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Estimates

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February between the Prime Minister and Minister Andrews with the chair and research director of the CRC. I just wanted to correct the record in relation to what is, I have no doubt, a deliberately misleading statement by Senator Carr.

Senator KIM CARR: No, it is not misleading at all.

CHAIR: Senator Carr, this is not a debating forum.

Senator Cash: It is important to have—

Senator KIM CARR: And the minister had them in the cabinet room yesterday—and you intend to close them.

CHAIR: Senator Carr, this is not a debating forum!

Senator KIM CARR: You intend to close them. They're going to terminate their funding and they have to wind up their operations.

CHAIR: Senator Carr, this is not a debating forum.

Senator Cash: Chair, that was not the evidence given.

Senator KIM CARR: Of course it was!

CHAIR: Thank you, Minister. Outcome 1 is released insofar as program 1.1 and program 1.2, subprograms 1.21, 1.22 and 1.23, as per the program are released.

Mr Fredericks: And our corporate—those who are here for the nine o'clock corporate session are excused as well?

CHAIR: Yes, that is excused. But outcome 1, program 1.2, 'Growing business investment and improving business capability', subprograms 1.24 and 1.25 are still required later on today. That is all clear as mud?

Mr Fredericks: Yes.

CHAIR: I will ask representatives from the CSIRO to come to the table.

Commonwealth Scientific and Industrial Research Organisation

[12:48]

CHAIR: Welcome. Dr Marshall, I understand you have provided us with an opening statement, which we very much appreciate and we are happy to accept. I assume nobody has any objection to it being tabled? No. You have kindly agreed not to read it into the record, in the interests of time. Thank you very much for that. We do appreciate it. I am sure we will all read it as we get going here now. We will get straight into questioning unless there are some key points you wish to make before we start? No. In that case, Senator McAllister has the call.

Senator McALLISTER: I wanted to ask about the roundtable meeting of scientists and experts that was hosted by Minister Andrews on 15 January this year. I understand that the meeting was to work together in response to the devastating bushfires. Do we have the people at the table who can speak to that?

Dr Marshall: Perhaps ask your question and we'll figure out who to get for you.

Senator McALLISTER: Can I have confirmation of who attended?

Dr Marshall: This is the meeting that we held—the first one, that we held at Black Mountain in January?

Senator McALLISTER: It was on 15 January. I don't think the minister's release says where it was held. It was a meeting held on 15 January, a roundtable meeting of top scientists and experts.

Dr Marshall: We held that meeting at the CSIRO headquarters on Black Mountain in January.

Senator KIM CARR: There was one yesterday as well.

Dr Marshall: And there was one yesterday here in Parliament House.

Senator McALLISTER: I am asking about the meeting on the 15th. Can you confirm who attended?

Dr Marshall: We'd probably have to pull that list of names up but we can do that.

Ms Urquhart: For the meeting on the 15th, the attendees included, of course, the minister, Karen Andrews, as chair. The chief executive here from CSIRO attended, as did Cathy Foley, CSIRO's Chief Scientist; Peter Mayfield, Executive Director, CSIRO's Environment Energy and Resources Group; and Dr Dan Metcalfe, Deputy Director, CSIRO Land and Water. Also attending were the CEO of ANSTO, Dr Adi Paterson; the CEO and Director of Meteorology for the Bureau of Meteorology, Dr Andrew Johnson; Geoscience Australia's CEO, Dr James Johnson; from the Office of the Chief Scientist, the Chief of Staff, Sarah Brown; Dr Katherine Woodthorpe, Chair of the Bushfire and Natural Hazards CRC; Dr John Bates, Research Director for the Bushfire and Natural Hazards CRC; from the ANU, Associate Professor Geoff Carey; from the Queensland University of

Technology, Professor Vivienne Tippett; from the Australian Institute for Machine Learning at the University of Adelaide, Dr Paul Dalby; and, from the Minderoo Foundation, Project Manager Mr Adrian Turner. President of Science and Technology Australia, Dr Jeremy Brownlie, also attended, as did the Chief Executive of the Australian Academy of Science, Anna-Maria Arabia. I assume you don't want a list of observers.

Senator McALLISTER: No. I just wanted to get a sense of the agencies that were involved. Thank you very much. Ms Andrews put out a media release which I can table if needed, but I think you are all familiar with that. It says:

It was agreed that the CSIRO would develop a document, in consultation with the group, for the public to understand key facts around the contributing factors to bushfires. This will be a factual document that would be easy to read and could be distributed widely through the group and their networks.

Can you tell me what happened after that release went out and this commitment was made public? Who did the work?

Ms Urquhart: I would leave that to CSIRO to answer.

Dr Marshall: It's a CSIRO document, but we did it in consultation with the broader community, but in particular the other members of the roundtable. We would generally do any such document in broad consultation with the sector.

Senator McALLISTER: So the document was produced by the CSIRO and then circulated to the other participants in the meeting?

Dr Marshall: We shared various drafts of the document with the participants and with others, to get their input. We also took input from them to begin it. But, at the end of the day, it's a CSIRO branded document. We are responsible for it. Therefore, the end of the day, we have to, you know—

Senator McALLISTER: Own the document. I will table the document. I've brought multiple copies. It is on the website. Where is the chair? Have we agreed to table it?

ACTING CHAIR (Senator Kitching): We're happy to table it.

Senator McALLISTER: Great. On the website it indicates that CSIRO produced this information with input from attendees of the bushfire science roundtable held on Wednesday 15 January 2020, and it links to that ministerial statement that Minister Andrews put out. What was the date of the public release of the document?

Dr Mayfield: I don't recall the date, but it was in the last few weeks.

Dr Marshall: It was in February.

Senator McALLISTER: On the second page of the explainer, there's a relatively large blank space which I'm curious about, because generally graphic designers will work to the space that they've been given. Was the document rushed or incomplete or is there anything missing?

Senator PRATT: Or deleted?

Dr Mayfield: The document basically captures the information that we thought was relevant to meet the audience. We didn't want to overcomplicate it with excessive information; you can start to lose the simplicity of the document. That is where we ended up in terms of the amount of content we thought was appropriate for that. It wasn't meant to be a scientific document. It was meant to be a document for the public, with a scientific basis but written in very simple language to make it accessible.

Senator McALLISTER: I have been provided with an earlier draft of that document which I would also like to table. I have multiple copies of that also. Can you confirm that this is an earlier draft and that it was shared with other participants of the roundtable?

Dr Marshall: We had many, many drafts of this document, so it wouldn't surprise me that this was an earlier one.

Senator McALLISTER: I would like to describe my observations about what has changed on the second page. It appears that a paragraph, a graph and a caption for the graph—which is roughly the size of the blank space in the final version and is about bushfire patterns in Australia—have been removed. The material that has been removed, the text and the graph show, 'Consistent with predictions from more than a decade ago, this pattern has shifted with climate change'. The other piece that has been deleted is text that says: 'There is a clear trend in recent decades towards a greater number of very high fire weather days in spring.' Why was that removed?

Dr Mayfield: As you can appreciate, in the preparation of any document there is a lot of review, discussion and debate. That is a normal process within CSIRO for producing our ultimate science, to make sure that it is rigorous and robust. This document went through a similar process. Some of the information that is in that version

appears in the *State of the climate 2018*, so it is actually out in the public record with similar statements. We came down to a view that it related to the Victorian forest fire danger index or high danger index days, and we decided we didn't want Victorian data; we wanted Australian data. Given it was already out in the public, we decided we would not use that in this particular one. But we do have text in the final version, which relates to that fire index data, which shows that same trend or talks about that same trend.

Dr Marshall: Yes. Peter is right. The text you have referred to comes straight out of the *State of the climate*. I refer you to the second paragraph on page 2:

The impact of climate change has led to longer, more intense fire seasons and an increase in the average number of elevated fire weather days, as measured by the Forest Fire Danger Index (FFDI). Last year saw the highest annual accumulated FFDI on record.

The problem with that data is that it is incredibly variable. It depends remarkably on location. We have seen parts of Australia where that has gone up and we have seen parts where it has gone down. It varies dramatically from year to year. That is essentially the difference between weather, which is very variable, and the underlying climate trend, which is actually quite clear.

Senator McALLISTER: Who made the decision to remove it? You said 'we' did.

Dr Mayfield: There was a team of us producing the document. I was leading that. We went through and decided what we wanted to include for the final read. Ultimately, it was my decision.

Senator PRATT: The key information—that the bushfire season we've had was somewhat predicted—was the information that was removed. Why has that information, specifically, been removed? If you made that decision, what was the logic of removing it?

Dr Mayfield: The logic? A lot of changes were made as we went through. Predominantly, we wanted to make sure there were simple statements that had simple scientific background. There's a lot of data that sits behind that sort of statement, and we felt that was more suited to a more scientific document.

Senator McALLISTER: I suppose the key idea that isn't reflected in the document is that there were predictions more than a decade ago about these circumstances. That wasn't considered relevant?

Senator Kim Carr: Predicted by CSIRO.

Dr Marshall: That has been broadly published over the decade that you talk about. It's in the *State of the climate*. It's well and truly out there, and it's in the document.

Senator McALLISTER: Yes, but it is not, it appears, universally accepted in Australia's political class. So I'm interested to understand why you chose to remove it from this public communications document.

Dr Marshall: It's in the *State of the climate*, as I said, which we published last year, and it is in this document, but it is in simple, easy-to-understand words. We said: 'The fire index has gone up consistently as a result of climate change and last year we saw the highest accumulated one on record.' So it is in there.

Senator McALLISTER: It's the 'predictions from more than a decade ago' phrase that I'm interested in, in particular.

Dr Marshall: From memory, there was work done in 2003, 2005 and 2007, and also more recently, and all of that work has been published. It is in the public domain and it's in multiple versions of the *State of the climate*. It's well and truly out there and well understood.

Senator McALLISTER: Okay. In the draft, on the first page, the third-last dot point in that right-hand text box, the sentence of bracketed text says: 'The annual national mean maximum temperature was also the warmest on record at 2.09 degrees Celsius above average.' That is scientifically accurate, isn't it?

Dr Mayfield: Yes.

Senator McALLISTER: Why was that removed?

Dr Mayfield: There was an assessment that the actual definition of that would be hard for some people to understand, because it is the annual national mean maximum temperature, so you end up with quite a few different dimensions to take on board when you look at that. Whereas, we thought the average temperature was a lot easier for people to understand. So we went with one measurement to make it simple.

Senator McALLISTER: Did you make that decision, Mr Mayfield?

Dr Mayfield: Yes. I led the group that was working through the editing process; so, yes.

Senator McALLISTER: Did the minister have any input into the review or the production of this document?

Dr Marshall: Senator, with respect, just above the picture of the wonderful fire danger indicator that we built beside most large freeways in Australia, it actually says:

In 2019, southern and eastern Australia experienced record low rainfall and record high temperatures which have contributed to increased frequency of fire weather days.

Isn't that point covered there?

Senator McALLISTER: I'm trying to understand the provenance of the changes to the document. That is the question that I asked Mr Mayfield.

Dr Marshall: I understand.

Senator McALLISTER: I'm waiting to find out whether or not the minister's office was involved in reviewing this document.

Dr Mayfield: We shared later versions of this document with a range of stakeholders, all of the participants of the roundtable. We also shared that with the minister's office.

Senator McALLISTER: What date did you provide it to the minister's office?

Dr Mayfield: I don't have that date in my mind. I can get that for you.

Senator McALLISTER: Perhaps someone sitting behind you could.

Dr Marshall: Also, on the second page, in the first paragraph, that text that you read out in the original draft is actually repeated here:

In addition to 2019 being the driest year since records began in 1900, it was Australia's warmest year. In 2019 the annual mean temperature was 1.52 °C above average.

So I believe that covers what you thought was missing.

Senator McALLISTER: Did the minister's office request any changes to the document?

Dr Mayfield: We had changes and observations suggested by all of the participants in this exercise.

Senator McALLISTER: Did the minister's office request any changes?

Dr Mayfield: I believe there would have been some suggestions, yes.

Senator McALLISTER: When you say, 'there would have been', that's not a very precise answer. Did the minister's office request changes? It's a question of fact.

Dr Mayfield: There were suggestions made by all participants. Yes.

