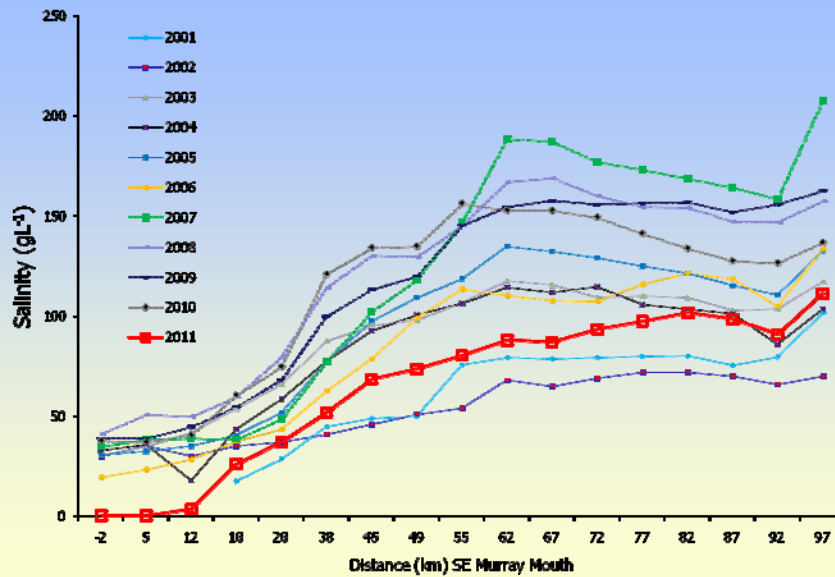


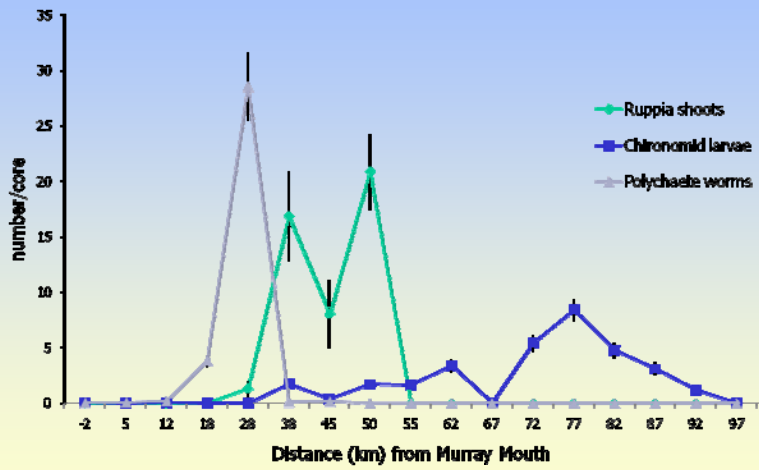
Waterbird responses to the return of freshwater flows to the Coorong and Lower Lakes

David C. Paton

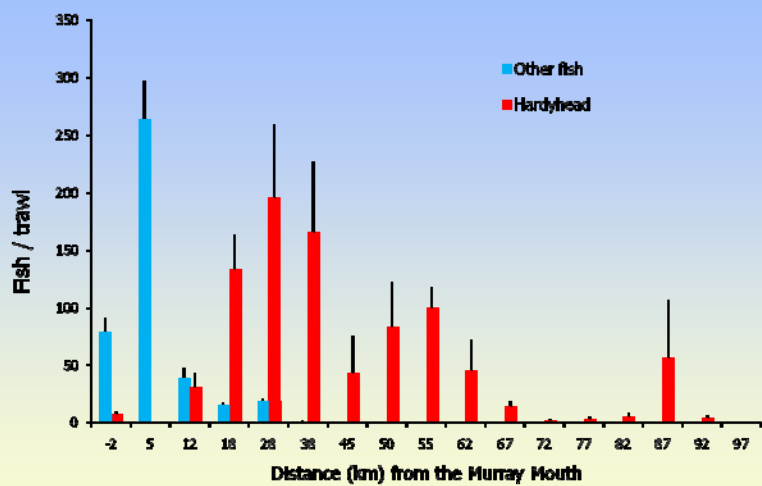
School of Earth & Environmental Sciences



