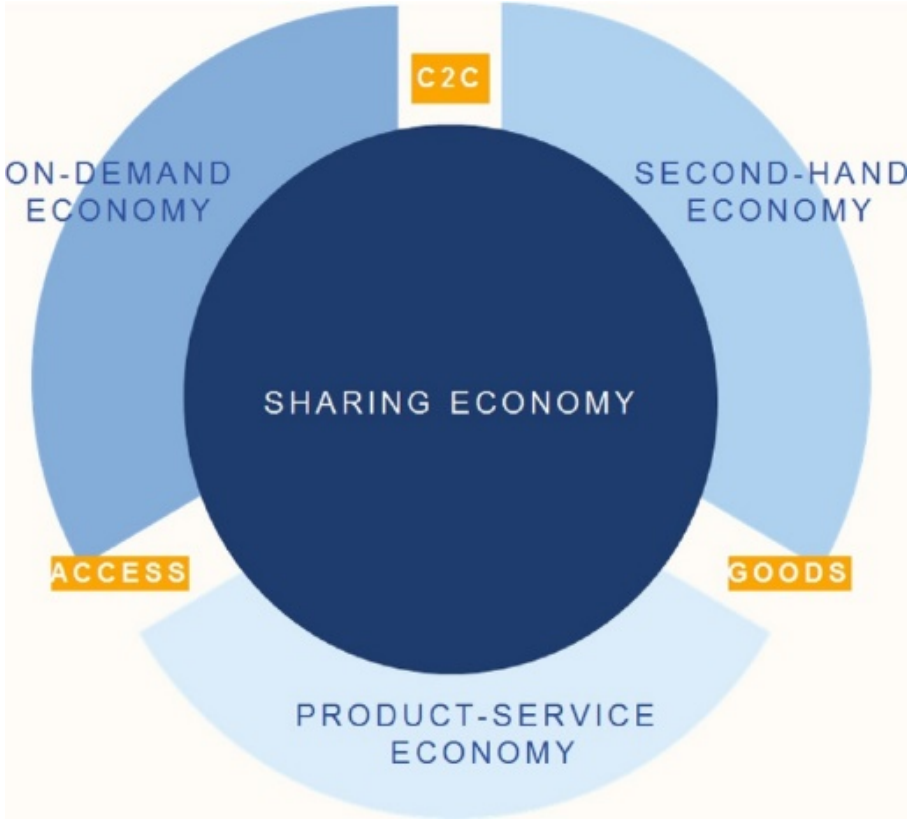
- relevant to the management of fisheries, aquaculture and biodiversity

1. Hi-tech precision fishing
2. Blue revolution
3. Rigid coastal planning & settlement policies
4. Aquaculture and social license to operate
5. Rise of ocean protection
6. Fast climate change
7. Energized conservation due to space travel

Example 1 – Science in the 21st Century

Science in the gig economy

- Will we outsource?
- Will there be a Uber equivalent?
  - As for coding jobs already



Indicators

1. Increase in use of casual staff on projects
2. Increase in individual research businesses – individuals offering “gig” services, such as editing, data entry, collection, and design.
3. Payments for citizen science – currently free – are demanded by citizens.
4. Development of a clearing house for the matching of workers to agency scientists (e.g. Turk)
5. Our colleagues begin to run their projects this way

Example 2 – Marine resource management

Rise of hi-tech precision fishing

- Increased sensorization of natural world
- Increased processing capacity
- Increasingly networked world

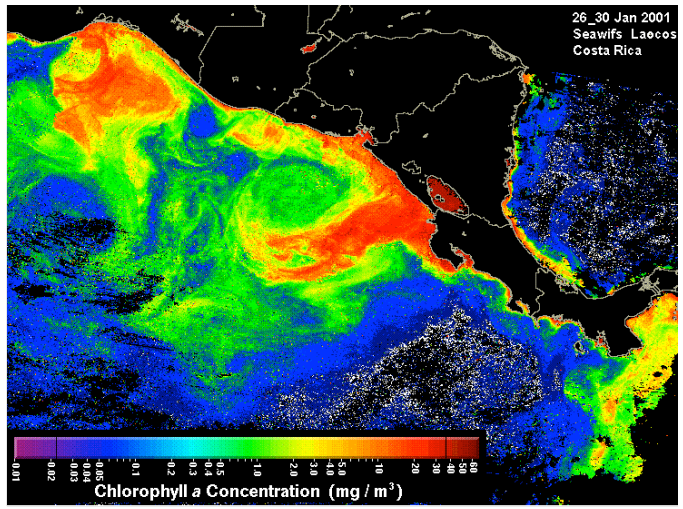
Indicators

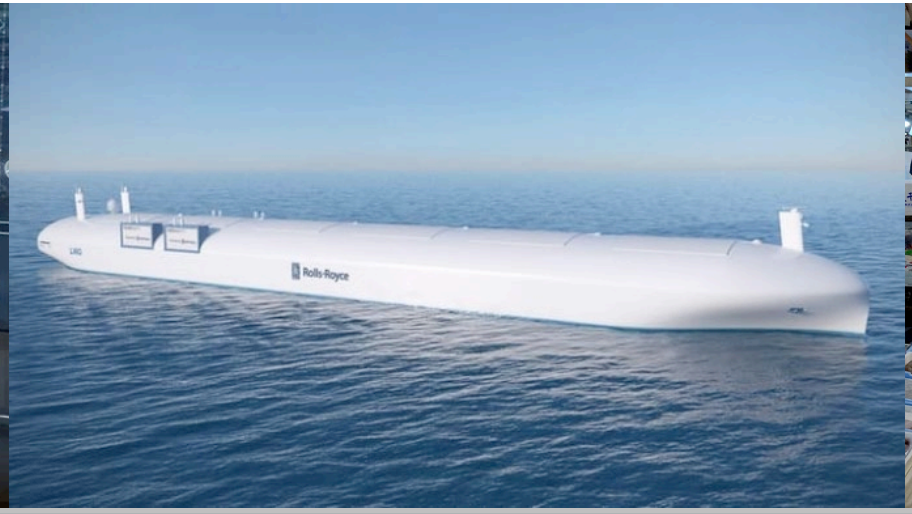
1. Number of fisheries managed by ITQs, catch shares or IQEs exceeds 25%
2. Nominal fishing effort (fishing power increases).
3. Nominal wild capture in Australia increases as bycatch decreases
4. Employment in the wild capture fishing industry declines 33%
5. Number of realtime (RT) or near real time (NRT) fisheries rises

Possible outcomes

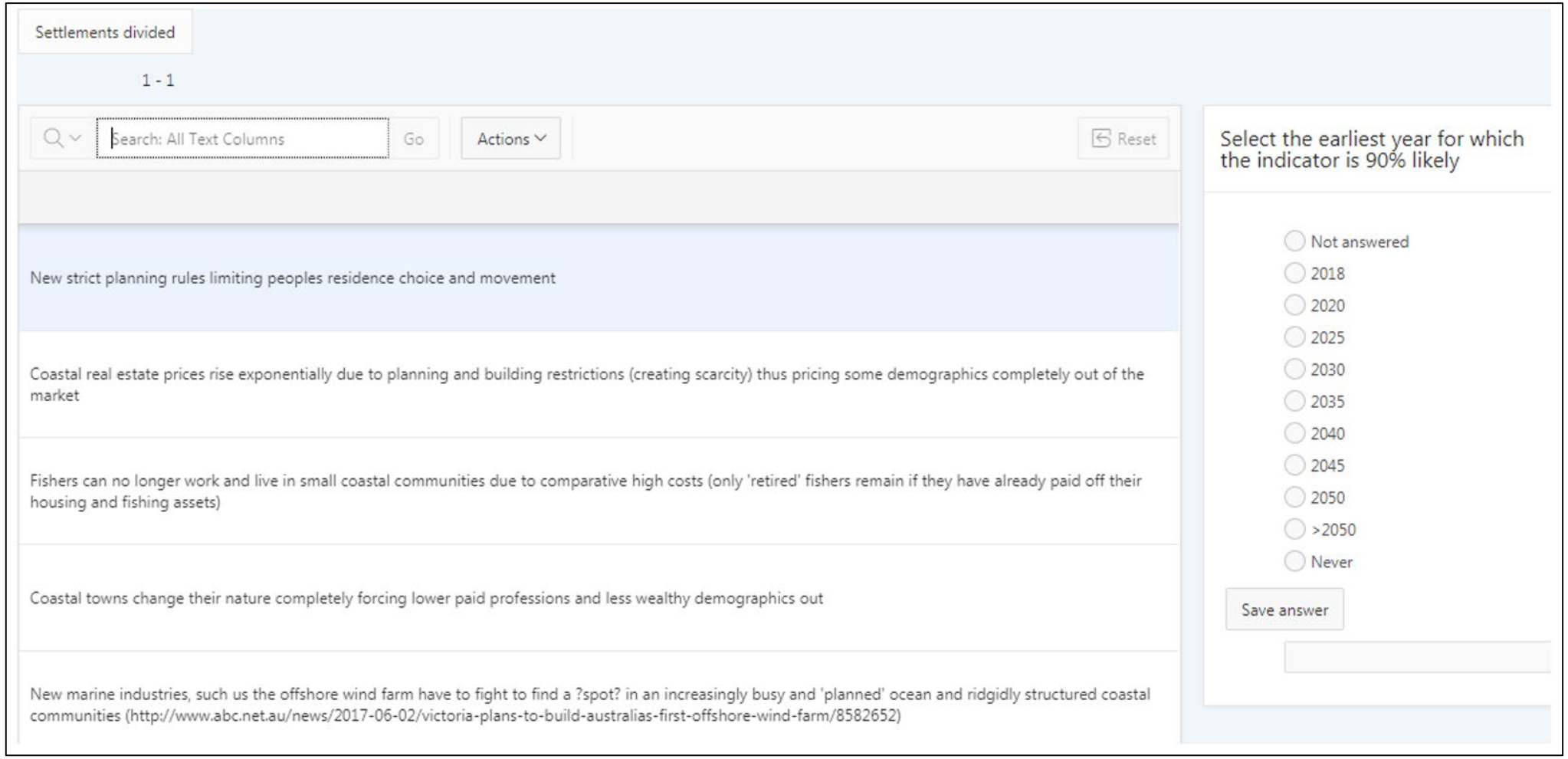
- Corporatization of fishing industry
- Strong profit motivation
- Reduced costs e.g. labour
- Dynamic management needed