Dr Marshall: Senator, if I can—

Senator McALLISTER: Mr Mayfield, you have an obligation to correctly and honestly answer the questions of the Senate. Did the minister's office request changes to the draft that was provided to them?

Dr Marshall: Senator, we said at the beginning of our testimony that all participants at the roundtable contributed to the document. But it's a CSIRO document, it carries the CSIRO brand, it goes through the CSIRO process and CSIRO held the pen. It's a CSIRO document. We wrote it for the purpose of explaining to the public—because let's face it, you can't understand what's going on with bushfires by reading the media. We wanted to give a simple explainer for the public about the causes behind the fires and the actions we were taking. It's really that simple.

Senator McALLISTER: Mr Marshall, if that's true—

Dr Marshall: No, 'Dr Marshall', Senator.

Senator McALLISTER: there should be no objection to being transparent and open about whether or not the minister sought changes from your organisation to the document that was presented to them.

Dr Marshall: Senator, you've asked the same question three times now, and I've answered you three times: all participants in the roundtable contributed to the document. But ultimately—

Senator McALLISTER: So the answer is yes?

Dr Marshall: People from the minister's office and people from the department were in the room.

Senator Cash: Chair, the question has been asked several times and has been answered several times.

Senator McALLISTER: Alright, I'm going to ask a different question. My question is: what did the minister's office request be changed in the draft?

Dr Mayfield: I would have to take that on notice. I don't have all that detail with me.

Senator McALLISTER: When you do provide answers to the Senate on this question, Mr Mayfield, I'd like to know precisely what it was that they asked to be changed, I'd like to see any correspondence that was provided to CSIRO in relation to the changes sought by the minister's office, and I'd like to receive any file notes that were taken by any member of staff in CSIRO about the changes requested by the minister's office. I understand that you'll be taking that on notice.

Dr Mayfield: Yes.

CHAIR: Senator Canavan has a follow-up question in this area.

Senator CANAVAN: I'm happy to wait, but before lunch would be good if that's all right.

Senator PRATT: I have a follow-up too. Mr Mayfield, you've taken on notice the nature of the changes, but if it's within your knowledge now to advise the committee about whether it was the minister's office that asked for the specific predictions about future fire events being removed then you don't have to take that on notice. You would be able to tell us.

Dr Marshall: Senator, the officer is well aware of his obligations—and it's 'Dr Mayfield', not 'Mr Mayfield'. If we knew, we would tell you. The practical matter is that there were so many participants in the roundtable and it's such a broad community. There's an enormous amount of input.

Senator PRATT: I understand that, but if Mr Mayfield did know the answer to that question then he could provide it to us.

Senator Cash: 'Dr Mayfield'. And I believe that both witnesses have said that the question is taken on notice.

Senator PRATT: Just to be clear, I understand why Mr Mayfield—

Senator Cash: 'Dr Mayfield'.

Senator PRATT: Sorry. My sight is not very good from here. Of course he can take on notice the aspects that he doesn't have his own knowledge of now. If he does have knowledge about the specific changes requested by the minister's office, he is able to provide those to the committee, because that is the onus of estimates.

CHAIR: With due respect, Senator, Dr Marshall has said that the officials understand their obligations. The question has been taken on notice, which is within the rights of officials to do. You've pointed out what you wanted to point out.

Senator PRATT: Only if there's something inaccurate in the knowledge that they can give us now are they able to take that on notice.

CHAIR: We are drawing perilously close to the lunch break.

Senator McALLISTER: Can I finish my line of questioning?

CHAIR: I thought you had. Sorry.

Senator McALLISTER: I've got more questions. Does the CSIRO consider arson to be a type of lightning? It seems a ludicrous question, but I'm interested to know.

Dr Marshall: No, we call that out separately in the document as a cause.

Senator McALLISTER: When Minister Dutton was speaking to journalist Patricia Karvelas on 5 February this year, he said:

... did the bushfires start in some of these regions because of climate change? No. It started because somebody lit a match.

Were arsonists the predominant cause of the devastating bushfires?

Dr Marshall: As it states in all versions of the document, I believe, dry lightning is the predominant cause. Man-made fires do happen—more often by accident than deliberately, but they do occasionally happen deliberately.

Senator WHISH-WILSON: That's not answering the question, Mr Marshall. You were asked whether arson was responsible.

Dr Marshall: Sorry. I spent eight years getting a PhD in physics, so I'm a little precious about the 'Dr'.

Senator Cash: Dr Marshall directly answered the question.

Dr Marshall: I don't understand your point.

CHAIR: Dr Marshall answered the question.

Senator WHISH-WILSON: No, I don't think he did answer the question.

CHAIR: The member for Hughes, Mr Kelly, has publicly said that unprecedented arson caused the bushfires. Senator Abetz has said the same thing, Mr Christensen has also said that the cause of bushfires was man-made

arson that to him 'almost borders on terrorism'. Can I ask why the final dot point in the draft document, which said, 'Lightning has been the predominant cause of ignition for the 2019 bushfires,' was removed?

It's the final dot point on page 1, at the bottom of that text box. Why does that idea not appear in the final document?

Dr Mayfield: I believe that point is covered elsewhere in the text. It was to remove repetition.

Dr Marshall: First page, second paragraph.

CHAIR: What was that reference?

Dr Mayfield: First page, second paragraph:

... most commonly due to a lightning strike and sometimes human-influences (mostly accidental such as the use of machinery which produces a spark).

I think it's all there, Senator.

Senator McALLISTER: Right, except the idea that it was a 'predominant' cause of ignition in the 2019 bushfires is a distinct and different point to the text which actually appears in the final document.

Dr Marshall: Sorry, Senator, it's not a legal document; it's a public explainer!

Senator McALLISTER: No, it's not.

Members of the committee interjecting—

CHAIR: Order!

Senator McALLISTER: It actually looks like a political document to me, Dr Marshall, and that is my concern.

Dr Marshall: You're stretching the bow a bit far here, Senator! But it says here 'most commonly due to a lightning strike and sometimes human influences'. 'Most commonly' is the most common cause. I don't understand your point.

Senator McALLISTER: It is that there was a very strong statement about lightning being 'the predominant cause', and that has been removed. Who asked for that to be removed? Which of the stakeholders, Dr Mayfield, asked for that point to go?

Dr Mayfield: I can't answer that at this point in time. It's part of the review process. As per my previous answer, I think we'd need to go look at that, on notice.

Senator McALLISTER: OK. In the headline paragraph of the draft document, this sentence is in the original: 'Tragically, lives have been lost, properties destroyed, millions of native animals killed, and smoke has covered towns and cities for many days.' That doesn't appear in the final document. Who asked for that to be removed?

Dr Mayfield: If I can refer to my previous answers, it will be the same. I'll take that on notice. It's part of a detailed—

Senator McALLISTER: Can you recall why it was removed—

Dr Mayfield: review process. I don't have all the specifics.

Senator McALLISTER: Can you recall why it was removed, what the rationale was—why that material wasn't of interest to the public?

Dr Mayfield: Again, I'll take that on notice, in the same exercise we were talking about before.

Senator McALLISTER: I'd observe we've had four or five key questions taken on notice. It's fairly consistent with the government's pattern across estimates hearings right through this week. I will look forward to the answers when they come back and I'm hopeful that they'll actually be accurate and comprehensive.

CHAIR: OK. We'll go to Senator Canavan and then we're going to the break.

Senator CANAVAN: I just had a question in regards to a report, jointly authored, I believe, by the CSIRO and the Bureau of Meteorology, called *Climate change in Australia: technical report*. When I was on the other side there, I was told this was the go-to guide to look at projections of climate change when you're doing major projects. In that document, when you talk about fire weather, there's a paragraph which, in part, is reflected in this explainer, and I'm quoting from the *Climate change in Australia* document now. It says:

The FFDI—

the forest fire danger index—

increases are partly driven by temperature increases that are attributable to climate change. Similarly, temperature changes alone have been shown to contribute significantly to evaporation and surface evapotranspiration in drier catchments of the

Murray Darling Basin ... However, no studies explicitly attributing the Australian increase in fire weather to climate change have been performed at this time.

Why wasn't that sentiment included in the explainer document?

Dr Mayfield: As we pull together the document, we were trying to keep concise in terms of its scope. So it's really a question of what you choose to put in and to not put in. There are a lot of other things we could have written.

Senator CANAVAN: Alright. This is apparently the latest version of *Climate change in Australia*.

Dr Mayfield: That's correct.

Senator CANAVAN: Is it still the position that there are 'no studies explicitly attributing the Australian increase in fire weather to climate change'?

Dr Mayfield: There are historical studies around that, but at this point in time we haven't done any specific work.

Senator CANAVAN: My understanding is it's not referring to the CSIRO per se, because this is a document collating scientific information from a variety of sources. So it seems to me, unless you say otherwise, that there have been no studies explicitly linking the Australian increase in fire weather to climate change. At least, that seems to be the view of the CSIRO and the bureau.

Dr Marshall: There are a series of modelling papers that we published, going back more than 10 years or so. But I will tell you that, when we asked the specific question about how the fire danger days performed with respect to the models, it probably took us quite a few months to get an answer to that, and we still don't have a complete answer. We have been correlating the data in various regions. The problem is that in some regions the fire danger days go up significantly, in other places they actually go down and in some places they stay the same. So it's very highly dependent on terrain, geographic location and the continent. We are trying to pull that together, but the officer is quite correct: there hasn't been a detailed study of that other than that we tried to do as part of our review of the situation.

Senator CANAVAN: As you said before, Dr Marshall, there's a variable signal here; so I presume it's sometimes very hard to get a statistical relationship at that point. If you could take on notice, though, the status of that claim in that report that would be great.

CHAIR: I suspect we will come back to this topic after lunch.

Senator KIM CARR: Absolutely. It is equally true on rainfall, is it not, that the variations occur, in terms of your studies, about changes in the patterns of rainfall, which of course relates to the question of fire risk?

Dr Marshall: That is precisely why the risk is higher than in eastern Australia.

CHAIR: We will go to a break. I suspect that we will return on a very similar topic when we return. I understand that we tabled both of those documents.

Proceedings suspended from 13:16 to 14:15

CHAIR: We will resume this hearing of the Senate Economics Legislation Committee. We are currently dealing with the Commonwealth Scientific and Industrial Research Organisation.

Senator ABETZ: Is it ethical and legal for scientists at CSIRO to be at the same time drawing financial benefits from the Chinese talent programs such as the Thousand Talents Plan?

Ms Zielke: Our code of conduct, under which all of our employees operate, does not permit that to occur. That being said, I am assuming you are referring to an article that appeared in the paper some weeks ago that implied that that circumstance was occurring. We investigated it as a result of that, and that was definitely not the case.

Senator ABETZ: At this stage I am just asking on matters of principle, but is it ethical and legal for scientists at CSIRO to at the same time be drawing financial benefits from Chinese talent programs. The answer, I would assume, is either yes or no.

Ms Zielke: I am hesitant to say a definite no, because, if we put arrangements in place, legally they could do that, but it is not our arrangement. We have an arrangement that says that is not appropriate and we don't do it.

Senator ABETZ: And to your knowledge nobody has done so?

Ms Zielke: No, that is exactly right.

Senator ABETZ: The CSIRO requires CSIRO scientists to declare conflicts of interest?

Ms Zielke: It does, yes.

Senator ABETZ: And no CSIRO scientist has made such a disclosure in recent times generally?

Ms Zielke: In relation to disclosures, our scientists disclose any memberships that they have or any appointments that they have accepted in relation to their employment with us. They disclose rather than declare a conflict, because it is not a conflict if it is part of their work opportunity; it is a disclosure.

Senator ABETZ: Do CSIRO scientists declare any conflicts of interest? Is there a requirement that they do?

Ms Zielke: There is, yes.

Senator ABETZ: So, there is that requirement, thank you. Has anybody declared such a conflict of interest in recent times? I am not talking about memberships but what you just referred to as the actual conflict of interest.

Ms Zielke: They have presented disclosure statements to that effect. We have dealt with them appropriately.

Senator ABETZ: Are you at liberty to tell us what those conflicts have been?

Ms Zielke: Can I give you an example?

Senator ABETZ: Time is of the essence with respect to my colleagues, so can I ask whether or not you are able to disclose to us and, if so, can you provide that to us on notice, what conflicts of interest have been disclosed by your scientists over the past 12 months.