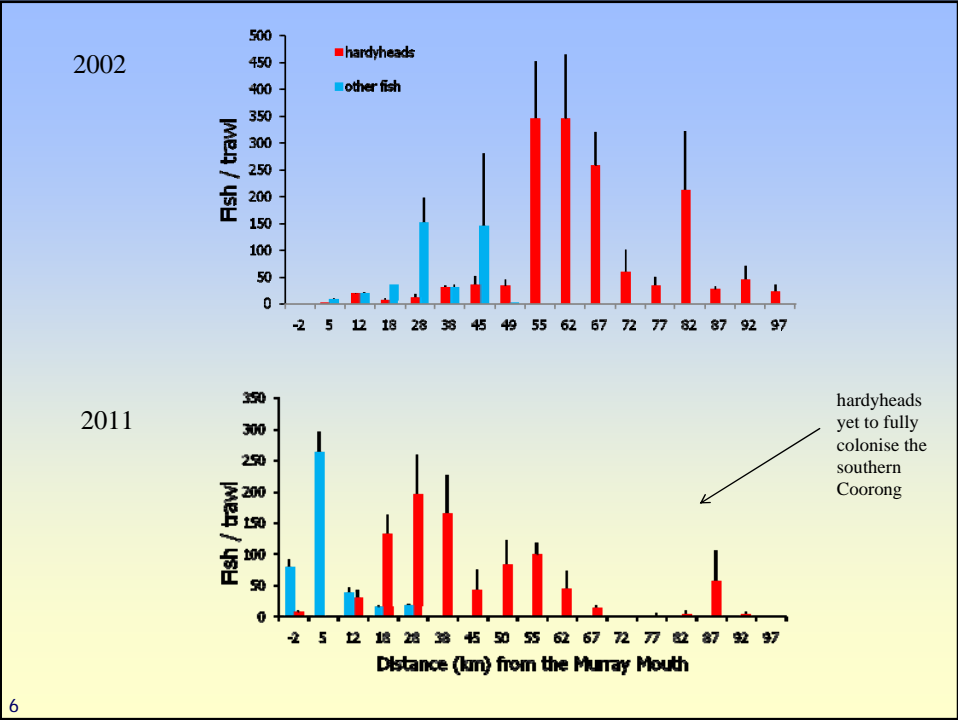
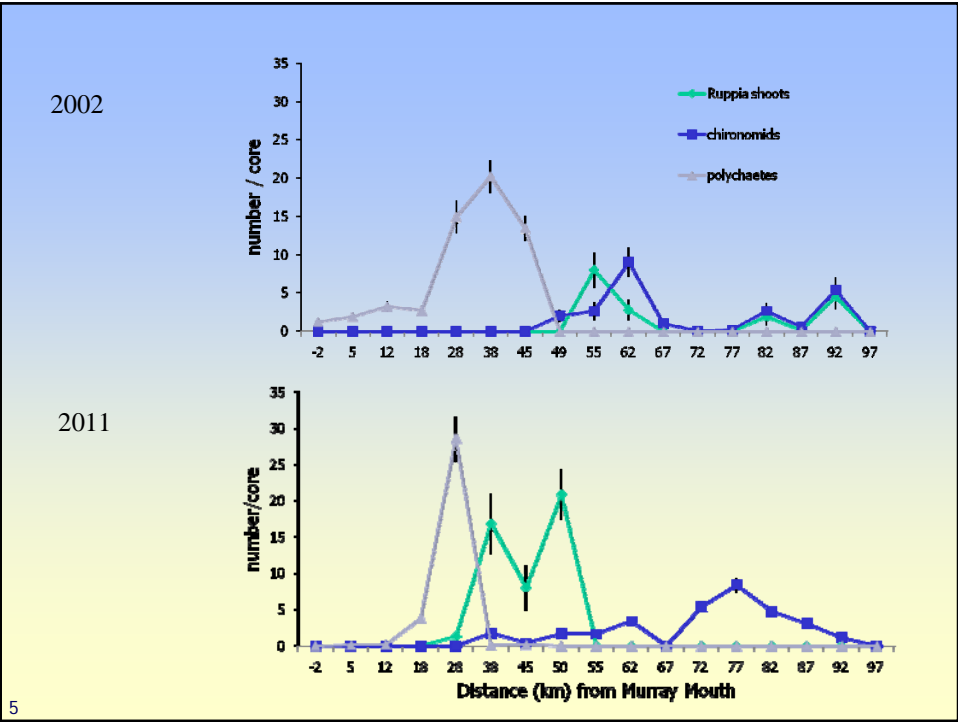
Availability of benthic resources