Precision fishing – coming soon?



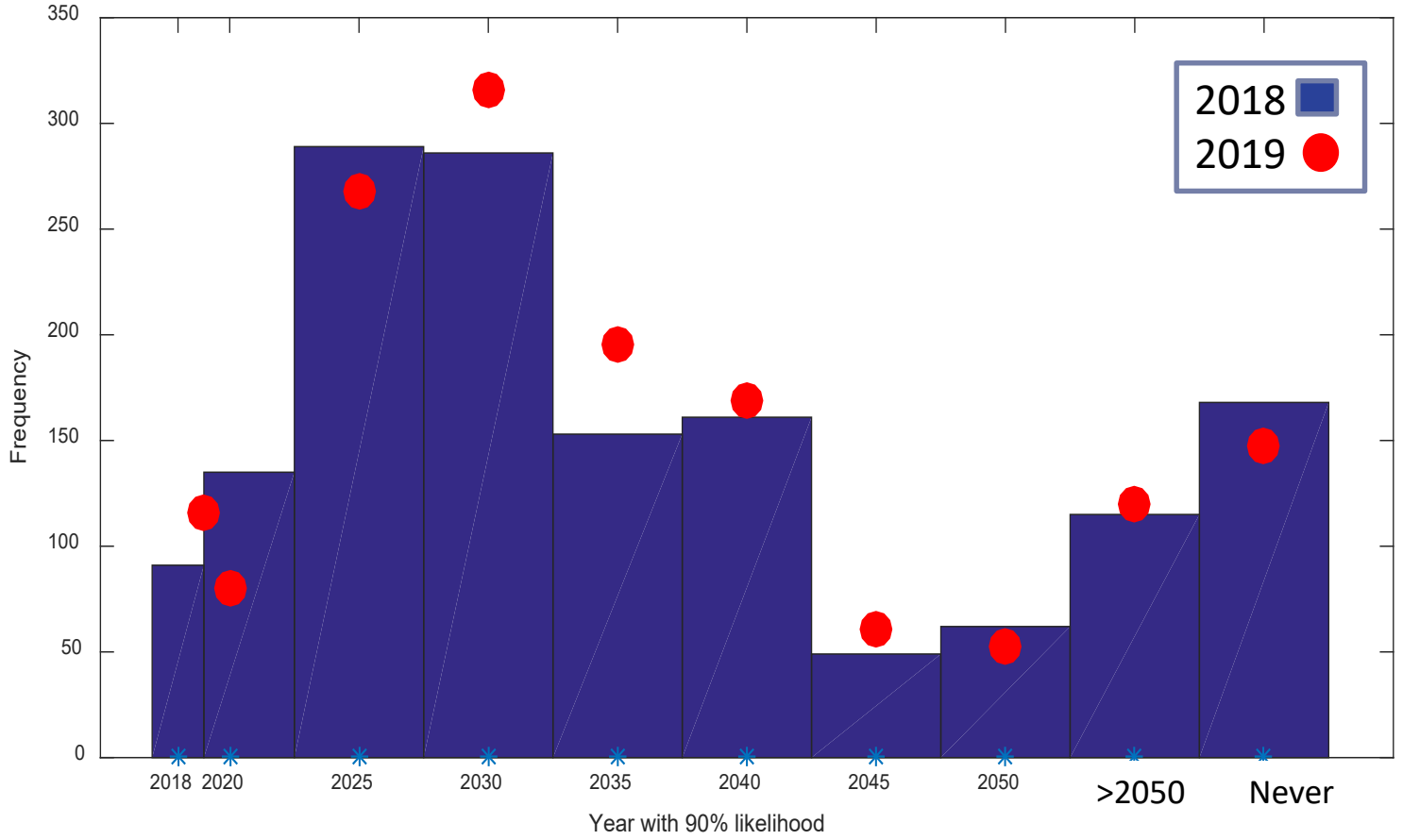


Indicators - Web-based scoring

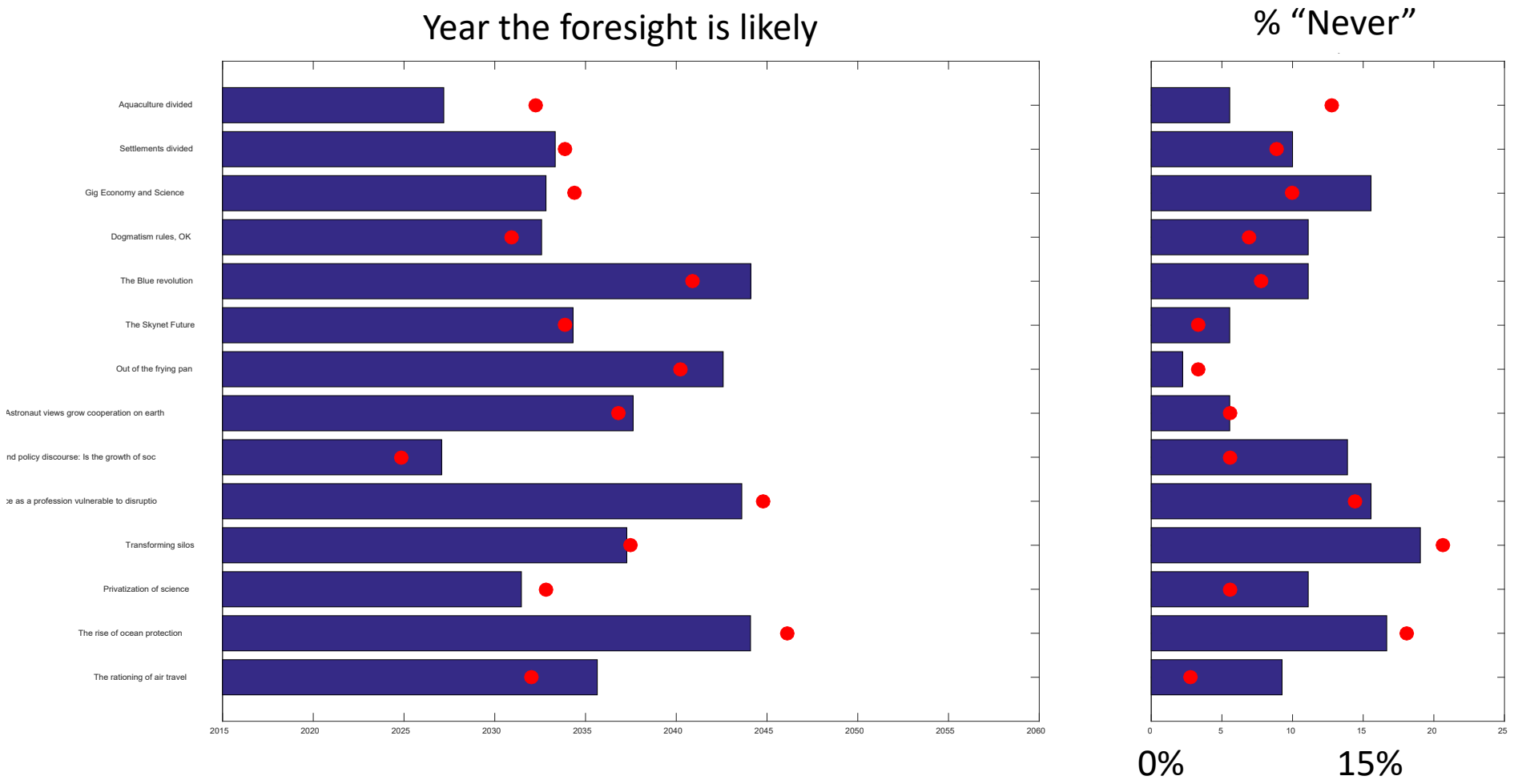


Indicators considered likely in near future

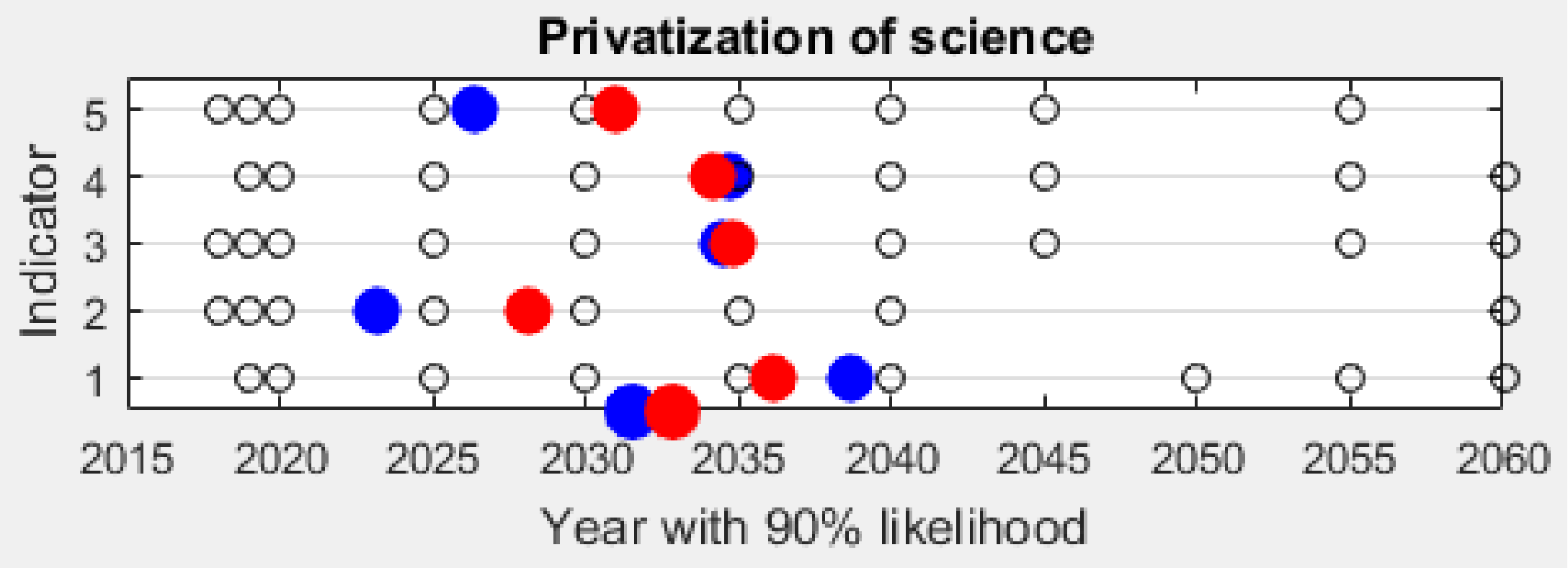
- Scoring in 2018
  - 18 people
  - 14 scenarios
  - 85 indicators
  - 1190 “years” selected
- Scoring in 2019
  - 18 people (14 from 2018)
  - 14 scenarios
  - 85 indicators
  - 1190 “years” selected