Senator KIM CARR: 6,000, was it?

Ms Zielke: I am happy to take this on notice and check that this is not the case.

Senator ABETZ: I daresay there have not been 6,000 declarations of conflict of interest.

Ms Zielke: There have not been any conflict—

Senator ABETZ: If that is what you are suggesting, Senator Carr, then there's a real problem—

Senator KIM CARR: No, I'm asking, 'Is that what you mean, 6,000?'

Senator ABETZ: but I suspect it's only a handful.

Ms Zielke: No, there are no conflicts. There were a number of disclosures.

Senator ABETZ: Wait a minute, this is circular.

Ms Zielke: If it put them into a conflict situation, we will not agree to their taking up the proposal.

Senator ABETZ: I thought we agreed there's a requirement that CSIRO scientists declare conflict of interest.

Ms Zielke: There is.

Senator ABETZ: If there is such a requirement, which you have just now admitted, I want to ask again: has any such declaration of a conflict of interest been made by a CSIRO scientist in the last 12 months?

Ms Zielke: I will take that on notice for you and come back.

Senator ABETZ: Then could you tell us what those conflicts were, let's say, for the last 12 months, for those scientists that have made such a declaration that there was a conflict of interest.

Ms Zielke: Can I just check the breadth of that request. Of course, an employee of ours could have declared a conflict because they have, for example, a partner working on a similar project, or it could be because they have some shareholding in something. The breadth of that is quite broad, so were you wanting it to be more specific, for example, in regard to appointments on committees?

Senator ABETZ: I would've thought there would be a register of conflicts of interest held by somebody high up in the organisation who has oversight of that, which would be pretty easy to get and provide to the committee.

Dr Marshall: The officer is just trying to limit the scope. To Senator Carr's point, there are a lot of people. They declare memberships and so on. It is up organisation then to decide whether the membership of a society is a conflict or not, and we give them advice on that.

Senator ABETZ: You are the chief executive. How many conflict-of-interest issues have come to your desk?

Dr Marshall: Very few.

Senator ABETZ: In that case the scope of that which I'm asking is very few, and I would invite you to undertake that which I requested on the basis of your own admission that it is very few, thank you very much. Can we move on then and ask, regarding the Centre for Southern Hemisphere Oceans Research, there was a joint project between the CSIRO and China's Qingdao National Laboratory for Marine Science and Technology. Does CSIRO accept that knowledge of ocean temperatures and currents is vital to submarine warfare?

Dr Marshall: We don't know much about submarine warfare but it is absolutely vital to our climate models, particularly in the Southern Ocean.

Senator ABETZ: Was CSIRO aware of this Chinese National Laboratory for Marine Science and Technology's Project Guanlan, launched in May 2018, which aims to use satellite mounted light detection and ranging technology to pinpoint submarines at depths of up to 500 metres?

Dr Marshall: I wasn't directly aware of that, but I did my PhD on that project in the eighties. It has been around for a very long time.

Senator ABETZ: We are cooperating with the Chinese in relation to this. You would be aware of their civil-military fusion doctrine so that anything that is developed in this civilian sense, such as through CSIRO, as of necessity, from the Chinese side, will be provided to their military?

Dr Marshall: Just to make a correction, we are not involved in the submarine project that you mentioned.

Senator ABETZ: Who runs the Centre for Southern Hemisphere Oceans Research?

Dr Marshall: CSIRO. I'm just correcting what you said.

Senator ABETZ: That is you guys. Do you have a joint project between CSIRO and the Qingdao National Laboratory for Marine Science and Technology?

Dr Marshall: Yes, we do.

Senator ABETZ: Do you accept knowledge of ocean temperatures and currents is vital to submarine warfare?

Dr Marshall: I can't say. I'm not an expert on that.

Senator WHISH-WILSON: That's Senator Patrick.

Senator ABETZ: Ocean temperatures and currents are the issues which are being considered in this project, is that correct? And then I can ask Defence whether that is important for submarine warfare.

Dr Marshall: CSIRO conducts extensive measurements of the Southern Ocean for all countries. It is part of Australia's contribution to the global fight against climate change. We have Argo floats, sail drones and all manner of technology.

Senator ABETZ: You share this information with this particular Chinese laboratory?

Dr Marshall: We share it globally.

Senator KIM CARR: It's called a website.

Senator ABETZ: Are you aware of this other project to which I referred—namely, the marine science and technology laboratory's Project Guanlan, launched in May 2018? You are aware, but it is not a CSIRO one?

Dr Marshall: It's not a CSIRO project, so we are not involved in that project.

Senator ABETZ: Do you know who is, within the Australian science network?

Dr Marshall: I don't, personally.

Senator ABETZ: Does anybody else from CSIRO? If not, thank you very much.

Senator KIM CARR: I have follow-up questions. You should sit down and listen to this, Senator Abetz. You might find a few things quite interesting.

Senator ABETZ: If I need to learn from you, I know I'm in trouble.

Senator KIM CARR: You are in a lot of trouble, aren't you.

Senator Cash: Did Hansard get that?

Senator KIM CARR: Dr Marshall, has the CSIRO been notified of any breaches of the defence controls act?

Dr Marshall: Off the top of my head, I can't recall any. No, I don't believe we have.

Ms Zielke: No, Senator, I can confirm we don't not.

Senator KIM CARR: Have any of your partners or collaborators been in breach of the act?

Ms Zielke: Not that we're aware of, no.

Senator KIM CARR: And you obviously speak regularly to the Department of Defence and security agencies in regard to the monitoring of those provisions?

Dr Marshall: We do.

Senator KIM CARR: Turning specifically to the matters that Senator Abetz has raised with you and the article that appeared in *The Australian* which has exercised the minds of you folks, I would like to talk to the senior officers here that actually were part of setting up that project, which I believe was in 2016.

Dr Marshall: Yes, Senator.

Senator KIM CARR: Are you able to help me with that, Dr Marshall, or is there someone else?

Dr Marshall: I can help you with some of it. I was part of setting that up and Peter Mayfield—

Senator KIM CARR: What security arrangements were made with the defence department and any other security agencies in regard to the establishment of that research centre in 2016?

Ms Zielke: There are no security arrangements in relation to it.

Senator KIM CARR: Yes, there are. I will ask you to think again, Ms Zielke, because under the defence control act, it actually is very closely monitored, and that's why I ask if there are others officers here who might be able to help with it who actually have direct knowledge of this matter. At the time, these questions were carefully canvassed, given the nature of a project of this type.

Ms Zielke: They were canvassed, yes.

Senator KIM CARR: And I'll ask you if you can confirm that this was given a clean bill of health under the defence control act and particularly under the prescribed exports list?

Ms Zielke: That's correct—as a result of that and the assessment that the research had no military application or any concerns under the defence export controls work.

Senator KIM CARR: No military application.

Ms Zielke: There were no security arrangements required above normal operations.

Senator KIM CARR: And that has been the case every year since, because this is under review every year; is that the case?

Ms Zielke: I'm not aware of whether it's undertaken on a 12-month basis, but we do review it, yes.

Senator KIM CARR: I put it to you that it is undertaken on an annual basis. There is actually a monitoring process undertaken. Given that Dr Marshall has said that there have been no notifications of any breaches, I'm just—

CHAIR: Senator Carr, this is turning into quite an extensive line of questioning.

Senator KIM CARR: It's very extensive, because what's been alleged here—

CHAIR: Senator Carr, we will come back to you, but I did say that Senator Whish-Wilson had the call.

Senator KIM CARR: I'd like to know precisely, in terms of the officers that have been—

CHAIR: This is the last question now, Senator Carr.

Senator KIM CARR: There has been an allegation made against a senior CSIRO member of personnel. I have raised this matter in the chamber because it is deeply offensive, and I want to go to a few other matters including the way in which the CSIRO has been treated.

CHAIR: We will come back to you, Senator Carr. Finish this question and then Senator Whish-Wilson has the call.

Senator KIM CARR: How long has Dr Cai Wenju, who heads up the centre, been with CSIRO?

Dr Marshall: Wenju's been with us for a very long time. He's an esteemed—

Senator KIM CARR: Do you have a precise number?

Dr Marshall: We can get that for you, Senator, but it's a very long time. He's a huge contributor. He's one of the key scientists that showed the link between sea surface temperature and the onset of early El Nino-La Nina cycle, which is a key element to predicting early droughts for us and early floods for China. He's a huge global contributor and was instrumental in enabling us to make this arrangement. Also—

Senator KIM CARR: When you say he's a huge global contributor—

CHAIR: Senator Carr, we will come back to you, but Senator Whish-Wilson has the call.

Senator WHISH-WILSON: I'd like to ask some questions specifically around marine issues and fisheries. I'm not sure who the right person would be to address those questions to.

Dr Marshall: It depends what they are, Senator.

Senator WHISH-WILSON: Recently, on 31 January, an article in *The Age* by Royce Millar and Chris Vedelago quoted Dr Alistair Hobday, a principal research scientist at the CSIRO. The article was about rising ocean temperatures and the impact of climate change on fisheries—

Senator Cash: Do you have a copy of the article?

Senator WHISH-WILSON: I do. I'll table it.

Senator Cash: Could we see it now, so that Dr Marshall has the benefit of the entire article?

Senator WHISH-WILSON: Sure.

Senator Cash: Chair, we're just getting copies of the article for the benefit of the witnesses.

Senator WHISH-WILSON: While you're waiting for that, my question relates to a reference in the article from Dr Hobday. He says:

The latest modelling from the CSIRO says climate change will be responsible for a damaging 1 degree rise in average water temperatures by 2040 and likely increase the intensity of extreme events.

CHAIR: Sorry, have you got the article there?

Senator WHISH-WILSON: I'll need it to ask my question, so if you can wait one second—

Senator Cash: What were you referring to? I can pull it up online, just to ensure we've got the entire article.

Senator WHISH-WILSON: Minister, let me finish the next sentence and then I'll give this to you straightaway, so you can have a look for yourself. He says:

"The majority of models also indicate that many of the [species in the SESSF]—
the fishery that was discussed in the article—

may decline in abundance by 20 per cent or more as a result of climate related changes," the soon-to-be-released report says.

When is that report going to be released?

Dr Marshall: The report on the impact of climate change on fisheries?

Senator WHISH-WILSON: On ocean temperatures and fisheries—yes.

Dr Mayfield: Senator, we can look into that for you. I don't know the date that will be released, but we can source that information for you.

Senator WHISH-WILSON: I'll just wait for you to get a copy of the article. The article talks about the impacts of a two-degree rise in ocean temperatures and it alludes to rises in ocean temperatures that we've seen already, the fact that our ocean temperatures in places like Tasmania are rising at four times the global average and the kinds of impacts we're seeing on fisheries. The article is very clear. It talks about decade-long declines in the abundance of fish stocks and fisheries management being unable to grow those sufficiently and therefore, new approaches might be needed. My question, aside from that, is: are you aware of a report released in 2018 by Professor Edgar and Professor Ward titled 'Rapid declines across Australian fishery stocks indicate global sustainability targets will not be achieved without an expanded network of "no-fishing" reserves'? Is someone at CSIRO—

Dr Mayfield: There will be people at CSIRO, but I'm personally not across that report.

Senator WHISH-WILSON: Do you have anyone here who looks at fisheries science or fisheries research?

Dr Mayfield: No, there's no-one here who could talk as an authority on that particular area.

Dr Marshall: We have a lot of experts on fisheries and I can arrange a briefing for you, Senator, if that would be helpful.

Senator WHISH-WILSON: Indeed. Just to give you a bit of background, when that report was released it caused a bit of a stir because it made some very strong conclusions about Australian fisheries management. What happened at the time was that that report was rebutted by a number of fisheries scientists, including some well-known CSIRO scientists. Then, through my questioning at estimates to AFMA and FRDC, Senator Colbeck at the time undertook to go through a process of bringing fisheries scientists and fisheries ecologists together to have a number of workshops and meetings to see if they could sort out their differences. To cut a long story short, it has created a scientific process now which is healthy and robust where scientists are going through the process of assessing each other's conclusions about fisheries management. There have been two of those workshops, one of which was in Hobart in early 2019. Are you able to tell me whether any CSIRO personnel attended those workshops?