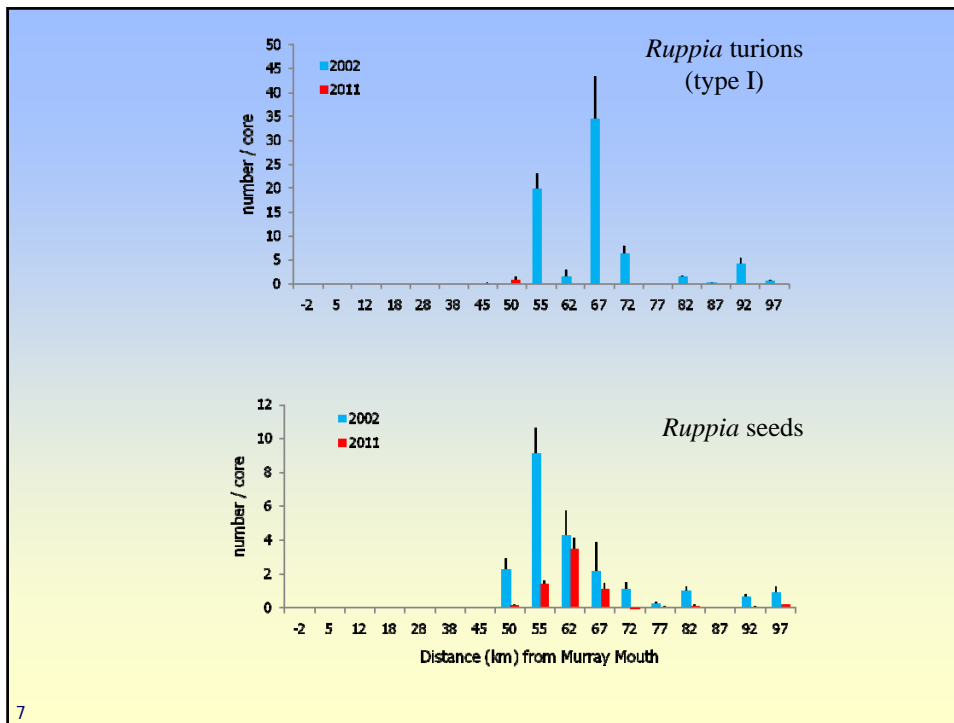


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4





7

| Species | 2000-2007 | 2008-2010 | 2011 | Trend | |
|------------------------|--------------|---------------|-------|-------|-----------------------|
| | mean ± s.e. | mean ± s.e. | | | |
| Australian Pelican | 3624 ± 391 | 1890 ± 532 | 4262 | I | 4 species increased |
| Great Cormorant | 1201 ± 483 | 464 ± 321 | 2726 | I | |
| Silver Gull | 8846 ± 1203 | 8619 ± 1586 | 14839 | I | |
| Caspian Tern | 650 ± 127 | 213 ± 33 | 375 | I | |
| Little Black Cormorant | 1190 ± 310 | 686 ± 349 | 833 | | 6-8 species no change |
| Australian Shelduck | 8016 ± 1999 | 16008 ± 5567 | 17551 | | |
| Chestnut Teal | 12237 ± 2113 | 5385 ± 410 | 4779 | | |
| White-faced Heron | 146 ± 15 | 154 ± 31 | 133 | | |
| Bar-tailed Godwit | 20 ± 12 | 27 ± 26 | 32 | | |
| Crested Tern | 4088 ± 841 | 7609 ± 2211 | 3777 | | |
| Banded Stilt | 27150 ± 9848 | 95310 ± 59327 | 18054 | (D) | |
| Red-necked Avocet | 3077 ± 750 | 450 ± 216 | 162 | (D) | |