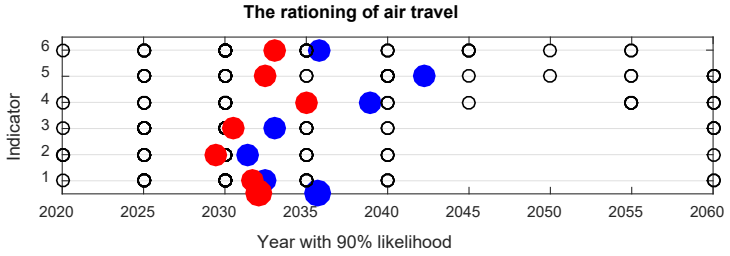


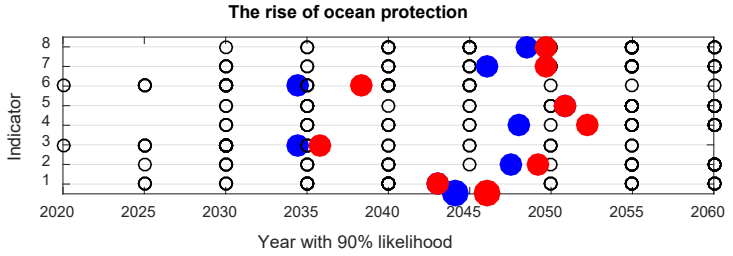
Comparison across years

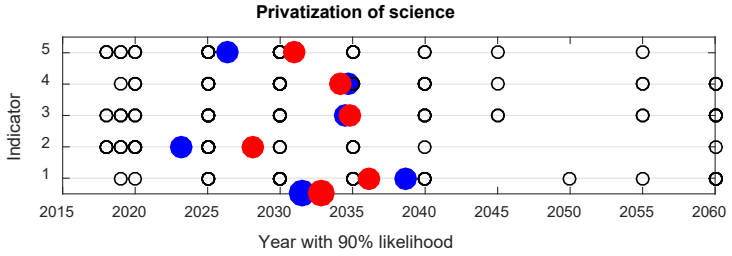


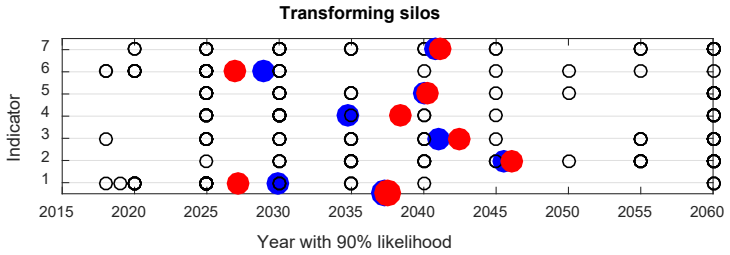
Example result

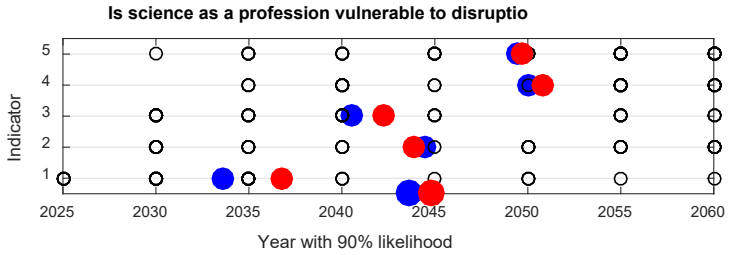


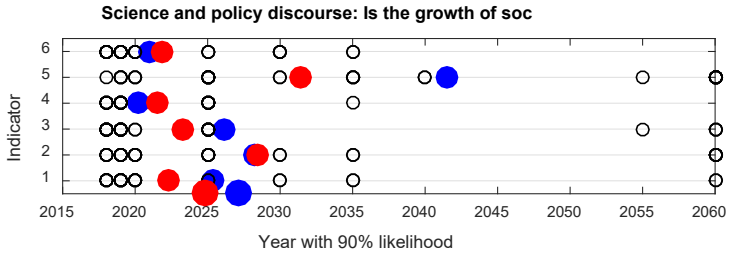

The rationing of air travel
Indicator
Year with 90% likelihood

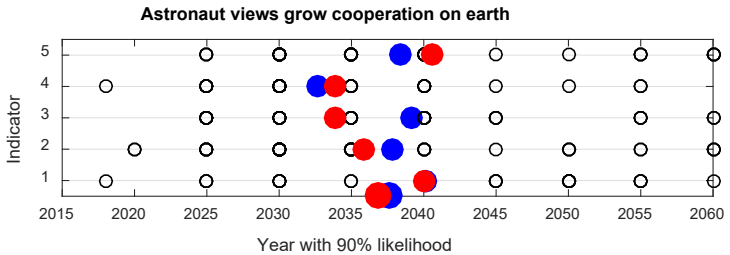

The rise of ocean protection
Indicator
Year with 90% likelihood

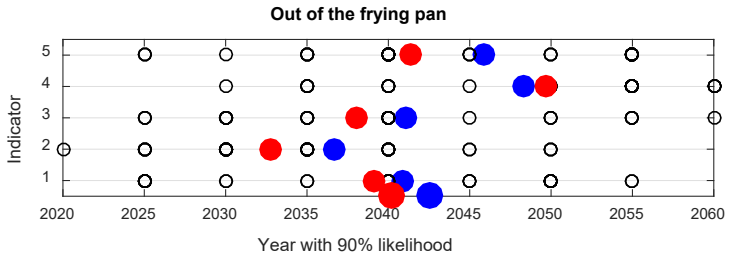

Privatization of science
Indicator
Year with 90% likelihood

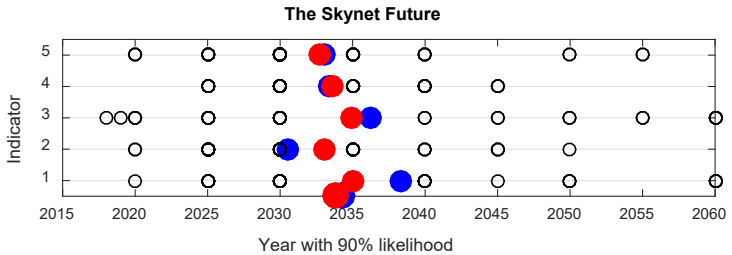

Transforming silos
Indicator
Year with 90% likelihood

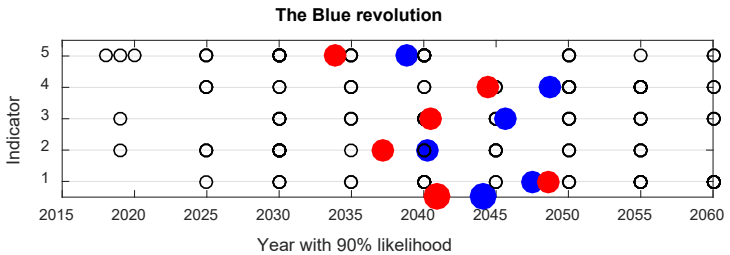

Is science as a profession vulnerable to disruptio
Indicator
Year with 90% likelihood

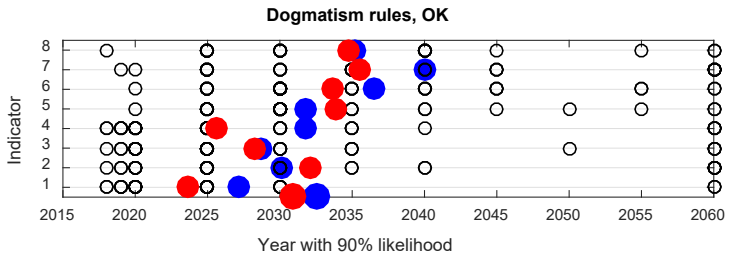

Science and policy discourse: Is the growth of soc
Indicator
Year with 90% likelihood