Dr Mayfield: I'd have to take that on notice, Senator. I don't know who—

Senator WHISH-WILSON: Could you take on notice who attended those workshops. I also understand that the workshops produced a brief that was designed to alert the Australian science and policy community at all levels that there's evidence of important issues in fisheries that need to be addressed. I would like to know if the CSIRO has a draft copy of that brief.

Dr Mayfield: We can look into that for you.

Senator WHISH-WILSON: And whether you have carriage of that brief and whether it's going to be turned into a report.

Dr Mayfield: We can take that as a package of questions, and we'll come back to you on notice.

Senator WHISH-WILSON: I'll make it more specific. I'll probably add some extra detail on notice. It's an interesting debate. It's a good thing when scientists are going through a scientific process to test each other's reports and conclusions. Are you aware of any divisions within the fisheries management and the fisheries science community, including among CSIRO researchers, around the effectiveness of Australian fisheries management?

Dr Marshall: When you say 'divisions', do you mean disagreements?

Senator WHISH-WILSON: Differences of opinions.

Dr Marshall: If you want three opinions, put two scientists in a room. It's quite a natural part of the process.

Senator WHISH-WILSON: I'm not sure that's so true about climate change.

Dr Marshall: Senator, I think you live in Hobart, don't you?

Senator WHISH-WILSON: No, I don't; I live in Launceston. It's much sunnier than Hobart.

Dr Marshall: But in Tasmania. We could easily arrange a briefing for you on all of these matters if that would be helpful.

Senator WHISH-WILSON: A briefing would be good, but I would like to get a copy of the notes and the briefing that arose from that workshop. My understanding is that there were some fairly explosive conclusions that all the researchers agreed on, including fisheries scientists and fisheries ecologists, that essentially we do have a crisis in our ocean and in our fisheries management that needs urgent action. It's a pretty significant thing to see some of the most credentialed scientists, including the Tasmanian scientist of the year, making these kinds of conclusions. So I would like to see the detail of that report, and I understand CSIRO has that report.

Dr Marshall: If it's a CSIRO report, Senator, we will absolutely have it.

Senator WHISH-WILSON: My understanding, Dr Marshall, is that it's not a report; it's notes from the meeting and a brief that was put together by a small group of expert consultants and scientists.

Dr Marshall: Senator, if it's not a CSIRO document, we may or may not have it.

Senator WHISH-WILSON: If it was being hosted by CSIRO, would that mean that you would have a copy of that?

Dr Marshall: We'll have to get back to you, Senator, to understand the details of this.

Senator WHISH-WILSON: I'll put a little bit more of that on notice.

Senator RICE: I'll continue, since the chair is distracted! It's good to see you again, Dr Marshall. I want to talk about CSIRO's involvement with the work of the *United In Science* report which was released for the UN climate action summit in New York in September last year and CSIRO's contribution to that report.

Dr Marshall: Are you aware of that, Peter?

Dr Mayfield: No, I'm not familiar with our contributions to that particular piece of work.

Senator RICE: Essentially it was prepared for the UN climate action summit by IPCC, WMO and a whole range of other organisations. It says that it provides a unified assessment of the state of our Earth system under the increasing influence of anthropogenic climate change. I understand that Pep Canadell was an author of the report—

Dr Mayfield: If Pep was involved, we can certainly find out some more for you. Our scientists are attending a whole range of different forums around the globe all the time, so it's very hard to keep abreast of all of those.

Senator RICE: It's basically an up-to-date assessment, filling in the gaps between IPCC reports of where things are currently at with our climate crisis, and it had a CSIRO contribution to it. The report summarised that implementing the current unconditional nationally determined contributions would lead to a global mean temperature rise between 2.9 and 3.4 degrees by 2100 relative to preindustrial levels and then continuing thereafter. And that's consistent with what CSIRO's projections say regardless, isn't it?

Dr Mayfield: CSIRO's approach also is to work globally with the global body of scientists, and we support the work of the IPCC. If those are the specific conclusions coming out of that particular exercise, I would expect that there would be strong alignment to that.

Senator RICE: We discussed this with the Bureau of Meteorology at estimates on Monday. They advised us, when discussing this report, that we are looking at 3.4 degrees of warming under the current NDCs with what the world is currently tracking for. With regard to Australia, they said that Australia in fact was on track for probably

closer to four degrees of warming. As CSIRO works very closely with the bureau in your climate projections work, would you also support that conclusion from the Bureau of Meteorology?

Dr Mayfield: We do collaborate closely with the BOM and we have an interchange of both modelling work and science. So I'd have to check into the specifics of that, but, if we're working together, we land at a robust agreed outcome is our normal position.

Dr Marshall: I think you made the key point, though, Senator, that this is a global issue and the world is not doing a good job of reducing emissions. Whereas Australia has actually reduced emissions even since Kyoto, the rest of the world hasn't, and that's a big problem for us because we live in the southern hemisphere and, as we know, the southern oceans absorb a disproportionate amount of the excess CO₂.

Senator ROBERTS: If I might jump in—

Senator RICE: No, Senator Roberts, I've got the call.

Senator WHISH-WILSON: Dr Marshall, can I just clarify on what basis has Australia reduced their emissions?

Senator RICE: No.

Senator WHISH-WILSON: Okay.

Senator RICE: But we're in agreement that currently this latest report by the IPCC, the WMO and contributed to by one of your leading researchers, Dr Pep Canadell, says that we're heading for 3.4 degrees of warming and the Bureau of Meteorology on Monday said that because Australia is particularly exposed we're essentially heading towards more than four degrees of warming. I want to know what work CSIRO is doing to prepare Australians for the potential prospect of four degrees of warming by 2100?

Dr Marshall: I don't know that there's necessarily agreement on that level of warming. As you know, in the *Australian national outlook*, which we published last year, we did model many scenarios, but there are four key ones for the future of Australia's economy, society and environment. We've a more positive and a more optimistic outlook, but it's based on our Low Emissions Technology Roadmap as to how we will transition to lower emissions energy and more broadly across the economy without derailing the economy. A big part of that is our transition to hydrogen and our National Hydrogen Roadmap. I thought these questions might come up, and I'd be happy to table all this information.

Senator RICE: I've got access to all of those reports. Although you said you had more optimistic scenarios, obviously there's a range of scenarios and it depends on how quickly the world comes to its senses and rapidly reduces its emissions; but, regardless, this report is saying the world is currently on track for 3.4 degrees warming, and that Australia is going to be more exposed than that and is currently on track for closer to four degrees. I return to my question: do you have a strategy to inform the Australian people of what life would be like under four degrees of warming?

Dr Marshall: Again, in the scenarios we model in the *Australian national outlook*, there are clear pathways for not just Australia but also the world to reduce its emissions. The reduction in the cost of solar panels, lithium batteries and associated technologies; the development and breakthroughs that CSIRO has contributed to hydrogen; our Future Feed breakthrough, which eliminates limits methane emissions from cattle: these are all breakthrough examples of science and technology that we share with the world to help us avoid that scenario. The scenario we're aiming for in the *national outlook* is for a reduction in emissions, is for less warming globally. But also to your point, whatever action we take we have many decades to live with before that action—if we stopped emissions tomorrow across the world, we'd have many decades to live with the consequences of the emissions that are already there while the atmosphere returns to its former state.

Senator RICE: Obviously making people aware of the future that we are facing, if we don't reduce emissions, is an important part of the work that needs to be done.

Dr Marshall: Actually, I think the more important part for us is to come up with solutions so that we don't have to live through that, so to mitigate, to adapt, to improve our resilience.

Senator RICE: The *United in science* report also said:

The current level of [nationally determined contributions] ambition needs to be roughly tripled for emission reduction to be in line with the 2[degrees]C goal and increased fivefold for the 1.5[degrees]C goal. Technically it is still possible to bridge the gap.

Technically we can with the sorts of innovations you were talking about. But my point is: if we don't do that, if we don't, as a world, reduce our emissions five times as much as we're currently doing, then we're heading for some pretty difficult times ahead. Yesterday I was citing the CSIRO research, your weather analogues, that say

with four degrees of warming the climate of our wheat-growing areas is going to become like the climate of the central deserts. The climate analogues are an excellent tool on the CSIRO 'Climate change in Australia' website. Minister Anne Ruston accused me of having a doomsday rant by focusing on what the prospects of four degrees of warming would be, but you would agree it's important to actually let people know, as your climate analogues work does, that these are the consequences the world's facing unless we take serious action to reduce our emissions.

Dr Marshall: Globally, the world does have to shift. As I said before, Australia has reduced its emissions since Kyoto, but the entire world hasn't though, and that's a big problem, so more global activism clearly is needed. Australia leads the world in deployment of rooftop solar. In fact, the invention of the solar cell design in all of those solar panels we use is an Australian invention, so Australia has done a huge amount to contribute to this. We carry the lion's share of the burden in the Southern Hemisphere; we provide the data to the world for how to model and manage and adapt to the changing climate. I think Australia's doing a lot in that area—we do get beaten up, I think unfairly—but this is a global problem and the world needs to join up and actually solve this.

Senator RICE: But there are many other jurisdictions that are doing considerably more than what Australia is doing. Yes, there are jurisdictions that aren't doing as much, but if you look at the contributions made by Europe, for example, they're doing massively more than Australia is doing. You have to acknowledge that.

Dr Marshall: Europe has a completely different geography; they're not spread out on a country as big as continental United States. They have a dense population, nuclear, hydro in the north.

CHAIR: Senator Rice, we've got a large number of senators with an interest in CSIRO. Can you give me an indication of how long you think you're line of questioning will go for?

Senator RICE: I've got a couple of lots of questions, but I'm about to finish with this first lot.

CHAIR: Okay, so I will share the call after this.

Senator RICE: Yes. With regard to the prospects of four degrees of warming, have any ministers, as far as you know, sought briefings from CSIRO on that threat?

Dr Marshall: We've done extensive briefings around the *Australian national outlook* and our scenarios. Many ministers have asked for briefings on this, many members of parliament—

Senator RICE: Basically, under RCP 8.5, which is what we're currently tracking on, we're heading for four degrees of warming in Australia by the end of the century, and CSIRO's work is part of the work that shows that that's the case. As far as you know, have any ministers sought briefings from CSIRO about the potential threats caused by four degrees of warming by the turn of the century?

Dr Marshall: The briefings I'm aware of relate to the scenarios in the *Australian national outlook* and the transition to carbon neutral.

Senator RICE: And have you been asked at all to contribute to any costings of what the impact of four degrees of global heating or four degrees of Australian heating would be?

Dr Marshall: Again, our work has been focused on the *Australian national outlook* and the outcomes in that—

Senator RICE: Okay, so as far you're aware there's not a Commonwealth agency or department that is looking at costing what the impact of four degrees will be?

Dr Marshall: Senator, maybe we can that on notice and give you a detailed answer?

Senator RICE: Thank you.

Senator Whish-Wilson interjecting—

CHAIR: Is it a genuine clarification?

Senator WHISH-WILSON: Yes. Mr Marshall, you mentioned earlier Australia has reduced its emissions since Kyoto. What basis are you referring to there?

Dr Marshall: Senator, we've spent a lot of time together in this room. I'm not precious about being called 'Dr', but don't call me 'Mr'. Call me Larry, if you want—

Senator WHISH-WILSON: Sorry. I'll be okay if you called me 'Mr' as well, for what it's worth, Dr Marshall.

Dr Marshall: So are you Dr Wilson?

Senator WHISH-WILSON: Call me 'Dr' if you like; whatever floats your boat.

Dr Marshall: But don't call you late for dinner.

Senator WHISH-WILSON: Pardon the pun.

Dr Marshall: Sorry, what was your question?

Senator WHISH-WILSON: On what basis are you saying Australia has reduced its emissions since Kyoto?

Dr Marshall: The publicly available data on greenhouse gas emissions since 1990.

Senator WHISH-WILSON: Right. But since Kyoto? Can you provide on notice exactly what that means?

Dr Marshall: Sure, happy to do that.

Senator WHISH-WILSON: My understanding is our emissions have actually gone up on most bases, but you've stated exactly the opposite. It's a pretty major thing to say, considering most countries, including Australia, have had rising emissions over that period of time.

Dr Marshall: According to my briefing: from 1990 to 2018, we're down about 12 per cent in greenhouse gas emissions.

Senator WHISH-WILSON: In terms of our allocation of what we were allowed under Kyoto?