8

| Species | 2000-2007 | 2008-2010 | 2011 | Trend | |
|----------------------------|----------------|----------------|-------|-------|---|
| | mean ± s.e. | mean ± s.e. | | | |
| Little Pied Cormorant | 407 ± 85 | 271 ± 142 | 0 | D | |
| Great Crested Grebe | 276 ± 69 | 461 ± 199 | 2 | D | |
| Hoary-headed Grebe | 3909 ± 731 | 9505 ± 3045 | 0 | D | |
| Black Swan | 1853 ± 332 | 1101 ± 62 | 216 | D | |
| Grey Teal | 17335 ± 4142 | 7255 ± 976 | 222 | D | |
| Musk Duck | 265 ± 47 | 194 ± 56 | 13 | D | |
| Great Egret | 55 ± 19 | 10 ± 4 | 3 | D | 23 species declined substantially |
| Little Egret | 10 ± 4 | 6 ± 2 | 0 | D | |
| Australian White Ibis | 322 ± 56 | 220 ± 44 | 151 | D | |
| Straw-necked Ibis | 41 ± 16 | 232 ± 210 | 4 | D | |
| Common Greenshank | 526 ± 31 | 491 ± 33 | 208 | D | |
| Marsh Sandpiper | 3 ± 1.5 | 13 ± 5.7 | 0 | D | |
| Black-tailed Godwit | 53 ± 18 | 99 ± 41 | 0 | D | |
| Sharp-tailed Sandpiper | 14244 ± 3098 | 15453 ± 1738 | 146 | D | |
| Red-necked Stint | 29541 ± 2898 | 17262 ± 1850 | 6505 | D | |
| Curlew Sandpiper | 3760 ± 754 | 1159 ± 243 | 217 | D | |
| Pied Oystercatcher | 164 ± 14 | 179 ± 18 | 131 | D | |
| Masked Lapwing | 530 ± 53 | 471 ± 30 | 401 | D | |
| Pacific Golden Plover | 43 ± 17 | 31 ± 10 | 0 | D | |
| Red-capped Plover | 1083 ± 151 | 972 ± 283 | 71 | D | |
| Black-winged Stilt | 463 ± 68 | 516 ± 99 | 44 | D | |
| Whiskered Tern | 6164 ± 1653 | 7308 ± 1937 | 155 | D | |
| Fairy Tern | 389 ± 63 | 371 ± 35 | 169 | D | |
| TOTAL | 152923 ± 15726 | 201574 ± 70910 | 76793 | (D) | |
| Total (excl. Banded Stilt) | 125785 ± 10671 | 106264 ± 16335 | 58739 | D | |

9

| Changes in abundances of birds in the Lower Lakes | | | | |
|---|-----------|-------|-------|--------|
| Species | Abundance | | | Change |
| | 2009 | 2010 | 2011 | |
| Australian Pelican | 4259 | 4460 | 2996 | D |
| Pied Cormorant | 1342 | 982 | 1717 | I |
| Little Pied Cormorant | 166 | 96 | 82 | D |
| Great Cormorant | 2081 | 6124 | 4997 | |
| Little Black Cormorant | 107 | 1298 | 826 | |
| Great Crested Grebe | 12 | 24 | 217 | I |
| Black Swan | 896 | 2791 | 4166 | I |
| Cape Barren Goose | 1692 | 1215 | 1303 | |
| Australian Shelduck | 12022 | 15787 | 14296 | |
| Pacific Black Duck | 1187 | 2003 | 1684 | |
| Grey Teal | 10854 | 13857 | 804 | D |
| Chestnut Teal | 654 | 302 | 430 | |
| Musk Duck | 2 | 4 | 12 | |
| Dusky Moorhen | 13 | | 30 | |
| Purple Swamphen | 9 | 32 | 47 | I |
| Eurasian Coot | 252 | 3308 | 39 | D |