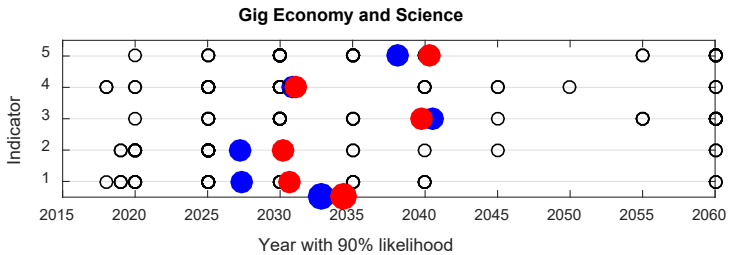

Astronaut views grow cooperation on earth
Indicator
Year with 90% likelihood

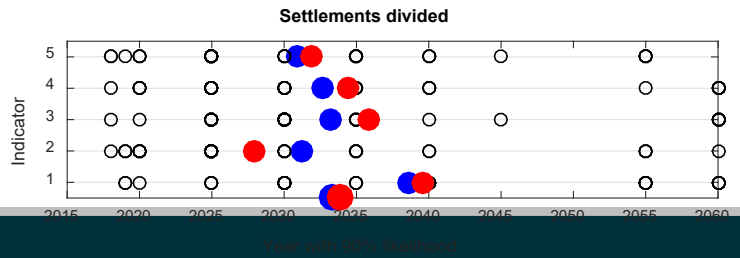

Out of the frying pan
Indicator
Year with 90% likelihood

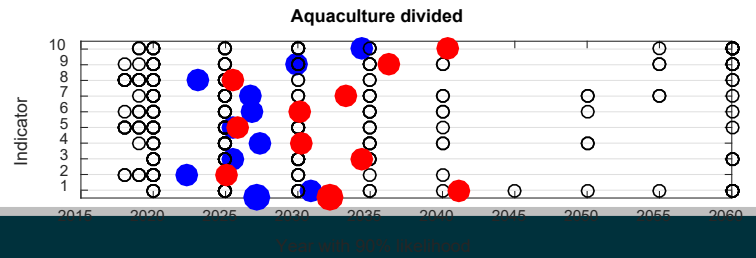

The Skynet Future
Indicator
Year with 90% likelihood

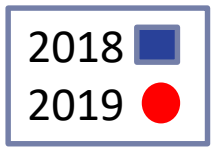

The Blue revolution
Indicator