Senator RICE: In actual emissions—

Senator WHISH-WILSON: You're talking about net down four per cent.

Senator ROBERTS: Chair, I'd just like to clarify something.

Senator WHISH-WILSON: It's about to get really—

CHAIR: Here we go, we've really opened up! Very quickly, and then we're going to Senator Carr.

Dr Marshall: We'll answer you on notice, Senator Whish-Wilson.

Senator ROBERTS: How much of a role in cutting our carbon dioxide production in Australia have credits had for stealing farmer's land use rights in a deceitful way to comply with the UN's Kyoto protocol?

Dr Marshall: Senator, I know you have lots of important questions, but I can probably only answer the ones that relate to CSIRO.

Senator ROBERTS: I'm clarifying your comment about our compliance with the UN and our reductions of carbon dioxide output. I'd like to know what is involved in terms of the credits that we got for stealing farmer's land use rights for Kyoto.

Senator Cash: Well again, Chair—

CHAIR: I'm sorry; I was distracted momentarily, Minister.

Senator Cash: I think Dr Marshall has said he can only answer questions insofar as the information relates to CSIRO. Senator Roberts, you have put certain statements to him that are your statements. I think that, to be fair to Dr Marshall, the question may need to be rephrased.

CHAIR: Apologies, Minister, I did not hear it. I am going to give the call to Senator Carr now.

Senator KIM CARR: Dr Marshall, I would like to return to questions around the article that appeared in *The Australian* on 10 February which was attacking the CSIRO and, particularly, leading scientists. I would like to table a letter that you sent to *The Australian*. I take it you stand by that letter, where you said:

I am writing in response to the article 'Security risk in China marine project' ...

Dr Marshall: Yes.

Senator KIM CARR: That's your letter, with your name on the bottom?

Dr Marshall: That's my letter. It is, admittedly, a little bit tamer than the first version I wrote!

Senator KIM CARR: That's what I want to go to. There are a couple of matters. I had a look at the original letter, which is on the CSIRO's website, and it is markedly different from the letter that was published. For instance, you say you wanted:

... to convey my disappointment in such a highly speculative and misleading piece.

The word 'highly' was taken out. You go on to claim that the piece:

... poses a national security risk, without any supporting claims of fact, is alarmist and irresponsible reporting.

The word 'irresponsible' was taken out. It makes other assertions further on, but the really important bit is that a whole paragraph was taken out:

CSIRO has been successfully partnering with China in excellent research and development for over 40 years and will continue to do so. Through these partnerships and research collaborations, we will continue to deliver great science not only for the benefit of Australia and all Australians, but for millions of people around the globe.

That was all deleted. Furthermore, you say:

As a national newspaper perhaps *The Australian* should consider publishing the achievements of Australia's great scientific endeavours rather than, without evidence, dismantling them.

The words 'without evidence' were deleted. Have you taken up any of these matters with *The Australian*, in terms of the way in which your letter was censored?

Dr Marshall: I personally had an off-the-record conversation with the editor of *The Australian*, in which we resolved to avoid this type of situation in the future by them calling us and having a conversation with us to check the facts before publishing a story like this.

Senator KIM CARR: That would be a breakthrough—checking facts! Specifically, though, one of the assertions made in this article that I found particularly entertaining is the suggestion that the heightened awareness over foreign influence has led to you establishing a major transaction committee. It is my understanding that there has been a major transaction committee in place since 2001 and that it covers—and I ask you to confirm this; if my understanding is wrong, please tell me—guidelines and procedures for all countries, not just the People's Republic of China, when you are engaged in international collaboration; is that correct?

Dr Marshall: Correct—and all projects with risk exposure or over a certain dollar amount. There is a series of guidelines for what goes through the MTC, but any major transaction goes through there.

Senator KIM CARR: Are we talking IP protection measures here?

Dr Marshall: Yes.

Senator KIM CARR: What other measures are considered in this transaction process?

Dr Marshall: Risk to the organisation or its people—

Senator KIM CARR: Reputational risk?

Dr Marshall: Reputational risk—and national benefit. Also, the dollar size of the transaction would be a MTC trigger. There is a series of triggers that would ensure that something went to the MTC.

Senator KIM CARR: Who is the steering committee made up of?

Dr Marshall: It is chaired by my wonderful Chief Operating Officer.

Ms Zielke: Along with five of my colleagues who are also executive directors within CSIRO and some other staff within the operations group—our Chief Financial Officer, who is with us, and the head of our governance team.

Senator KIM CARR: So the management team and the executive team. What about scientific oversight? Who is responsible for scientific oversight?

Ms Zielke: My three scientific executive directors are on the committee—Dr Mayfield, Dr Williams and we also have another area.

Senator KIM CARR: Given the, as you say, highly speculative and misleading assertions that are made in this article—the security oversight—who is responsible for liaison, given the defence export control act?

Ms Zielke: I am the chief security officer for the CSIRO. However, we also have a team that is specifically responsible for our involvement in relation to defence export control work. In relation to security, as you would expect, we cover all physical personnel and IT security matters.

Senator KIM CARR: I recall there was evidence presented last year—I think it was Dr Williams—that you have something like 800,000 attempts to break into your systems every year. Is that still the case?

Dr Marshall: Sadly, it's more now.

Senator KIM CARR: What is the number of cyberattacks on the CSIRO now?

Ms Zielke: I will look for that number, if you want to continue.

Senator KIM CARR: My understanding is that the CSIRO has been diligent, conscientious and very thorough in regard to security obligations. That's why I asked you initially, Dr Marshall: have you at any point been advised of any breaches of your responsibilities in regard to the defence control act or any of the associated provisions of those monitoring arrangements with the Department of Defence or the security agencies?

Dr Marshall: No.

Senator KIM CARR: When we see these reports in *The Australian*, which are appearing all too frequently, based on spurious advice provided by ASPI—for instance, the claims that are made go to a range of your projects. Do they all cover the same procedures with the CSIRO?

Dr Marshall: Any time we do work with a country outside of Australia, we have very specific protocols in place. We liaise extensively with the Department of Defence and the Department of Foreign Affairs and Trade.

Senator KIM CARR: In regard to the scientist concerned—

Dr Marshall: Wenju Cai.

Senator KIM CARR: you indicated you had undertaken some due diligence subsequent to this article appearing to ascertain the assertions in it. I understand he would have been subject to due diligence over a period of time. Have you reassessed those assertions since this article appeared?

Ms Zielke: Yes, we have. You asked earlier how long he has been with us. He has been with us since at least the mid-2000s. We investigated—

Senator KIM CARR: So you're talking 15 years?

Ms Zielke: At least, yes. The website that is mentioned in the article incorrectly had him listed in relation to it. As soon as we pointed that out, they removed him from the website. So the way in which human error has impacted on that website has led to this being implied in relation to it. It is not correct.

Senator KIM CARR: I am concerned about the civil liberties of our scientists and of Australians as well as people who work for the CSIRO. Is there any mechanism they have within the CSIRO to defend their reputations?

Ms Zielke: No; hence why the letter to the editor was presented, because it is our only fallback in relation to trying to protect our people.

Senator KIM CARR: I want to commend you, Dr Marshall—you've probably waited a while to hear me say that—for what you have done in this regard. I think what is happening to our scientists and the way in which they are being absolutely pilloried by a number of media outlets is truly appalling. I would hope that the government, not just a few people in this parliament, would take these issues up, because it is an outrageous abuse of leading citizens in this country. They provide enormous service to this country. Unless it can be demonstrated that they have broken the law or acted against the interests of this country, to make the suggestion that they are the cat's paw of a foreign power—which is what's being said here—has to be confronted.

CHAIR: Senator Carr, that is commentary.

Senator KIM CARR: That is absolutely commentary and it will be continued, because it's really important that we don't reduce this to another blacklist, like we saw in the Cold War.

Senator ROBERTS: Thank you all for attending today. Is it true that CSIRO has established research partnerships with a range of international partners?

Dr Marshall: Yes.

Senator ROBERTS: Is one of those partnerships with China through the Centre for Southern Hemisphere Oceans Research?

Senator KIM CARR: I've just been talking about this. This is the same stuff.

Senator ROBERTS: We don't know that yet.

Senator KIM CARR: It is! It's the third go at this.

Senator WHISH-WILSON: Point of order, Chair.

Senator ROBERTS: My question was to Dr Marshall.

Senator Cash: Senator Roberts is entitled to ask questions, and he has the call.

Senator WHISH-WILSON: And I am entitled to make a point of order, too.

CHAIR: He is entitled to make a point of order.

Senator WHISH-WILSON: As a way forward, I just wanted to let Senator Roberts know—because I know he doesn't listen to much—that we've actually asked these questions before. Senator Roberts, we've actually asked these questions before.

Senator ROBERTS: Have you?

Senator WHISH-WILSON: And the officials probably don't want to go over the same. Have a look at the *Hansard*.

CHAIR: We should try not to repeat ground that we have already been over. I absolutely do agree with that. It's not possible for every senator to listen to every committee hearing as it is going on, and I think we also have to acknowledge that. Where a question has been asked and answered—

Senator KIM CARR: He's sitting next to me!

CHAIR: it is legitimate for officials to say, 'asked and answered' and then to move on.

Senator ROBERTS: Is one of those collaborative partners the Qingdao National Laboratory for Marine Science and Technology?

Dr Marshall: The Qingdao National Laboratory for Marine Science and Technology is the oldest marine research institute in China.

Senator ROBERTS: It is. Does this partnership provide a mechanism to collaborate on Southern Ocean's focused research based in Australia?

Senator KIM CARR: Mr Chairman?

CHAIR: Senator Roberts, we have been over this territory.

Senator WHISH-WILSON: Point of order: did you give the questions to Senator Abetz or did he give you his?

Senator ROBERTS: I will just move on to the next, which probably hasn't been asked. Is CSIRO aware that Qingdao National Laboratory for Marine Science and Technology is a key Chinese military research body?

Senator KIM CARR: It has been asked.

Dr Marshall: Senator Abetz asked all these questions.

Senator ROBERTS: Are you aware that one of the projects at the Qingdao National Laboratory for Marine Science and Technology is Project Guanlan, aimed at developing a satellite with a powerful laser for anti-submarine—

Senator KIM CARR: It's been asked.

CHAIR: Senator Roberts, these questions have been canvassed. Sorry, but they have been canvassed, I'm happy for you to keep the call if you want to move on to another area.

Senator ROBERTS: No; that's fine. I'll look forward to your response to my letter.

Dr Marshall: Senator, we have the response here, which we could discuss, if you like.

Senator KIM CARR: Oh, no, no!

Dr Marshall: I just wanted to address two issues in the chamber and then table the rest if that's okay. You had some very detailed questions, but there were two high-level strategic questions that I thought were important. You were concerned about what qualifies CSIRO to do what we do and how credible the organisation really is, which is a fair question, and why we do the work we do around climate.

Senator ROBERTS: I asked you some specific questions about—

Dr Marshall: I am tabling the response to those, but those two high-level questions—

CHAIR: He has a more extensive response.

Dr Marshall: These are the facts. We are in the top 0.1 per cent of the world for our four core areas of research. We're in the world's top one per cent for the other 14 fields. We've been independently ranked by Thomson Reuters as in the world's top 20 most innovative agencies. We rank in the world's top 3 national science agencies for our impact. Under Strategy 2020, which is the strategy we just finished, over the last five years, we've developed more real-world solutions from science than ever before, with an independently audited five-to-one return on the government's investment in us. Five to one is a magical return for a venture fund, let alone a government agency. So it's a really impressive number.

The reason I've mentioned the solutions from science is that CSIRO's purpose is of course to solve Australia's greatest challenges using science and technology, and Australia is under an existential threat currently. Our economy depends critically on export revenue from fossils because it pays one-third of all corporate taxes in this country. One of every \$3 that supports public health, social services and education comes from fossil related profits. Other countries don't have that dependence. They are innovation economies and they are not so exposed. Other countries aren't sitting in the middle of the Southern Ocean, where we get a disproportionate impact of the effects of all of their emissions on our climate. Yet other countries criticise Australia for its performance around climate, despite the fact that we lead the world in deployment of rooftop solar.

The world, regardless of what we believe, Senator, is inexorably moving towards zero emissions. It's no longer a matter of science; it's a matter of market. When the market takes over, the market shifts no matter what we do about it. And we have a choice: we can either be the disrupted by that market change or we can be the disruptors.