10

Changes in abundances of birds in the Lower Lakes

| Species | Abundance | | | Change |
|-------------------------|---------------|----------------|---------------|----------|
| | 2009 | 2010 | 2011 | |
| White-faced Heron | 95 | 94 | 222 | I |
| Great Egret | 104 | 65 | 105 | |
| Little Egret | 16 | 2 | 4 | |
| Australian White Ibis | 463 | 178 | 1195 | I |
| Straw-necked Ibis | 181 | 387 | 532 | I |
| Royal Spoonbill | 396 | 341 | 201 | D |
| Yellow-billed Spoonbill | 55 | 58 | 17 | D |
| Common Greenshank | 146 | 219 | 29 | D |
| Sharp-tailed Sandpiper | 9238 | 13250 | 32 | D |
| Red-necked Stint | 23727 | 31138 | 100 | D |
| Curlew Sandpiper | 66 | 1026 | | D |
| Masked Lapwing | 998 | 800 | 309 | D |
| Banded Lapwing | 178 | 424 | | D |
| Red-capped Plover | 1641 | 1164 | 2 | D |
| Black-winged Stilt | 197 | 86 | 7 | D |
| Red-necked Avocet | 141 | 324 | | D |
| Silver Gull | 3743 | 3484 | 2819 | D |
| Whiskered Tern | 3536 | 3744 | 80 | D |
| Caspian Tern | 283 | 236 | 186 | D |
| Crested Tern | 529 | 327 | 313 | |
| TOTAL | 81,448 | 112,264 | 39,874 | D |

11

Change in distributions of birds in the Lower Lakes

| Species | Area occupied | | | Change |
|------------------------|---------------|------|------|--------|
| | 2009 | 2010 | 2011 | |
| Australian Pelican | 169 | 178 | 233 | I |
| Pied Cormorant | 39 | 26 | 122 | I |
| Little Pied Cormorant | 19 | 13 | 21 | |
| Great Cormorant | 56 | 80 | 270 | I |
| Little Black Cormorant | 14 | 17 | 37 | I |
| Great Crested Grebe | 6 | 5 | 7 | |
| Black Swan | 50 | 63 | 179 | I |
| Cape Barren Goose | 58 | 44 | 50 | |
| Australian Shelduck | 105 | 128 | 105 | |
| Pacific Black Duck | 63 | 56 | 111 | I |
| Grey Teal | 76 | 73 | 22 | D |
| Chestnut Teal | 14 | 7 | 35 | I |
| Musk Duck | 1 | 2 | 7 | I |
| Dusky Moorhen | 1 | | 9 | I |
| Purple Swamphen | 5 | 6 | 13 | I |
| Eurasian Coot | 2 | 15 | 3 | |