Year with 90% likelihood


Dogmatism rules, OK
Indicator
Year with 90% likelihood

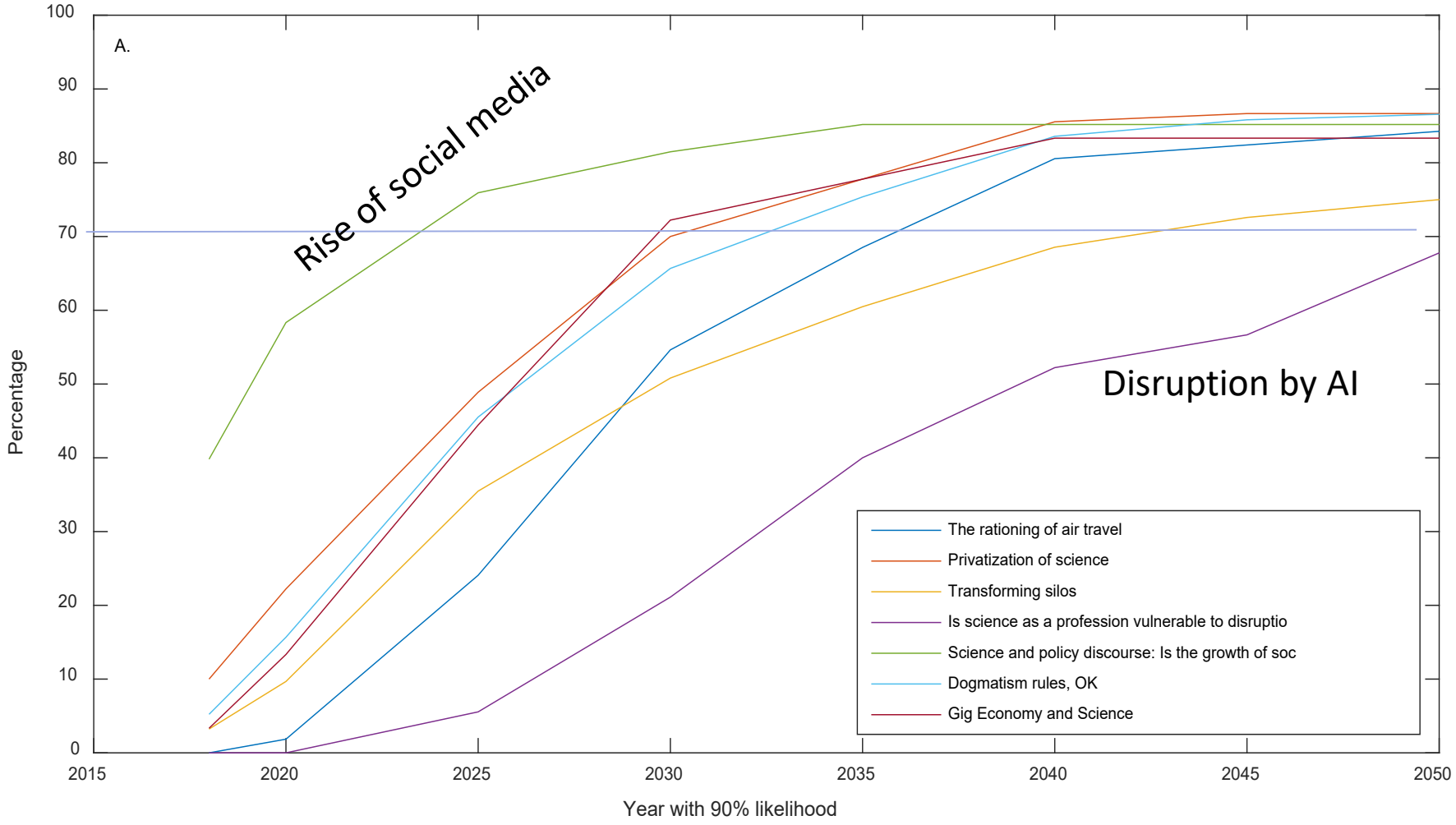

Gig Economy and Science
Indicator
Year with 90% likelihood


Settlements divided
Indicator

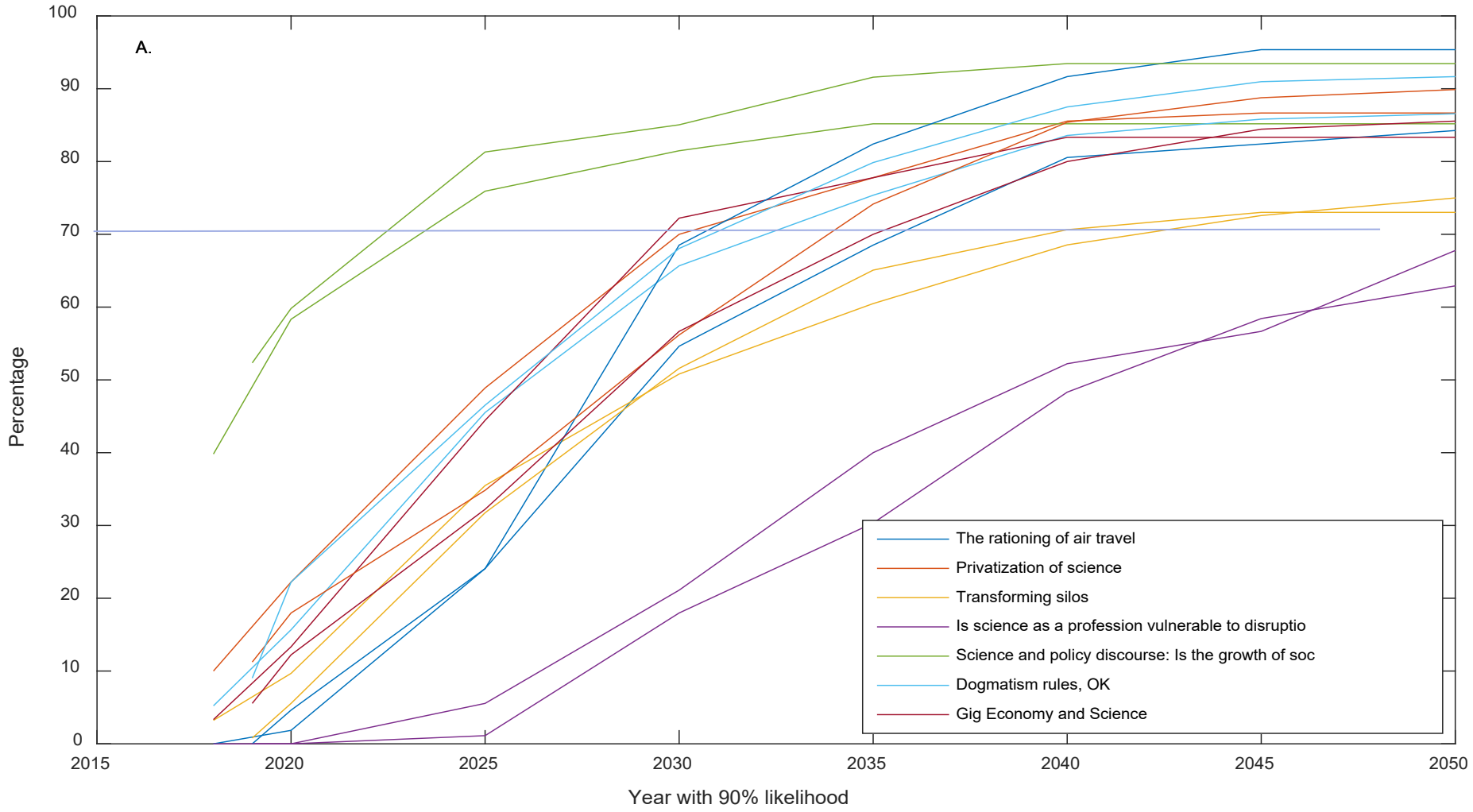

Aquaculture divided
Indicator


2018
2019

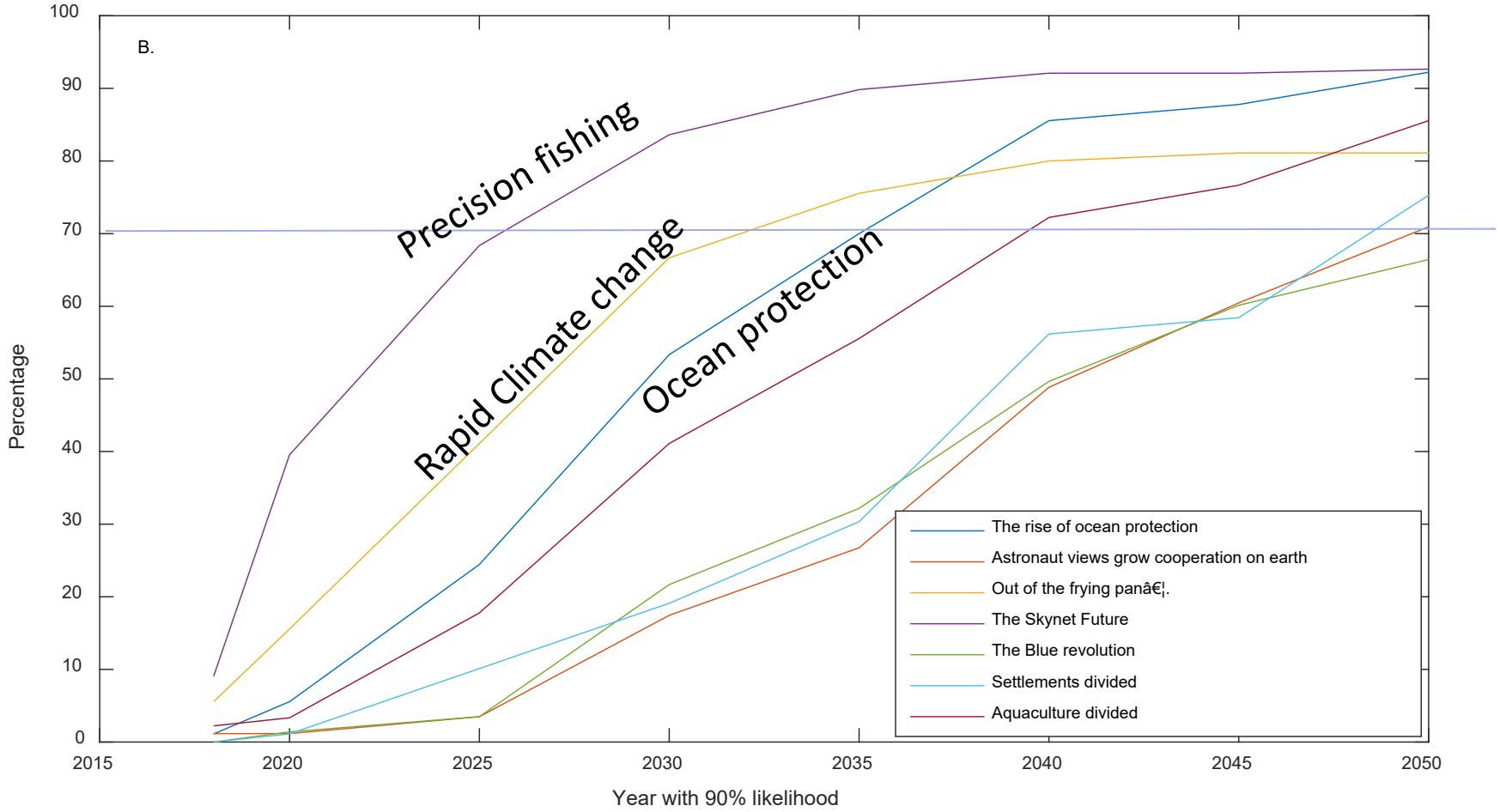
Results – Collective patterns – 21st C Science