The *Australian national outlook* and the *National hydrogen roadmap* are all about enabling Australia to benefit from this transition rather than be a victim of that transition. We've had many hours debating this and I truly—I acknowledge your debating skill. I don't think you and I are ever going to agree on this point. We look through

hundreds of pages of data that we've presented, and we're happy to table them here as well but maybe we can talk about something else.

Senator ROBERTS: I just need to make a comment, Chair, that your opening comments were an appeal to name, an appeal to authority not data, so I'm looking forward very much—whenever I see someone appeal to name, it indicates they're running away from the science. The second thing is you mentioned it's no longer a matter of science, it's about—

CHAIR: Estimates is not a debating forum.

Senator WHISH-WILSON: I don't know about running away from—

Senator ROBERTS: I'll be looking at the scientific response.

CHAIR: Estimates is not a debating forum, and you're not helping, Senator Whish-Wilson. We are formally happy to accept this documentation.

Senator WHISH-WILSON: Sorry, what is the document?

CHAIR: This is the reply to Senator Roberts from CSIRO. Happy with that?

Senator ROBERTS: Chair, I would like to ask that my letter that was written to Dr Marshall also be supplied to people.

CHAIR: Yes, it's part of this.

Senator WHISH-WILSON: Does it need to be translated to earth language as well?

CHAIR: Senator Whish-Wilson, you're not helping.

Senator ROBERTS: Again, you're showing that you don't have any counter to my argument. Thank you very much, Senator Whish-Wilson.

Senator WHISH-WILSON: Really? Is that a fact?

Senator ROBERTS: Name-calling is the usual substitute when there's no data.

Senator WHISH-WILSON: I didn't call you any name.

Senator ROBERTS: You implied lots of things.

CHAIR: Senator Davey has a short line of questioning.

Senator DAVEY: I have a very short line of questions that I'm hoping the CSIRO will be able to answer very quickly and non-controversially. My questions are mainly about agricultural and regional stations. At the turn of this century you had some research stations in Griffith, Deniliquin and Merbein, for example, sort of outstations. Locally, it was a really good thing. Kids could see the scientists working there and it was a good way to encourage children into STEM. But they seem to be disappearing. Can you please detail for me how many non-metropolitan centres you now manage and run compared to, say, 2000?

Dr Marshall: Going back to 2000? I don't have those off the top of my head.

Senator DAVEY: Sorry, feel free to take it on notice.

Ms Zielke: We're happy to take that on notice for you.

Senator DAVEY: Can you tell me how many you've got today?

Ms Zielke: I suppose it depends on your definition, of course, but we have locations in Cairns, Atherton, Townsville, Woodstock, Coopers Plains, Armidale, Chiswick, Narrabri, Mopra, Myall Vale, Tidbinbilla—I'm just running through the list, sorry, in relation to it—Murchison and Geraldton. They're the ones, looking at this list, that I would consider to be in regional locations.

Senator DAVEY: Would you agree that that list is a lot shorter than it would have been, say, in 2000?

Ms Zielke: Sorry, I can't answer that question—and I did forget Boorowa, sorry.

Senator DAVEY: I was going to ask about Boorowa!

Dr Marshall: Under three CSIRO strategies going back to 2000 or before, CSIRO has a massive property footprint. We used to have well over 100 sites around the country that I'm aware of, a long time ago, but under at least three or maybe even four strategies CSIRO has been consolidating their regional sites to get more critical mass and consolidating their city sites, again, to get more critical mass.

Senator DAVEY: Which does bring me to Boorowa. It replaced a site on the outskirts of Canberra, is my understanding. At the time, it was promoted as being part of the consolidation and cost-saving measures. How does that facility now compare to what was in Canberra?

Dr Marshall: To what was in Canberra?

Senator DAVEY: To the site that was closed on the outskirts of Canberra.

Ms Zielke: I'll see if Dr Mayfield—I don't think he, either, would be able to answer that in detail. What I can say in short, though, is that we are still utilising a small part of Ginninderra and do have some research projects still running at that facility. Boorowa was opened late last year and is now up and running. Projects are being progressively increased, therefore, in Boorowa, whilst we're still winding down the end of Ginninderra in that regard. It's a clear example of where we've had an area that, when it was first purchased, was in a semirural area, and then had to relocate that. Potentially, in coming back to you with the response to the previous question, we'll note those where, for example, we still held one property whilst we were moving it to another property.

Senator DAVEY: In areas like Griffith, Deniliquin and Merbein, they were all irrigation districts, which allowed a lot of on-the-ground work with irrigation stakeholders. Who does that research for you now? In your big, long list, there are no irrigation districts. I'm trying to work out how CSIRO now addresses the need for regular, in-the-field based research and monitoring on critical agricultural commodities and issues, specifically irrigation, when we're looking at a future with less water.

Dr Marshall: We employ a lot more remote sensing technology than we used to, and digital technologies really help with that. People still go out in the field, but they don't necessarily have to stay out in the field to gather that data.

Ms Zielke: We might not own the location, but we still undertake work in various locations.

Dr Marshall: A lot of Australian farmers are very cooperative with us, which is great, because we get to work with their properties.

Senator DAVEY: In regard to your agricultural research, can you explain what your key priority areas are and how your researchers are allocated to those priorities?

Dr Marshall: The really big one for us is navigating drought, and using all branches of science to help us navigate that—to maintain things like our wheat yields at high levels despite the impacts of drought and other changes in the climate. A secondary purpose is to determine a way that we can guarantee food provenance. Australia has really unique high-value food products, but a lot of them are counterfeited around the world, and that hurts our industry growth. That's a really important area for us. You may not know this, but CSIRO has Australia's oldest genetics group. It may not be the largest anymore, but it's certainly one of the largest, and it's certainly the oldest. That's part of the magic behind how we've kept Australia at the forefront of agriculture. A lot of Australian innovations are highly sought after in the rest of the world because we've figured out ways to use far less water, maintain high yields and maintain very high-end premium products that the rest of the world envies.

Senator DAVEY: Thank you.

CHAIR: Senator Bragg, you have two questions?

Senator BRAGG: Thank you, Dr Marshall, for your time. You mentioned before that we've been able to get emissions down since Kyoto. What have been the major drivers of getting those emissions down?

Dr Marshall: I think I mentioned the things that CSIRO had done in that area. Particularly over the last five years, while I've been running CSIRO, we've made major advances in emissions reduction technologies: things like hydrogen, things like FutureFeed—also, to make it easier to deploy electric vehicles. We deployed Australia's first large-scale—well, two megawatts is pretty large-scale—completely off-grid solar storage. We did that in Murchison. Interestingly, as an enterprise—and we're a large enterprise, with 57 sites around the country—we've reversed the previous year-to-year increase in our emissions. We've actually decreased it every year for the past five years. We're down about 15 per cent now, through use of CSIRO technology and others.

Senator BRAGG: In terms of the other point you made earlier about Australia leading the world on renewables, can you expand on that a bit more?

Dr Marshall: It's pretty well known that Australia leads the world in penetration of rooftop solar.

Senator BRAGG: I think if you worked in this building, you wouldn't know that. There are a whole lot of conspiracy theories and things that are put about, so your fact base is always useful for the record.

Dr Marshall: In addition to the solar cell design that is used, which was invented in Australia, it turns out that solar hot water was invented in Australia as well, and we have the largest deployment of that. It's quite remarkable.

Senator BRAGG: Thank you.

Senator DAVEY: We have had such an extraordinary take-up of solar panels, from water bores through to house rooftops and commercial farms, but there doesn't seem to be any technology yet about recycling the panels. Is that something you are doing work on?

Dr Marshall: We are a bit more focused on lithium. With recycling glass and aluminium, there are technologies for that. For silicon, I am not so aware of that, but for the bulk of the solar panels there are other priorities. Lithium is a real challenge for us.

Senator DAVEY: And cadmium?

Dr Marshall: Yes, it's the things that are inside the lithium batteries.

CHAIR: I understood there is actually a process to rejuvenate solar panels?

Senator DAVEY: I can't find it anywhere in government. Nobody knows about it, and we've got councils who have these big farms, and cities like Brisbane, and we're getting to the end of life for the first round. I'm just not sure that anybody's thought about what we're going to do next.

CHAIR: Fair enough. Senator Carr, you are next.

Senator KIM CARR: In regards to CSIRO's work on the Great Barrier Reef, what is CSIRO's view on how the reef has fared this summer?

Dr Marshall: I'll leave that to our expert, Dr Mayfield.

Dr Mayfield: Up until recently, I think the reef had been tracking reasonably well, but I understand there are a number of pools of hotter water up in the Great Barrier Reef region at this time, so the tracking of the degrees heating, which is a measure to look at how much stress the coral is put under, is on a close watch now. GBRMPA is probably the best organisation to talk to; they manage that information.

Senator KIM CARR: Yes, I understand that. But you also do a fair bit of work in the reef, don't you?

Dr Mayfield: We do work on the reef, but mainly through modelling of e-reefs, and a lot of our other work is about water quality impacts and COTS, so we don't necessarily monitor the state of the corals directly.

Senator KIM CARR: Okay. Have you got any assessment as to the claims of another bleaching episode? Do you have any insight into that?

Dr Mayfield: I'm only just aware that if you look at the monitoring of water temperatures there are some areas there getting hotter water where there is a higher risk of bleaching. But, as I said, I think GBRMPA is probably the right body to talk to.

Senator KIM CARR: We'll come to them. In terms of your research work, what is the moderation process before you publish about the Great Barrier Reef?

Dr Mayfield: It would be the same process that CSIRO adopts across all of our work. We undertake internal peer review and then, depending on the nature of the work, there will also be a form of external peer review. If it's published, it will be through the journal process. If it's in other forms, then there would be a form of external peer review as well. So, basically, there is internal peer review followed by external peer review.

Senator KIM CARR: So it's a standard procedure.

Dr Mayfield: A standard approach, yes.

Senator KIM CARR: Has there been any complaint about the quality of your research?

Dr Mayfield: No specific complaints that I'm aware of.

Senator KIM CARR: It's not been challenged?

Dr Mayfield: Our work gets challenged on a regular basis, on many fronts and many topics.

Senator KIM CARR: Particularly in regard to the Great Barrier Reef?

Dr Mayfield: With the Great Barrier Reef, our e-reef work, I think, is accepted. Our work on COTS, I think, is accepted. Our work on water quality is accepted. Around the RRAP program, I know that there is debate as to the sorts of activities taking place there, from certain parties in the reef community.

Senator KIM CARR: In particular, with the question about sugarcane farmers, I saw a recent release from CSIRO that said you've developed new facilities with regards to support for sugarcane growers. This is named 1622 WK. That's the app which deals with the issue of concentrations of nitrogen in local waterways. How well has that been received?

Dr Mayfield: Broadly, we believe that work's been well received by the farming community. It allows them to get the dual benefits of optimising their fertilisation regimes as well as protecting water quality.

Senator KIM CARR: Has there been any criticism of that work?

Dr Mayfield: I'm not aware of any specific criticisms but, again, this is an area where there's always debate.

Senator KIM CARR: In regard to the reef, could you perhaps provide me with any advice as to what work CSIRO is doing with farmers in the basin to help improve productivity and reduce pollution.

Dr Mayfield: The general nature of the work that we do there is around improvement in fertiliser types—a move to slow-release fertilisers so that you don't get excessive fertilisation—in conjunction with the state authorities looking at water quality monitoring and, overall, trying to work to the right level of fertilisation.

Senator KIM CARR: You were involved in the scoping study for the Reef Restoration and Adaptation Program, weren't you?

Dr Mayfield: Yes.

Senator KIM CARR: How is that going?

Dr Mayfield: The original piece of work, the \$6 million scoping exercise, has concluded, and we're currently in the process of putting in place the governance arrangements to take forward the main program. That's imminent. A chair has been appointed to oversee that work as part of the governance process.

Senator KIM CARR: Who's the chair?

Dr Mayfield: Rob Vertessy has been appointed as the chair.

Senator KIM CARR: How much money is involved with the ongoing project?

Dr Mayfield: If we're talking about the RRAP project itself, there's a \$100 million investment in the grant.

Senator KIM CARR: Yes, but that was the money that went to the foundation, wasn't it?