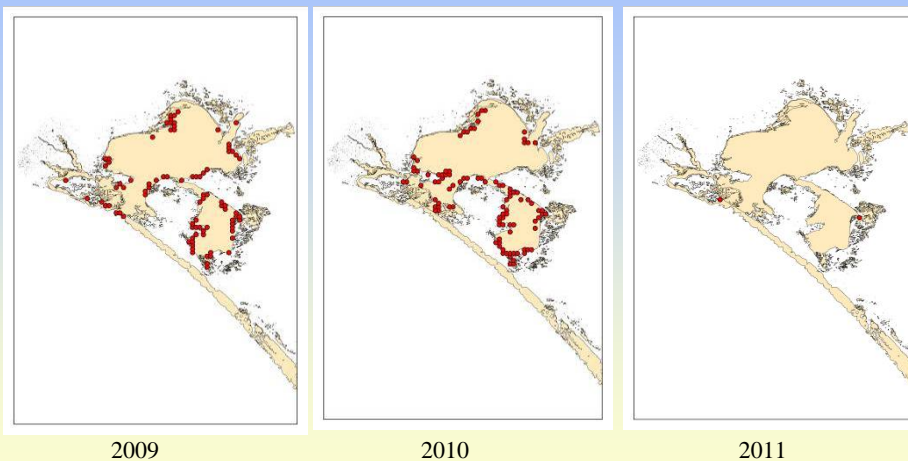
12

Change in distributions of birds in the Lower Lakes

| Species | Area occupied | | | Change |
|-------------------------|---------------|------------|------------|--------|
| | 2009 | 2010 | 2011 | |
| White-faced Heron | 51 | 61 | 63 | |
| Great Egret | 38 | 24 | 37 | |
| Little Egret | 5 | 2 | 4 | |
| Australian White Ibis | 52 | 34 | 138 | I |
| Straw-necked Ibis | 11 | 5 | 65 | I |
| Royal Spoonbill | 11 | 22 | 29 | I |
| Yellow-billed Spoonbill | 6 | 14 | 11 | |
| Common Greenshank | 36 | 39 | 14 | D |
| Sharp-tailed Sandpiper | 83 | 98 | 2 | D |
| Red-necked Stint | 85 | 98 | 2 | D |
| Curlew Sandpiper | 11 | 21 | | D |
| Masked Lapwing | 134 | 121 | 75 | D |
| Banded Lapwing | 9 | 10 | | D |
| Red-capped Plover | 130 | 119 | 1 | D |
| Black-winged Stilt | 22 | 9 | 1 | D |
| Red-necked Avocet | 6 | 7 | | D |
| Silver Gull | 165 | 163 | 159 | |
| Whiskered Tern | 88 | 116 | 6 | D |
| Caspian Tern | 71 | 69 | 63 | |
| Crested Tern | 72 | 63 | 79 | |
| TOTAL | 269 | 310 | 370 | |

