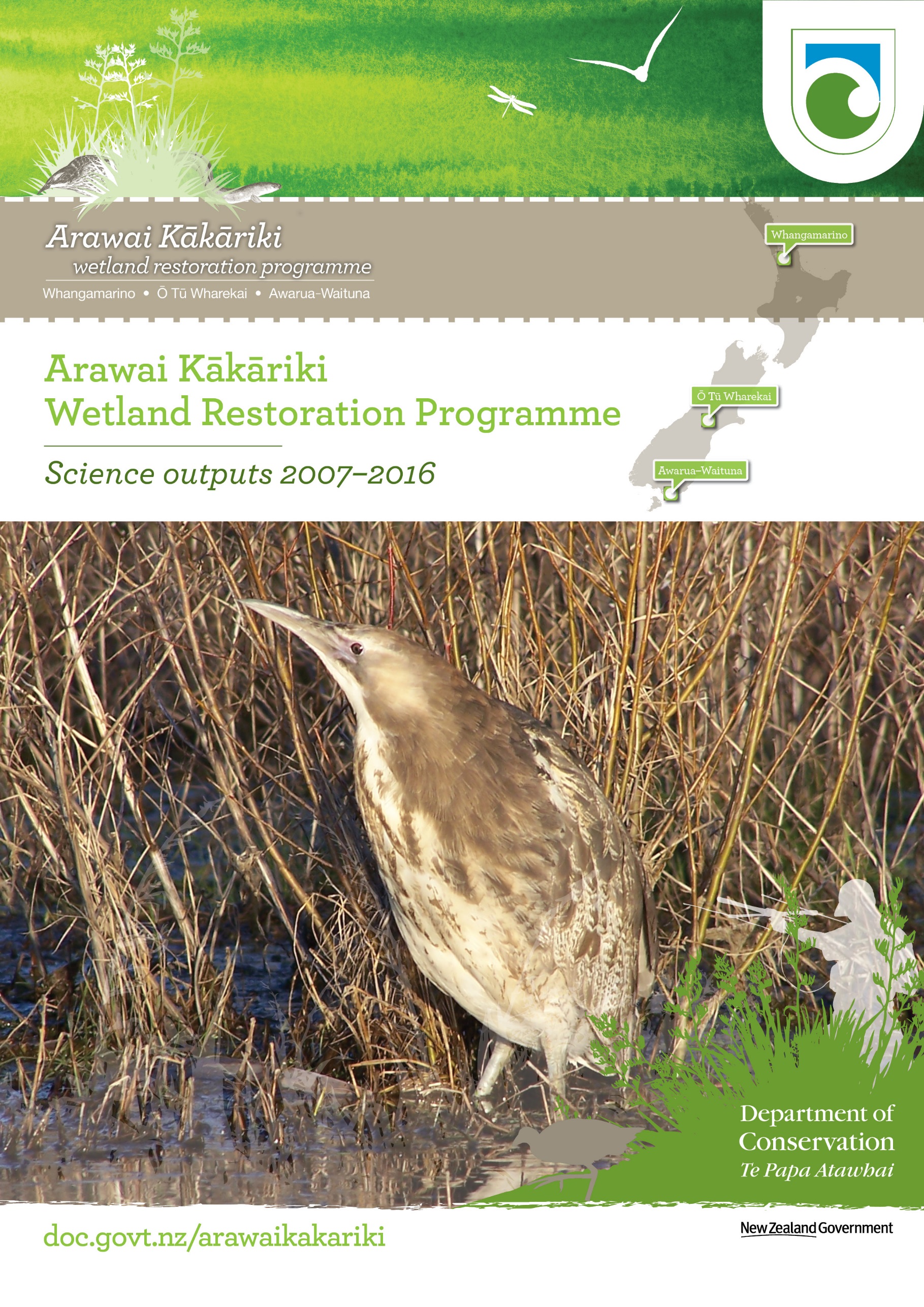
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Cover: An Australasian bittern (*Botaurus poiciloptilus*). *Photo: John Cheyne*.

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This report may be cited as: Macdonald, A.; Robertson, H. 2017: Arawai Kākāriki Wetland Restoration Programme, Science Outputs 2007–2016. Department of Conservation, Wellington.