Dr Mayfield: That's correct.

Senator KIM CARR: So there's \$100 million just for the RRAP?

Dr Mayfield: There's \$100 million, yes, to work on the restoration and adaptation work.

Dr Marshall: Senator, there may be a little bit of confusion. There's the scoping program which Dr Mayfield referred to, which is RRAP.

Dr Mayfield: That's RRAP, and it's a \$6 million exercise.

Senator KIM CARR: Why would there be any confusion?

Dr Mayfield: RRAP evolved into RRAS.

Senator KIM CARR: Ah, well, that clarifies it!

Dr Mayfield: It's the same body of work. It's just that the scoping phase has moved into the execution phase.

Senator KIM CARR: How many contracts does CSIRO actually have with the Great Barrier Reef Foundation at the moment?

Dr Mayfield: I'd have to take that on notice. I don't know the exact number.

Senator KIM CARR: Would you. Is there anywhere I can find that? Is that number posted anywhere?

Dr Marshall: I don't know. It might be on—

Senator KIM CARR: I need to talk specifically.

Dr Marshall: It's a small number. I'll get back to you on that.

Senator KIM CARR: Could you?

Dr Marshall: Yes.

Senator KIM CARR: Someone could give me a call or something just to let me know. And could I have the detail of those contracts please—which ones they are.

Dr Marshall: Yes.

Senator KIM CARR: Do you have any agreements other than contracts in terms of the work you're doing in monitoring the reef itself?

Dr Mayfield: In terms of monitoring of the reef?

Senator KIM CARR: Yes, the health of the reef.

Dr Mayfield: Obviously, we work in conjunction with AIMS and GBRMPA in that area, and we are looking at putting out information jointly. CSIRO doesn't do as much monitoring work on the reef per se. As I said earlier, a lot of our work is around modelling of water flows and how they impact reef behaviour.

Senator KIM CARR: And run-off, surely? You do work in terms of run-off?

Dr Marshall: Sedimentary run-off is a big part of the land use work.

Senator KIM CARR: But that's land use—

Dr Mayfield: It's land use work, but it's done in conjunction with the Queensland agencies.

Senator KIM CARR: Is there anywhere that I can find a compendium of what work you are doing, either in the catchment areas or on the reef itself, on water?

Dr Mayfield: We would have to compile it for you.

Senator KIM CARR: Would you do that?

Dr Mayfield: Yes, we can.

Senator KIM CARR: Is that difficult to do?

Dr Mayfield: No. We can do that.

Senator KIM CARR: Thank you very much.

Senator DAVEY: Would I be able to have a copy of that report too please?

Dr Mayfield: Yes.

Senator KIM CARR: It won't be secret.

Senator DAVEY: I'm not suggesting it would. But—just in case it was going specifically to you—could it come to the committee.

Senator KIM CARR: If I could get that fairly smartly, that would be useful for some proceedings we need to look at fairly quickly.

Dr Marshall: Yes.

Senator KIM CARR: There has always been some competition between AIMS and CSIRO. Are you genuine in collaborating in the work you're doing on the reef?

Dr Marshall: It used to be part of CSIRO. Most of the people there we have a good relationship with.

Senator KIM CARR: Yes, I know. That was fixed some time ago.

Dr Mayfield: We've had a very strong relationship, especially during the development of the RRAP scoping work, and that maintains itself. So I would say the organisations are working very well together, as we are with all the other partners involved in the activity. And there's a good complementarity of skills.

Senator KIM CARR: Have you got any other money out of the foundation itself?

Dr Mayfield: Nothing direct.

Senator KIM CARR: There is a report that a third of the money that's gone to the foundation is now being spent on administration. Are you aware of that?

Dr Mayfield: I'm not familiar with that report, or the details of it.

Senator KIM CARR: Certainly not your—

Dr Marshall: No.

Senator KIM CARR: Has the investigator been doing any work in terms of the outer reef?

Dr Mayfield: Not in the current season that I'm aware of.

Dr Williams: No, it's not been doing any work at the moment on that one.

Senator KIM CARR: In terms of its forward schedule, when does it next go on a voyage to the outer reef?

Dr Williams: I'd have to take that on notice. I haven't got the schedule in front of me.

Senator KIM CARR: Thank you.

CHAIR: We are now a bit over an hour behind schedule, so I really encourage people to sharpen their pencils. Senator Rice and then Senator Rennick.

Senator RICE: In the last session we had quite a lot of discussion about emissions targets. I wanted you to verify some figures, and I'm happy for them to be taken on notice if you can't verify them now. The first was Australia's Kyoto targets, given we were talking about those. Our first Kyoto target actually allowed for an increase—108 per cent since 1990 levels in I think the first Kyoto target period. The second Kyoto target was a five per cent reduction on 2000 levels by 2020.

Dr Marshall: I appreciate you're interested in those answers, but they're really questions for the department, not for CSIRO.

Senator RICE: That's alright, but, given we were talking about the targets, they were those.

Dr Marshall: I don't think I was talking about targets at all.

Senator RICE: Well, we were. You were talking about emissions targets. The second statistic I'd like you to verify is that, if you exclude land use, land use change and forestry, Australia's emissions have gone up 30 per cent since 1990 and are 20 per cent higher than they were in the year 2000.

Dr Marshall: I can't take any of those questions on notice; they're questions for the department.

Dr Mayfield: Those statistics were previously maintained by the Department of the Environment and Energy and will be maintained where that particular department moved to in the change in the government. So that's really one for them, we believe.

Senator RICE: I won't ask you to take them on notice then, but they are the facts in terms of our emissions. So, if you're talking about reducing emissions, the only reason we've reduced emission is a reduction in land use between 1990-95 and 2007-16.

Ms Zielke: We'll accept that as a statement.

CHAIR: Let's try and keep to questions.

Senator RICE: I want to talk about CSIRO's wonderful staff. What proportion of your current staff are hired on an ongoing basis?

Dr Marshall: As in permanent versus term contracts?

Senator RICE: Yes.

Ms Zielke: I don't have it as a percentage, and I don't think my head works that quickly—I'll be honest. But we have a small number of temporary staff in comparison with others. We have around about 350 contractors in that regard. At the moment we have a total headcount of 5,480-odd in that regard.

Senator RICE: About eight per cent or something. Is that an increase over time?

Ms Zielke: The number is still around what it is that we've had. We haven't seen a significant reduction at all. Sorry, was your question about an increase in contractors?

Senator RICE: The increase in contractors as a proportion of your staff.

Ms Zielke: It is an increase in contractors. We would previously have had closer to 150 than we do now.

Senator RICE: When would you have had 150?

Ms Zielke: In past years. I'll get you the breakdown. Last financial year it was around about 150 and the year before that it was about 140.

Senator RICE: And you've now got 350. That's a massive increase. Why is that the case?

Ms Zielke: We've been using a number of different mechanisms to undertake recruitment to find the skill sets and capabilities that we need for the organisation.

Senator RICE: But what's changed between this and previous financial years as to why you've needed to more than double the proportion of contract staff?

Ms Zielke: As we explored at the last estimates hearing, we are close to our ASL cap and we're using other mechanisms to be able to ensure that we comply with that policy.

Senator RICE: Right: well, that's a different answer than saying you need to have mechanisms to get a range of staff if you're close to your ASL cap. Is that the reason as to why you're having to employ contract staff?

Dr Marshall: We were actually over our ASL cap.

Senator RICE: So is that the prime reason as to why you are having to employ more contract staff because you're over your ASL?

Ms Zielke: It is the prime reason. It's not the only one, but yes.

Senator RICE: What proportion of those contract staff are employed through a labour hire company?

Ms Zielke: I don't actually have the number on me; I'm happy to take that on notice. I will note that we have some limitations on the way in which we actually report our information in differences, say, between a contractor that we would use to come in and do some electrical work as opposed to somebody who was in an admin position.

Senator RICE: I know one scientist in particular who is an extremely experienced climate scientist who is employed through a labour hire company. What labour hire companies are you relying on?

Ms Zielke: We are using a panel.

Senator RICE: Which ones are the key ones?

Ms Zielke: I'm sorry, Senator: we provided on notice a figure of around 12 that we are using at the moment in that regard as part of responses to last estimates.

Senator RICE: Could you update that information as to which labour hire companies you're using and how many full-time equivalent staff you're accessing through each one.

Ms Zielke: Certainly.

Senator RICE: I want to go back to someone at science—

CHAIR: Can I just get an indication of how long, Senator Rice? I believe Senator Rennick's only got a few questions.

Senator RICE: I've probably got two lots of five minutes, so another 10 minutes.

CHAIR: Senator Rennick, are you pressed to be anywhere else? Keep going, Senator Rice.

Senator RICE: I first of all want to talk about the feedstock technology, FutureFeed. In particular, I want to know about the economics of it—this is the seaweed additive to cattle feedstock to reduce methane. CSIRO developed the product, yes? Obviously, it adds cost to a farmer's feedstock—and good value in doing so—but how big a price difference? How much is it going to cost a farmer to add it to their feedstock?

Dr Marshall: It was developed in Townsville, which is a great indicator of the power of innovation happening in regional Australia where the customers are. The cattle industry at the time wasn't looking for something like this. They were probably a bit sceptical, but they trusted us and worked with us. It's only a feed supplement, so the cost of it is quite small because you only put a very small amount—I think it's one per cent or something—into the feed. Economically, the cattle industry already uses feed supplements so this is a substitute. My understanding of the cost is it's similar to the cost of other feed supplements but has the added benefit that it virtually eliminates, or dramatically reduces, the greenhouse gas emissions.

Senator RICE: What's the incentive for farmers to use it?

Dr Marshall: It's at least bottom-line neutral but, in general, the nutritional value of the feed supplement is slightly better than existing feed supplements. That is something we still have to really prove out in the way you would with any medicinal-type product, but I can say for sure it's cost neutral.

Senator RICE: So it's a substitute for other additives that they are using and has the added bonus of reducing methane emissions?

Dr Marshall: Correct.

Senator RICE: What's been the uptake of it so far?

Dr Marshall: We had some roadblocks in the initial commercialisation of it, and it took us about a year to sort those out so we're probably a year behind where we would be otherwise. We'd like to release this product to the world because in Australia 10 per cent of our emissions come from cattle, but we're a very small number in absolute terms relative to the rest of the world: Australia's emissions are less than 1.3 per cent.

Senator RICE: Staying with Australia, what do you think needs to happen to incentivise its uptake? Do there need to be financial incentives?

Dr Marshall: No. We need to scale up production, we need to scale up the quantities and we need to better educate the community as to the benefits and validate them. We need to work with partners and get it into the field.

Senator RICE: Have you asked the government to include the methodology under the Emissions Reduction Fund?

Dr Marshall: I'm not aware of that. We may not have done that yet.

Senator RICE: Given it reduces carbon emissions, would that it would be valuable be one of the advantages, in terms of selling it into markets that have got a carbon price?

Senator McDONALD: It reduces methane, not carbon.

Senator RICE: Methane is carbon.

Senator McDONALD: Sorry about that. There are several products on the market. The CSIRO's is not the only one out there.

Senator RICE: Methane is a much, much more intensive carbon.

Senator McDONALD: It's not the only one, so CSIRO will have to hurry up to get to market first.

Senator RICE: It's CH₄ rather than CO₂. Is there value in promoting its value in reducing greenhouse gas emissions, or carbon emissions, in terms of your sales to other countries that have a price on carbon?

Dr Marshall: I think there's value, regardless of a price on carbon, because of the fact that it's bottom-line neutral, and may even be bottom-line beneficial, so why wouldn't you do it?

Senator RICE: How far off do you think it is before FutureFeed will be commercial and widely deployed?

Dr Marshall: I've been commercialising science and technology for 30 years and I've learned never to try to speculate about how long it'll take. The reason is that there are two sides to this equation: there's the innovation push, but innovation only moves at the speed of the market, and, to Senator McDonald's point, there's competition.

Senator RICE: If we had a carbon price and if it were available either under the Emissions Reduction Fund or there was value in terms of its reducing emissions, there would be greater incentive for it to be taken up.

Dr Marshall: We initially got push back with the idea of this until farmers started testing it with us and realised it actually works and why wouldn't you do it. I don't think it needs to be forced on the market; I think the market gets the reason to do it.