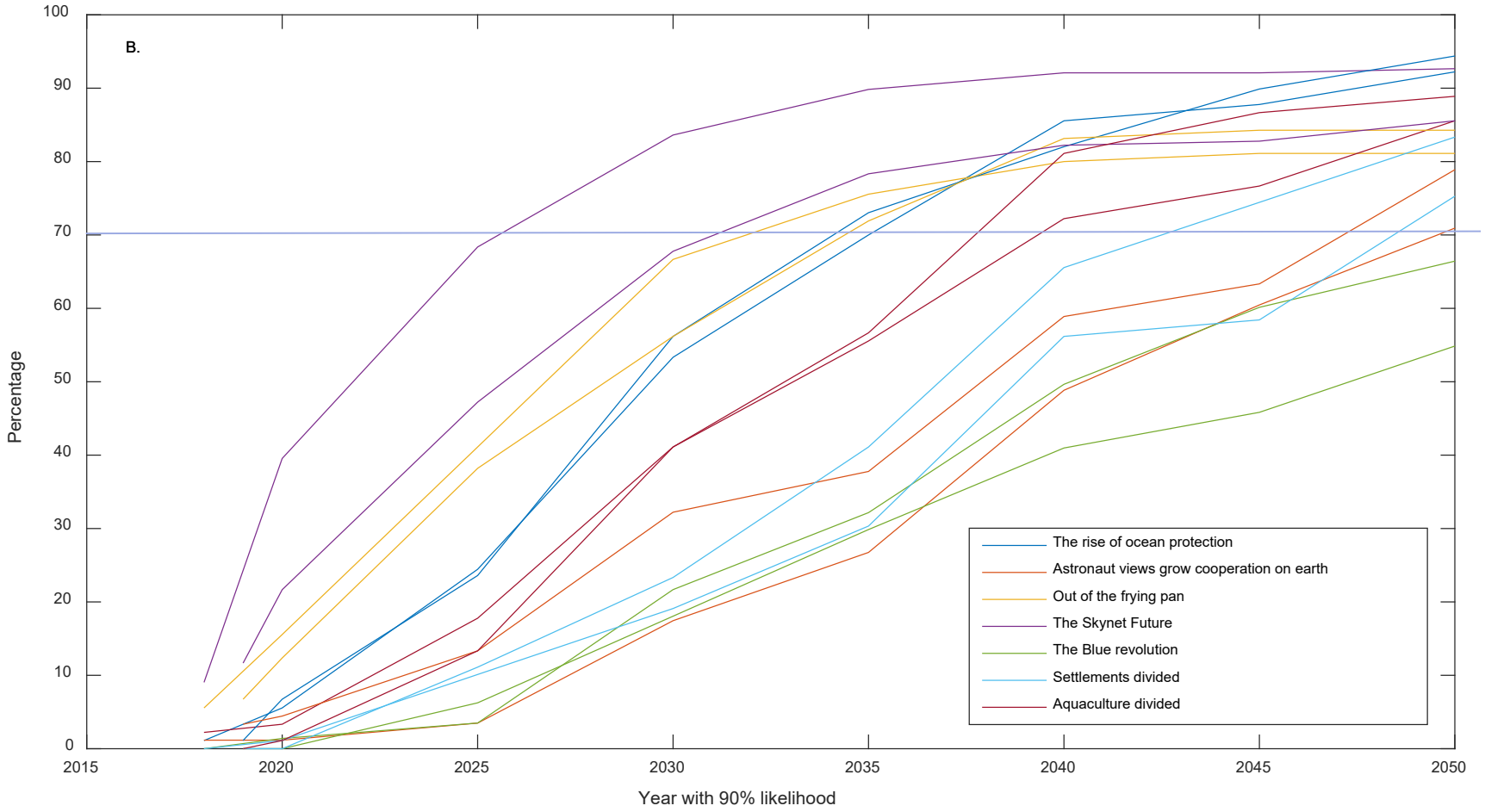
Results – Collective patterns (two years)



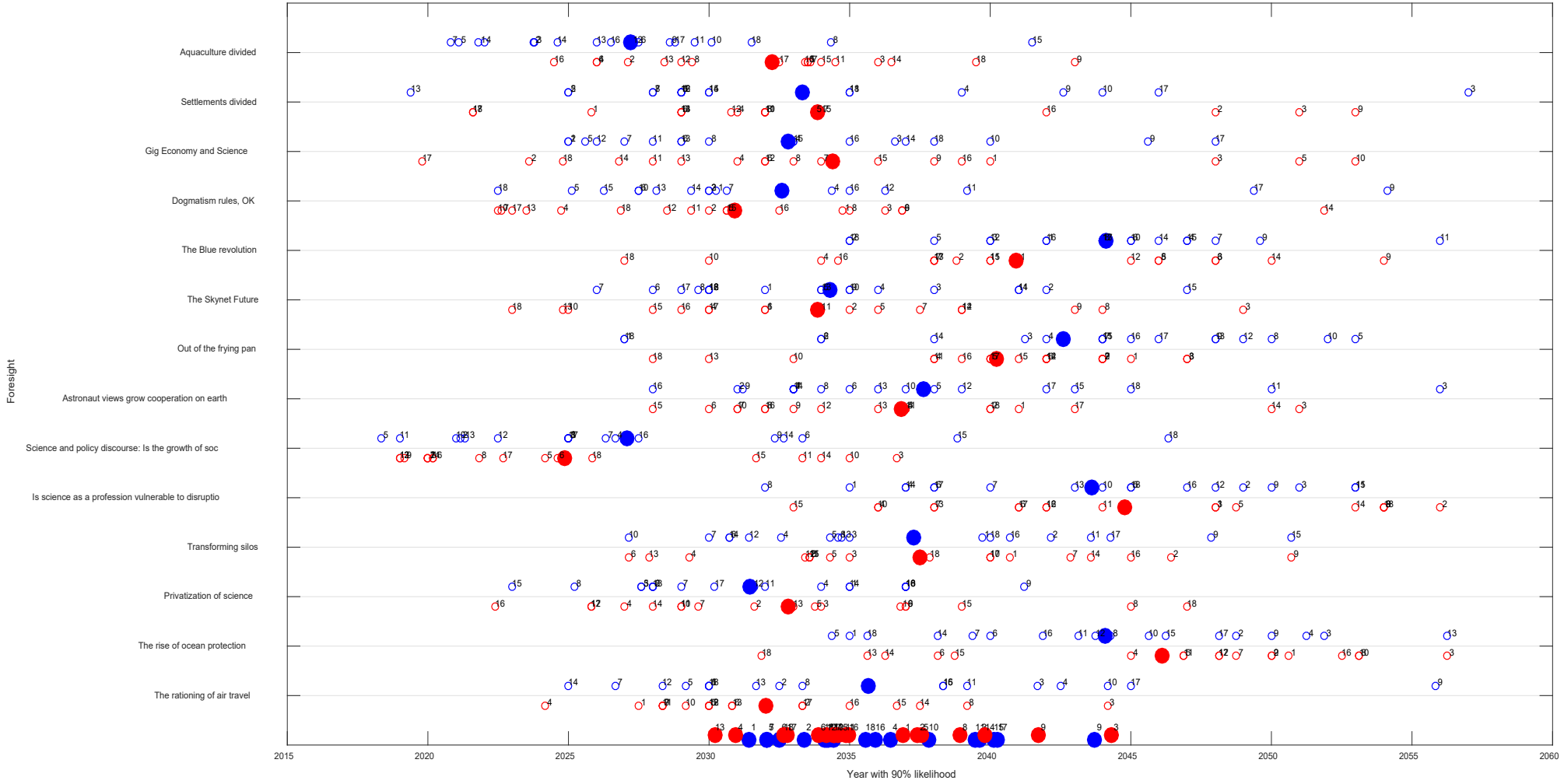
Results – Collective patterns – Marine Mgt



Results – Collective patterns (two years)