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# About Arawai **Kākāriki**

**Introduction and programme** description

Arawai Kākāriki is a large-scale wetland restoration programme led by DOC in partnership with others. The focus of Arawai Kākāriki is to protect and restore wetlands, and increase our understanding of these environments. The better our understanding of the status and functioning of vulnerable ecosystems and species, the more we can improve wetland restoration in New Zealand.

An important part of the programme is getting the community involved. We are also working with research partners to improve our knowledge of wetland conservation issues, and building stronger relationships with iwi and regional councils.

|  |  |
| --- | --- |
| Arawai Kākāriki sites Our focus is on three of New Zealand's most significant wetland sites:   * Whangamarino Wetland (Waikato) – a Ramsar site, and at 7,000 ha the second largest bog and swamp complex in the North Island. * Ō Tū Wharekai (Canterbury) – one of the best examples of an intact, intermontane wetland, lake and braided river system remaining in New Zealand. * Awarua-Waituna (Southland) – New Zealand's first Ramsar site and one of the largest remaining coastal wetlands in New Zealand. The wetlands include extensive peat bog, swamp, coastal lagoon, estuary and stream habitats. | Map of Arawai Kakariki wetland restoration projects. |

## Aims of Arawai Kākāriki

We have 10 national objectives to guide our conservation work and help us achieve the best possible outcomes.

Ecological restoration

1. Maintain or increase habitat extent
2. Enhance water regime and quality
3. Protect or restore ecosystem condition.
4. Enhance species diversity and protect threatened species

Mātauranga Māori

1. Work with iwi, hapū, and whānau to embrace Mātauranga Māori

Work with others

1. Maximise partnerships and participation
2. Increase awareness and appreciation
3. Share scientific and technical knowledge

Learning

1. Undertake research to improve wetland management
2. Develop best practice monitoring tools

# 

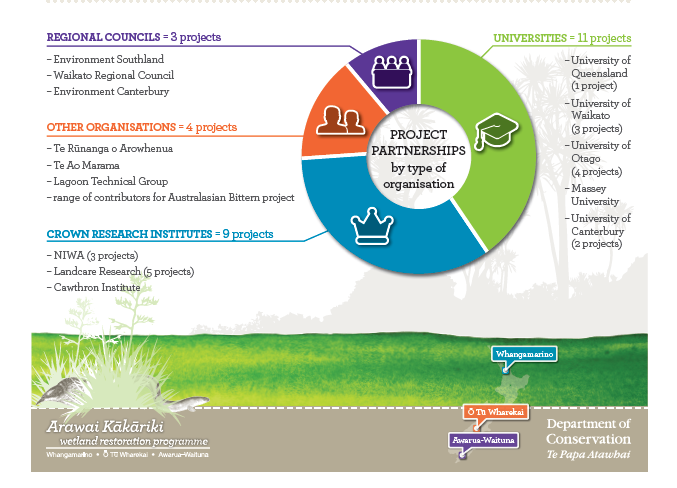
# Science at our wetlands

Scientific research guides our management decisions to help protect and restore wetland ecosystems. Identifying the greatest threats to our wetlands assists managers to put effort in the right places. Arawai Kākāriki has led a national research programme to address knowledge gaps that are a barrier to freshwater conservation – the research covers the fields of ecohydrology, paleoecology, environmental economics, botany, zoology, ecology and conservation biology.

To manage our wetlands effectively, we need to understand the ecological processes that keep these areas healthy and resilient. Currently there is limited information of some threats to wetlands and this creates a ‘knowing–doing’ gap. By working together, scientists and wetland managers can describe sensible goals and guidelines for restoration.

# Partnerships

Arawai Kākāriki has developed research partnerships with a number of universities and research institutions. Working collaboratively has helped address gaps in our knowledge more rapidly than if we had worked alone. The Department acknowledges the in-kind and co-funding from our research partners, such as the MBIE Restoring Wetlands programme.