Senator RICE: But the uptake is slow at the moment. Is it available commercially for farmers who want to use it now?

Dr Marshall: For testing, yes. For commercial outlet, we're not there yet.

Senator RICE: Is there more testing that needs to be done in order to test its value and its safety?

Dr Marshall: I think I mentioned that we have to scale up production capability and we have to get it out of CSIRO and into an actual company that's free to operate, to go do that.

Senator RICE: Finally—

CHAIR: Is it on this topic, because I've got a follow-up question?

Senator RICE: No, I'm moving on.

CHAIR: Senator McDonald pointed out that there are other companies in this space. Has the CSIRO developed protected IP around its solution? Is that significantly different and going to provide an internationally competitive advantage to this particular product?

Dr Marshall: Yes. I think we've got a good barrier to entry on that, and that was part of the reason for the year's delay while we dealt with that.

CHAIR: Okay. That was about protecting your IP.

Senator RICE: I want to move on to the coronavirus and the work that CSIRO's doing there. I understand that the CSIRO Animal Health Laboratory has been engaged by the Coalition for Epidemic Preparedness Innovations for critical research on the coronavirus, COVID-19. What can you tell us about your work in that space?

Dr Marshall: Probably two key things. There are two key elements that CSIRO has for fighting this new enemy. One is, as you quite rightly pointed out, the Animal Health Laboratory, which is one of only six such laboratories in the world. It is the only large-scale PC4 facility not just in Australia but in the Southern Hemisphere. Between them, AAHL, the Animal Health Laboratory, and these other five labs around the world essentially form the global centre for disease control. These labs share data. It's a 'team world' approach, if you like, to fighting disease. The other element, though, that's equally important, is that in 2016 we created our health group and we started to build a vaccine pipeline and a manufacturing capability to produce and scale up test vaccines, like the one produced recently at the University of Queensland. It's the combination of those two things that gives Australia the unique ability to be right at the forefront in fighting coronavirus. Often we forget them—because the people in spacesuits working in AAHL in the PC4 facility really get a lot of attention, and they deserve it—but, equally, it's the people at Clayton who are producing sufficient quantities to actually work with and who will ultimately figure out the manufacturability of a vaccine. It's a classic innovation problem. We celebrate when there's an invention, but unfortunately that's usually only about one per cent of the work. The hard work happens in turning that invention, that idea, into something usable by a real person. The team at AAHL and the team at Clayton really focus on that translation of these wonderful breakthrough inventions to actual usable cures.

Senator RICE: Yes. Your website says that that work is being fast-tracked, so what does that actually mean?

Dr Marshall: Essentially, we have pulled resources off other projects in order to increase the effort on the coronavirus, as we recognise it's a global pandemic.

Senator RICE: What resources are being spent on the coronavirus project?

Dr Marshall: I can give you the numbers of the top of my head, but Dr Williams will give you the detail.

CHAIR: I welcome Minister Hume to the table.

Senator Hume: Thank you, Chair.

Dr Williams: Senator, did you mean: what money is being deployed?

Senator RICE: Yes.

Dr Williams: We're working with CEPI, and CEPI have given us a contract for some \$4.7 million between the University of Queensland, Doherty and us. We're doing animal trials. We're preparing the animal challenge. With the resources we've pulled, we've slowed down other work at AAHL. When we have an emergency, we can slow down contracts and other programs and stop some. So we've taken people off other work and put them onto the coronavirus.

Senator RICE: How many people are working on the coronavirus?

Dr Williams: We estimate that, in a period of about 12 months, we're going to have 45 or 50 working on the project.

Senator RICE: Where did that \$4.7 million come from?

Dr Williams: CEPI have provided that to us. The remaining resources we've got by cancelling the existing work and just putting the staff onto the project, and we'll sort out how we resolve any problems as we move through the work.

Senator RICE: Is that the government's announced \$5 million to support the research?

Dr Williams: Which \$5 million?

Dr Marshall: No.

Senator RICE: Okay. So it's \$4.7 million from?

Dr Williams: CEPI.

Senator RICE: Which is?

Dr Williams: It is a coalition, and the Australian government puts money into it. That's one of the reasons why CSIRO has been—

CHAIR: Sorry, is it a word or an acronym? I haven't come across it before.

Dr Marshall: It's called the Coalition for Epidemic Preparedness Innovations. We joined that group about a year ago in anticipation of an event like this possibly happening in the future. It's the same reason we created, if you like, the vaccine pipeline and manufacturing capability.

Senator RICE: So it's an acronym?

Dr Marshall: It's the Coalition for Epidemic Preparedness Innovations.

Dr Williams: It was in Dr Marshall's opening statement.

Senator RICE: So you've been engaged by the Coalition for Epidemic Preparedness Innovations?

Dr Williams: Yes.

CHAIR: That's global, not just Australian?

Dr Marshall: It's a global group.

Senator RICE: So you've got \$4.7 million from this global organisation?

Dr Williams: Yes.

Senator RICE: I have been told that \$5 million had been announced to support this research in vaccine development, but you don't know anything about that?

Dr Marshall: I believe the government actually does fund or contribute to CEPI, but CEPI is driven by the Bill & Melinda Gates Foundation, the Wellcome Trust and a series of other philanthropic organisations.

Senator RICE: I understand what you were saying, Dr Marshall, about the unclear time line for getting products to market, or in this case use. What's the anticipated time on a vaccine being available for common use?

Dr Williams: The present schedule is that, if we get a vaccine that's agreed and we manage to produce quantities in our Melbourne facility, we will start the trials in CSIRO on animals towards the end of March. We'll probably finish those trials, if everything goes according to plan A, by the end of May, and the results will be available in June. Then CEPI would decide separately how to go to human trials with a prototype vaccine that would work on animals.

Senator RICE: Thank you.

Senator RENNICK: I'm not sure specifically who to ask these questions to, and you're more than welcome to take them on notice if you need to. Does CSIRO agree with the IPCC view on the heat-increasing properties of water vapour by two degrees—they're forecasting a potential three-degree rise, of which two degrees is related to the feedback of water vapour rather than carbon dioxide—or does it remain open to its impact? I will just quote the 2007 fourth assessment, where the IPCC admitted that over half of scientists agree that clouds produce an overall cooling effect on the climate, which is interesting because if it has a cooling effect then obviously it's going to offset the carbon dioxide rather than double up on it. Then later on it says that clouds are a significant source of error in all future predictions as their role is not understood.

Dr Marshall: While my colleague looks that up, maybe I can just say something. Things like water vapour are pretty much in equilibrium in our system. The sun shines, and the water evaporates from the ocean, goes into the atmosphere and comes back as rain. That's a pretty short-term cycle. Emissions from fossils are much longer lived—even the isotope of CO₂ that's emitted is longer lived—so it's a bit of a different timescale.

Senator RENNICK: Does that mean that water vapour increases temperature, or decreases it, or you're not sure?

Dr Marshall: Water vapour absolutely is an absorber of radiation. It's not as bad as methane and others, but it is an absorber. But the point is that it's short-lived, so it doesn't tend to build up in the atmosphere over long periods of time, whereas fossil emissions do.

Senator RENNICK: Can you quantify the heat-increasing properties of it?

Dr Mayfield: Obviously the way that you quantify these effects is through the use of climate models. They do take into account all of the various greenhouse gases—CO₂, nitrous oxide et cetera. Water vapour is one of those.

Senator RENNICK: I've got two climate models here: one was given to me by CSIRO and the other one was given to me by the Australian Academy of Science. On this one, the downwelling radiation is 333 watts per square metre, and on this particular energy flow it's 342 watts per square metre. So, there's a difference of nine watts per square metre in the two different models. The IPCC has modelled that the increase in radiative forcing from the increase in carbon dioxide in the atmosphere since 1750 is 1.8 watts per square metre. Just so that we can be clear: for the downwelling radiation from greenhouse gases, is it 342 watts per square metre or 333 watts per square metre?

Dr Mayfield: I'd have to look at those two particular situations, in terms of the models run, to understand what's in there and what's not in there, and it's not possible to answer that here today.

Senator RENNICK: Sure. The reason I raise it is that it is a 500 per cent difference over the 1.8 watts per square metre that carbon dioxide's supposed to increase the temperature—it's heat-increasing property. If we're looking at these models and making decisions based on these models then they need to be accurate. Would you not agree with that?

Dr Mayfield: You would understand that there is no one single definitive model of the climate.

Senator RENNICK: So you're saying that the science isn't settled?

Dr Mayfield: You have to run it with a lot of uncertainty. You do that by running a range of different modelling conditions, and you're looking at the probabilities within that range—

Senator RENNICK: So we're looking at probabilities, not certainties?

Dr Mayfield: It's not a deterministic model.

Senator RENNICK: So it's probabilities, not certainties.

Dr Mayfield: It's done on a probabilistic basis, which is the normal scientific method.

Senator RENNICK: Sure. No worries. You can take this on notice. Could you please state what the emissivity of carbon dioxide is.

Dr Mayfield: Sorry?

Senator RENNICK: How much heat does carbon dioxide radiate versus convection and conduction?

Dr Mayfield: I'm not a physicist. But, with the emissivity—and obviously it changes across wavelength bands—there's a known spectrum. We'll take that on notice to give you the most accurate answer.

Senator RENNICK: Sure. Are you familiar with Werner Heisenberg's uncertainty principle? Basically you can either know—

Dr Marshall: I'm a physicist and I'm familiar with the uncertainty principle, yes.

Senator RENNICK: He got a Nobel Prize in 1927 for I think it was coming up with statistic probabilities of the wave function. Basically, we're taught in grade 12 physics that you can either know the momentum or the position of a subatomic particle, but you can't know both. As a result, that has led to the introduction of quantum physics—which ironically enough Einstein could never reconcile with classical physics; hence his letter to Max Born, where he says, 'God doesn't play dice.' My point is that, given that infrared radiation has a lower frequency, and hence power, than visible light, it's very difficult to understand the properties of infrared radiation if you want to base it on Heisenberg's uncertainty principle, is it not?

Dr Marshall: The uncertainty principle applies at the quantum level.

Senator RENNICK: Yes, that's right.

Dr Marshall: If we move into the classical level, the macro world that we all live in, it's not really relevant. Those uncertainties are so tiny, they're irrelevant to the world we live in. So, if you're talking about uncertainty and radiation absorption, those things are all macro effects that you can easily quantify and measure.

Senator RENNICK: I dispute that, because the two models—and I've been trying to get the bottom of this—give a difference of nine watts per square metre on downwelling radiation. That's a factor of about three per cent on the overall downflow, so these things matter. Given the context, where we're talking about how carbon dioxide's radiative intensity has increased by 1.8, in terms of relativities, that variance is a big variance.

Dr Marshall: I'm not familiar with the academy's model—

Senator RENNICK: It's similar; it's just got different numbers.

Dr Marshall: CSIRO developed the original models that the BOM use to do the weather forecasting. It is a fact that the seven-day forecast today is more accurate than the one-day forecast was 10 years ago. The models have gotten really pretty good over a time. I certainly remember as a kid they weren't that reliable, but it is remarkable how we have improved them. I think our models are pretty robust, but I am not familiar with the academy and I don't know that they have ever produced a model for predicting weather or any of the operational weather predictions that we have. I imagine our numbers are pretty solid. We can get back to you on that.

Senator RENNICK: My last question is a bit of a dorothy dixer. If Australia's energy demand was 100 per cent powered by wind and solar, would we still get bushfires?

Dr Marshall: If you are asking does climate change cause bushfires, the answer is no, as we speak.

Senator RENNICK: I don't have an issue with climate change. The point is, will wind and solar solve the problem of climate change?

Dr Marshall: Sorry, bushfires?

Senator RENNICK: Well, either or.

Dr Marshall: Sorry, which question are you asking?

Senator RENNICK: Will wind and solar stop bushfires from happening?

Dr Marshall: No.

Senator RENNICK: That is all I wanted to know. Can you just come back on the emissivity of carbon dioxide? That is an important question.

Dr Marshall: Sure.

CHAIR: Doctor Marshall, Doctor Mayfield and other officials, thank you so much for your time today.

Office of the Chief Scientist

[15:51]

We will now move on to the Office of the Chief Scientist. Welcome, Dr Finkel. Would you like to make any opening remarks?

Dr Finkel: Straight to it, Chair!