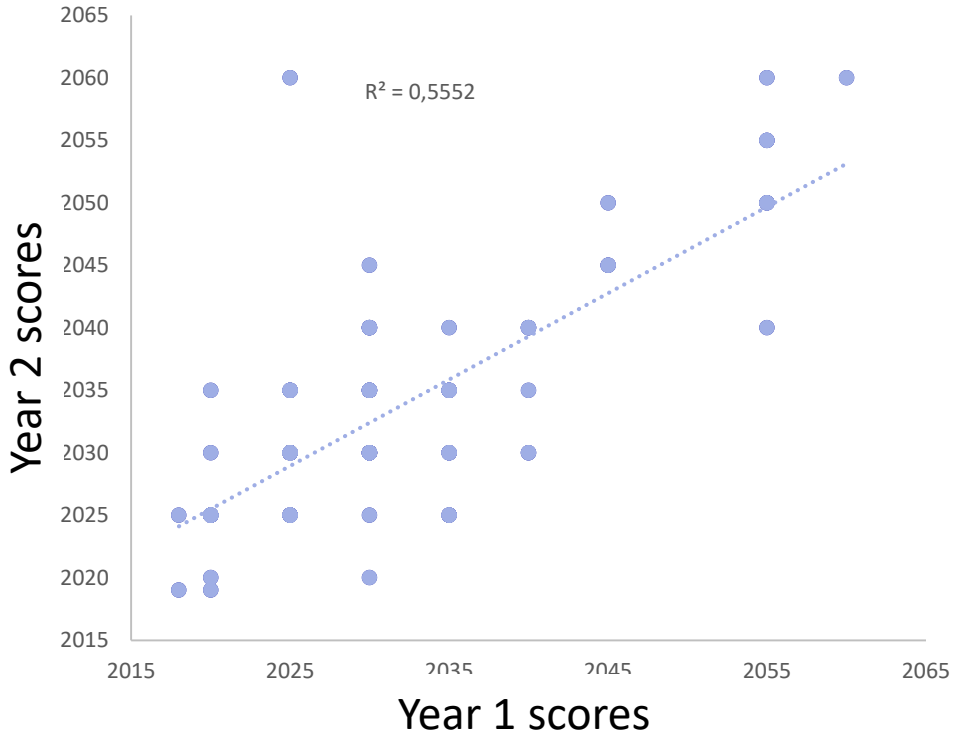


Results – Individual patterns



Scoring indicators for future scenarios

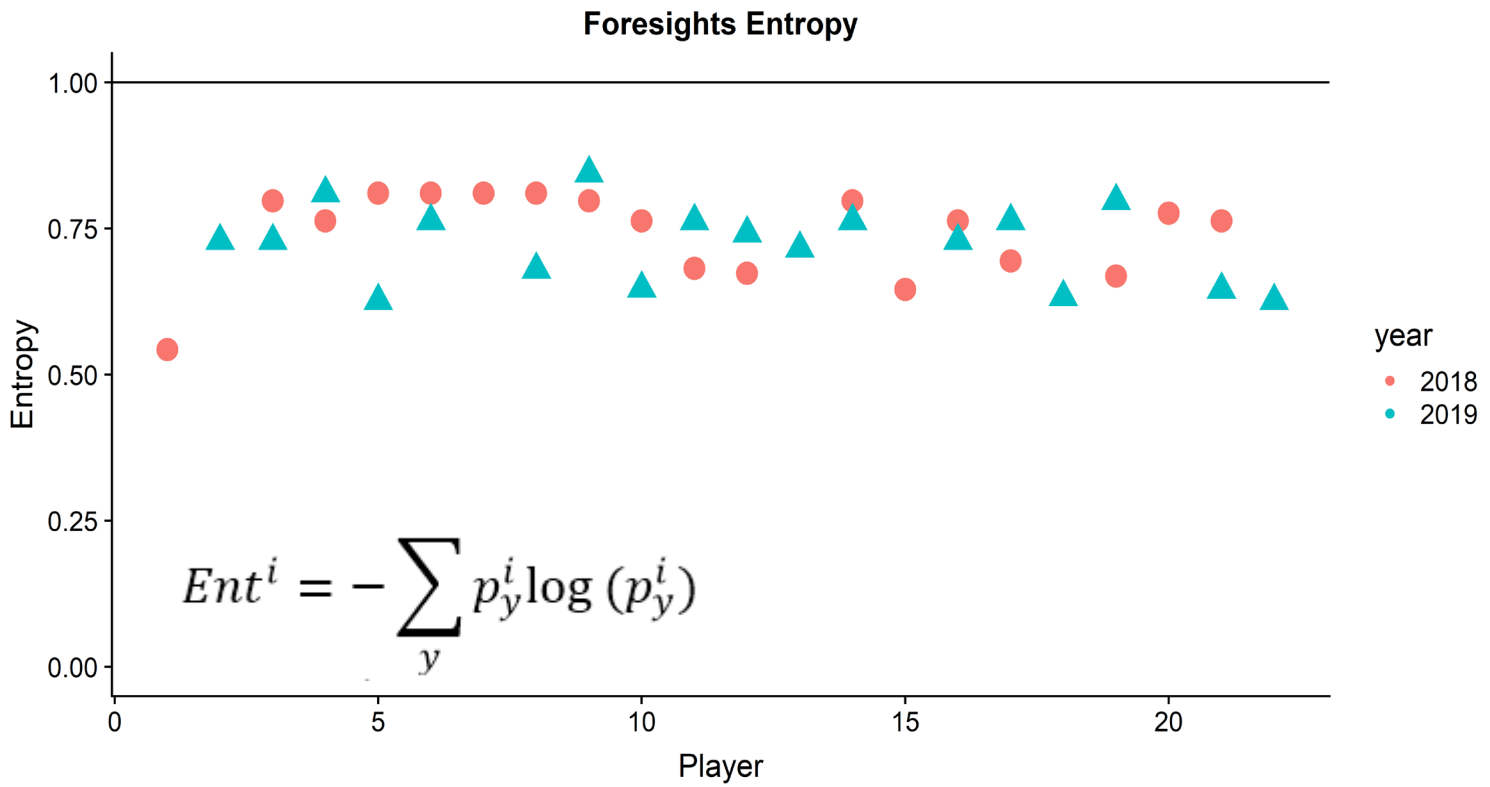
- Hard
  - Repeatability OK…
- By individual across foresights
  - R^2 0.55 to 0.14 (n=22)
- By foresight across individuals
  - R^2: 0.41 to 0.05 (n=14)



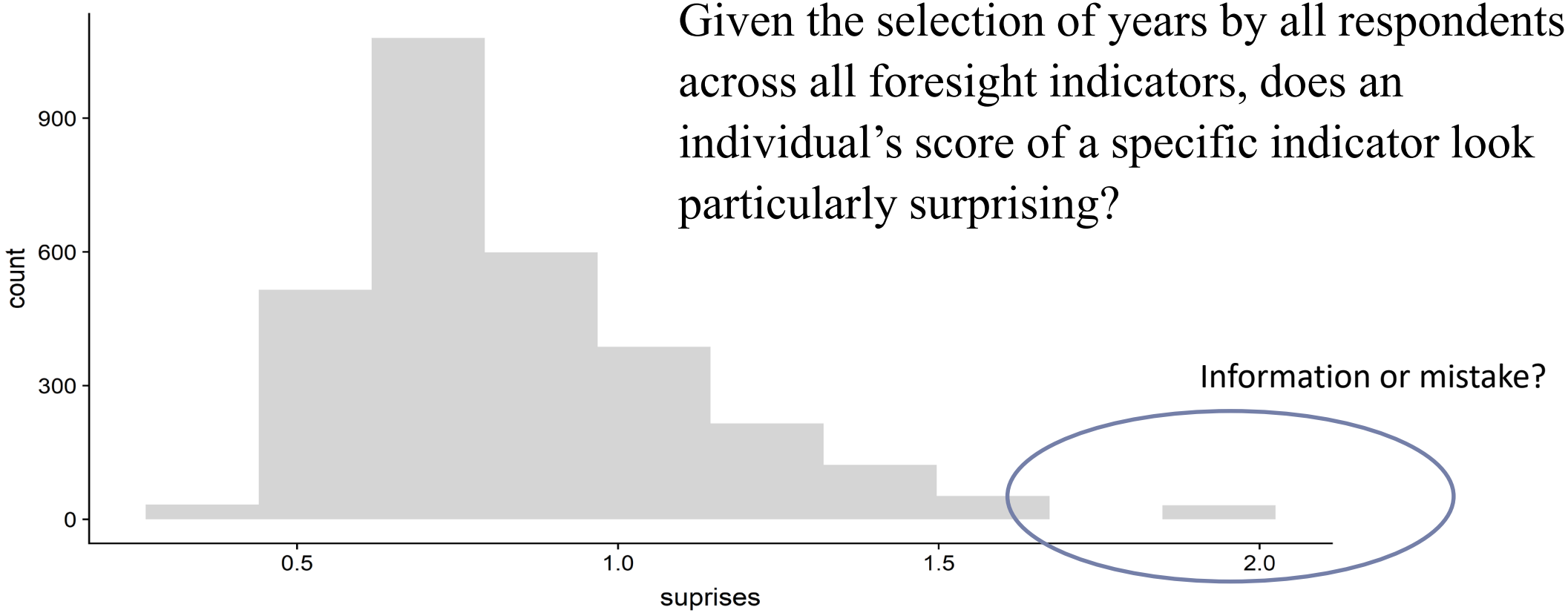
Entropy for foresight scoring

- Does an individual's selected years for each *foresight* reveal a propensity to imagine scenarios to occur sooner or later than other individuals?