# About this bibliography

This bibliography documents Arawai Kākāriki science outputs since the programme began in 2007, with the outputs organised under five themes. These are:

* Enhancing native species – fauna
* Enhancing native species – flora
* Understanding wetland history and values
* Addressing catchment impacts
* Reporting

**The bibliography tables are in the following format:**

**Theme**

**Project title**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Citation | [document](https://doccm.doc.govt.nz/wcc/faces/wccdoc?dDocName=DOC-2807375) link | Output type | Partnership? | Output ID |

**Key to bibliography symbols:**

|  |  |  |
| --- | --- | --- |
| Output Type | Report | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) |
| Communication/Memo/Report card | [Image result for clipart conversation speech bubbles](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjFzvuZwfTPAhULw7wKHfVQARYQjRwIBw&url=http://www.webweaver.nu/clipart/cartoon-speech-bubbles.shtml&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNEUxyzpY5ufX82NLYC3FpBsJg36Kg&ust=1477435192634807) |
| Presentation | [Image result for clipart presentation silouette](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjanpyiwvTPAhUJVbwKHTVTCJAQjRwIBw&url=http://www.flaticon.com/free-icon/male-cartoon-pointing-to-white-board_27759&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNG-IqnNKjoibKO_IEExcGq2DWJhRQ&ust=1477435472938198) |
| Publication/thesis | [Image result for clipart book](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjOvfK3w_TPAhWEUbwKHYCbArAQjRwIBw&url=http://imageenvision.com/all-graphics-pg7&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNHoUZRvO5J0VQ1jWSTZP7imTgpAeQ&ust=1477435536497020) |
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| Partnership project (In-kind and co-funded) | | [Image result for clip art hand shake](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwj9iq6Z4fTPAhVDJpQKHQ1gA-AQjRwIBw&url=http://www.clipartpanda.com/categories/handshake-20clipart&psig=AFQjCNHk5ZExI4juDnQO7VCR3wY8K_jPQg&ust=1477443776064482) |

# Summary of Arawai Kākāriki science outputs

The following table shows the number of the science outputs under the five themes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Output type** | Number of outputs by theme | | | | | TOTAL |
| Enhancing native species – fauna | Enhancing native species – flora | Understanding wetland history and values | Addressing catchment impacts | Reporting |  |
| Report | 24 | 24 | 5 | 15 | 6 | **74** |
| Communication/memo |  | 2 | 1 | 15 | 11 | **29** |
| Presentation | 10 | 11 | 8 | 10 |  | **39** |
| Publication/thesis | 8 | 8 | 11 | 8 |  | **35** |
| **TOTAL** | **40** | **39** | **23** | **46** | **17** | **177** |