(1 = random)



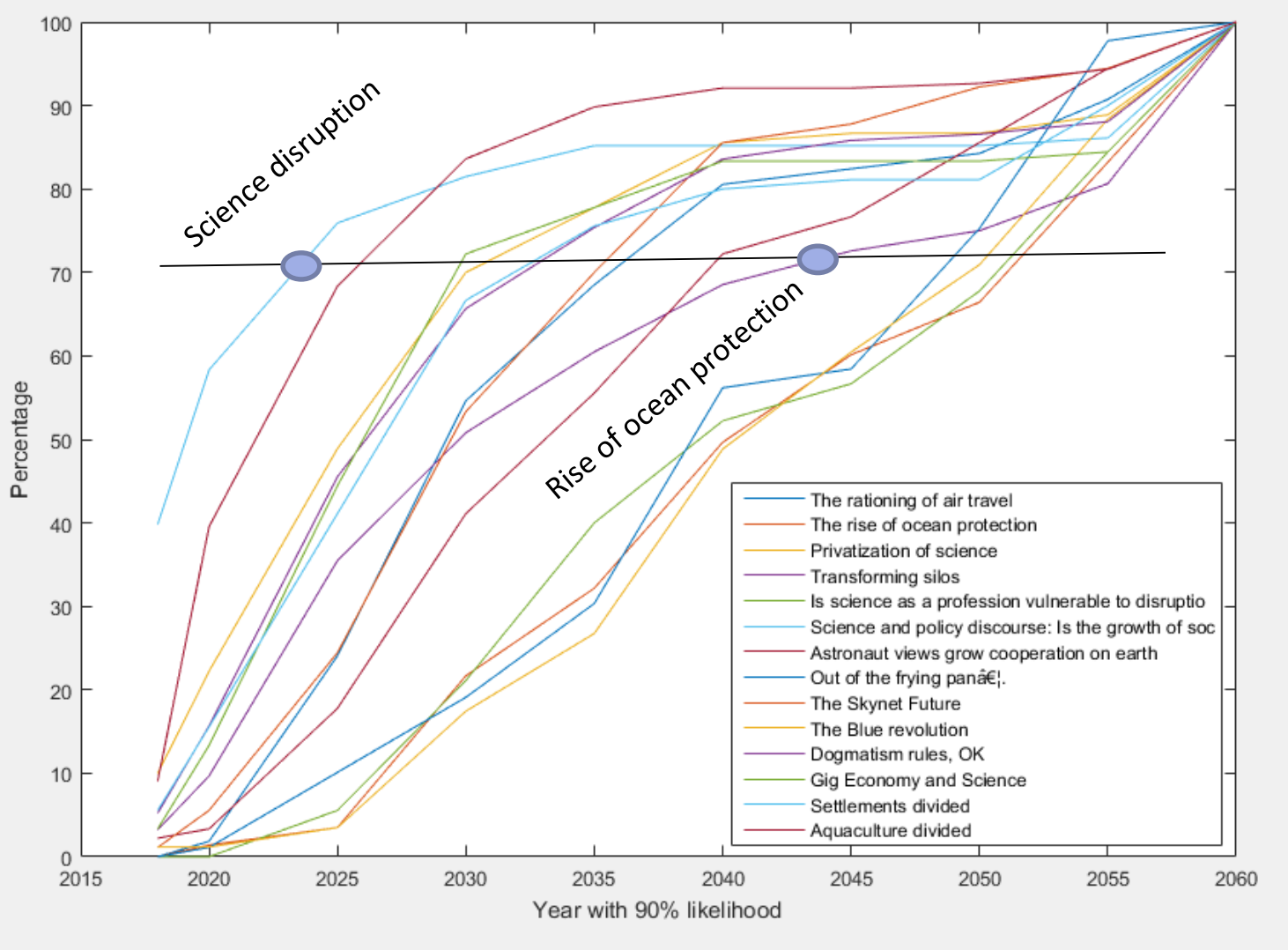
Detecting surprises - outliers



Given the selection of years by all respondents across all foresight indicators, does an individual's score of a specific indicator look particularly surprising?

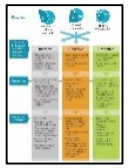
Information or mistake?

Responses to foresight “predictions”

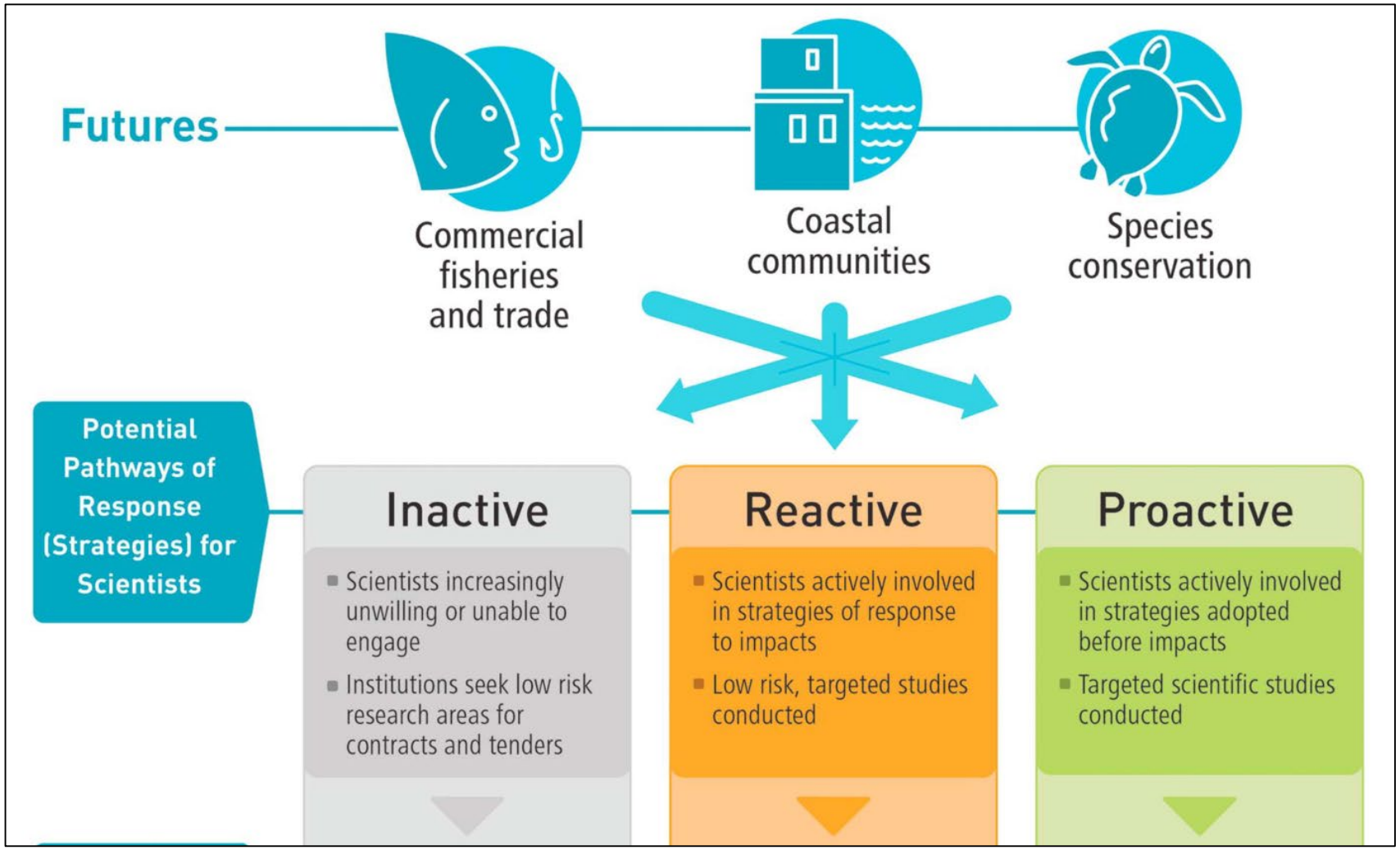


→ Informs our science

- Do nothing
- Reactive
- Proactive



Foresighting – Ocean Futures™



McDonald et al (2019). Earth's Future

Our strategic planning – as a result of this process

- We are responding to some futures
  - Directed funding into some AI/ML areas
  - Upskilling scientists in big data
  - Resisting the gig economy
  - Working on integrated management
  - Considering air travel options

- We are taking this approach to stakeholders wanting to prepare for an uncertain future
  - Fisheries RD&E plan for Australia (2020-2030)

- Improving our own foresighting (superforecasters)
  - Short-term testing of our group
    - We had no superforecasters…need wisdom of many people