# Enhancing Native Species: Fauna

## Cryptic bird monitoring

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| More, J.M. 2011: A survey for marsh crake in the Hakatere wetlands with the aim of gaining a better understanding of effective monitoring procedures. Department of Conservation, Christchurch |  | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) |  | 15t |
| O’Donnell, C. 2010: Draft protocols for index counts of fernbird. Research and Development Group, Department of Conservation, Wellington. |  | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) |  | 15f |
| O’Donnell, C. 2010: Draft protocols for index counts of Spotless Crake. Research and Development Group, Department of Conservation, Wellington. |  | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) |  | 15g |
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| O’Donnell, C. 2013: Draft protocols for index counts of Australasian Bittern. Research and Development Group, Department of Conservation, Wellington. |  | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) | [Image result for clip art hand shake](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwj9iq6Z4fTPAhVDJpQKHQ1gA-AQjRwIBw&url=http://www.clipartpanda.com/categories/handshake-20clipart&psig=AFQjCNHk5ZExI4juDnQO7VCR3wY8K_jPQg&ust=1477443776064482) | 15n |
| O’Donnell, C. 2013: Draft protocols for index counts of Marsh Crake. Research and Development Group, Department of Conservation, Wellington. |  | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) |  | 15e |
| O’Donnell, C. 2013: Standardised protocol for monitoring effects of predator trapping on fernbird populations at Whangamarino wetland. Research and Development Group, Department of Conservation, Wellington. |  | [Image result for clipart notebook and pen](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiq1pPswPTPAhVKObwKHXCqCgQQjRwIBw&url=http://oliverqnicks.blogspot.com/2011/09/notebook-paper-and-pencil.html&psig=AFQjCNH8IuQjfiSq9K5KSvcavSuvDSSI5Q&ust=1477435096870275) |  | 15o |
| O'Donnell, C. 2008: Developing national inventory and monitoring standards for specialist swamp bird species. Presentation to research workshop. |  | [Image result for clipart presentation silouette](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjanpyiwvTPAhUJVbwKHTVTCJAQjRwIBw&url=http://www.flaticon.com/free-icon/male-cartoon-pointing-to-white-board_27759&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNG-IqnNKjoibKO_IEExcGq2DWJhRQ&ust=1477435472938198) |  | 15h |
| O'Donnell, C. 2014: Conservation and monitoring methods for threatened swamp bird species. Presentation to Department of Conservation. |  | [Image result for clipart presentation silouette](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjanpyiwvTPAhUJVbwKHTVTCJAQjRwIBw&url=http://www.flaticon.com/free-icon/male-cartoon-pointing-to-white-board_27759&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNG-IqnNKjoibKO_IEExcGq2DWJhRQ&ust=1477435472938198) |  | 15j |
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| O'Donnell, C.F.; Williams, E. 2013: How to monitor a bird that thinks it's a blade of grass: Developing monitoring methods for Cryptic wetland species. Presentation to Department of Conservation. |  | [Image result for clipart presentation silouette](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjanpyiwvTPAhUJVbwKHTVTCJAQjRwIBw&url=http://www.flaticon.com/free-icon/male-cartoon-pointing-to-white-board_27759&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNG-IqnNKjoibKO_IEExcGq2DWJhRQ&ust=1477435472938198) | [Image result for clip art hand shake](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwj9iq6Z4fTPAhVDJpQKHQ1gA-AQjRwIBw&url=http://www.clipartpanda.com/categories/handshake-20clipart&psig=AFQjCNHk5ZExI4juDnQO7VCR3wY8K_jPQg&ust=1477443776064482) | 15k |
| O'Donnell, C.F.; Williams, E.M.; Cheyne, J. 2013: Close approaches and acoustic triangulation: techniques for mapping the distribution of booming Australasian bittern (*Botaurus poiciloptilus*) on small wetlands. *Notornis* (60): pp. 279-284. | <http://notornis.osnz.org.nz/system/files/O'Donnell%20et%20al.%202013.pdf> | [Image result for clipart book](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjOvfK3w_TPAhWEUbwKHYCbArAQjRwIBw&url=http://imageenvision.com/all-graphics-pg7&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNHoUZRvO5J0VQ1jWSTZP7imTgpAeQ&ust=1477435536497020) | [Image result for clip art hand shake](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwj9iq6Z4fTPAhVDJpQKHQ1gA-AQjRwIBw&url=http://www.clipartpanda.com/categories/handshake-20clipart&psig=AFQjCNHk5ZExI4juDnQO7VCR3wY8K_jPQg&ust=1477443776064482) | 15i |
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## Predator impacts on wetland birds

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| --- | --- | --- | --- | --- |
| O’Donnell, C. F.; Clapperton, B. K.; Monks, J. M. 2015: Impacts of introduced mammalian predators on indigenous birds of freshwater wetlands in New Zealand. *New Zealand Journal of Ecology* 39(1): 19-33. | <http://newzealandecology.org/nzje/3211.pdf> | [Image result for clipart book](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjOvfK3w_TPAhWEUbwKHYCbArAQjRwIBw&url=http://imageenvision.com/all-graphics-pg7&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNHoUZRvO5J0VQ1jWSTZP7imTgpAeQ&ust=1477435536497020) | [Image result for clip art hand shake](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwj9iq6Z4fTPAhVDJpQKHQ1gA-AQjRwIBw&url=http://www.clipartpanda.com/categories/handshake-20clipart&psig=AFQjCNHk5ZExI4juDnQO7VCR3wY8K_jPQg&ust=1477443776064482) | 40a |
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## Rare bird communities

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| --- | --- | --- | --- | --- |
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# Enhancing Native Species: Flora

## Drivers of macrophytes (Ruppia)

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## Peatland regeneration

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## Rare plant communities

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# Understanding wetland history and value

## Ecosystem services

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# Addressing catchment impacts

## High-country lakes water quality

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## Hydrological model – catchment scale

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## Wetland ecohydrology

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## Wetland limit setting

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# Reporting

## Arawai Kākāriki report cards

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| DOC. 2016: Australasian bittern in New Zealand. Report Card (Objective 4). Department of Conservation, Wellington. | link to be added | [Image result for clipart conversation speech bubbles](http://www.google.co.nz/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjFzvuZwfTPAhULw7wKHfVQARYQjRwIBw&url=http://www.webweaver.nu/clipart/cartoon-speech-bubbles.shtml&bvm=bv.136811127,bs.2,d.dGc&psig=AFQjCNEUxyzpY5ufX82NLYC3FpBsJg36Kg&ust=1477435192634807) |  | 63g |
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## Arawai Kākāriki reporting

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## Monitoring framework

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