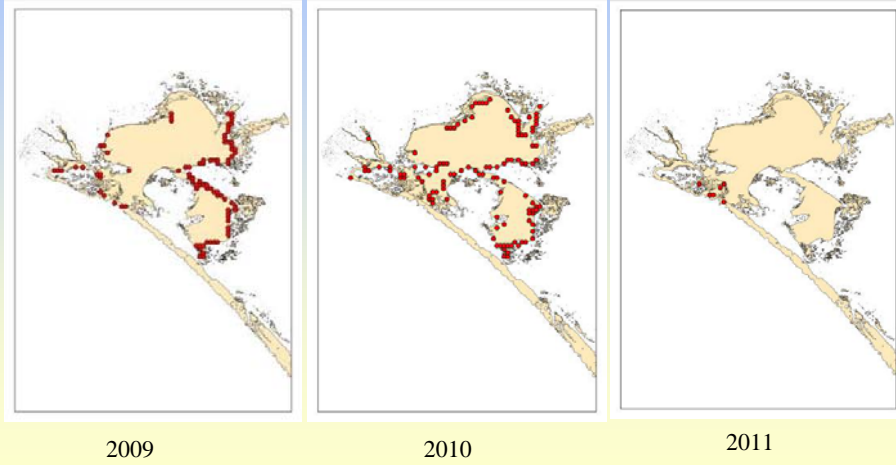
13

Red-necked Stint



14

Whiskered Tern



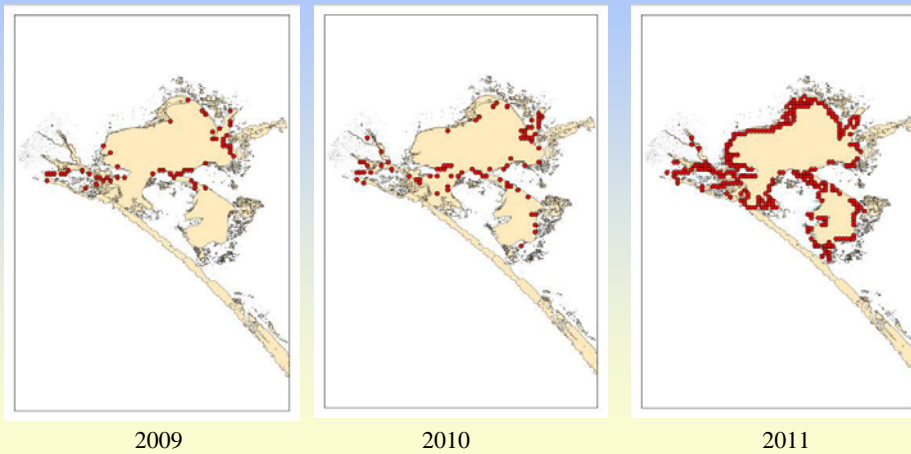
2009

2010

2011

15

Great Cormorant



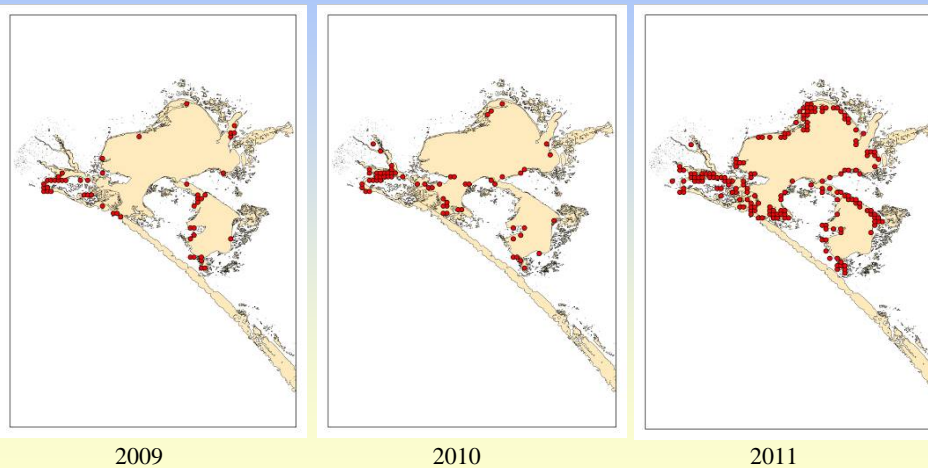
2009

2010

2011

16

Black Swan



2009

2010

2011

17

| Species | 2009 | 2010 | 2011 | Change |
|-------------------------|-------|-------|-------|--------|
| Australian Pelican | 5425 | 7509 | 7260 | |
| Black-faced Cormorant | 76 | 220 | 209 | |
| Pied Cormorant | 1611 | 1087 | 1944 | I |
| Little Pied Cormorant | 477 | 103 | 81 | D |
| Great Cormorant | 3186 | 6173 | 7723 | I |
| Little Black Cormorant | 1378 | 2020 | 1659 | |
| Great Crested Grebe | 799 | 520 | 219 | D |
| Hoary-headed Grebe | 14961 | 9120 | 0 | D |
| Black Swan | 1782 | 3400 | 4376 | I |
| Cape Barren Goose | 1738 | 1433 | 1383 | |
| Australian Shelduck | 28484 | 40865 | 31847 | |
| Pacific Black Duck | 1416 | 2033 | 1729 | |
| Grey Teal | 19644 | 21046 | 1026 | D |
| Chestnut Teal | 7073 | 5051 | 5209 | |
| Musk Duck | 113 | 304 | 25 | D |
| Eurasian Coot | 284 | 3321 | 41 | D |
| White-faced Heron | 189 | 270 | 355 | |
| Great Egret | 117 | 64 | 108 | |
| Australian White Ibis | 620 | 376 | 1346 | I |
| Straw-necked Ibis | 835 | 405 | 536 | |
| Royal Spoonbill | 396 | 346 | 234 | D |
| Yellow-billed Spoonbill | 55 | 58 | 18 | D |

18

| Species | 2009 | 2010 | 2011 | Change |
|------------------------|--------|--------|--------|--------|
| Common Greenshank | 578 | 714 | 237 | D |
| Eastern Curlew | 30 | 15 | 3 | D |
| Sharp-tailed Sandpiper | 25693 | 30023 | 37 | D |
| Red-necked Stint | 44050 | 48582 | 6605 | D |
| Curlew Sandpiper | 938 | 1988 | 217 | D |
| Pied Oystercatcher | 206 | 186 | 131 | D |
| Masked Lapwing | 1481 | 1325 | 710 | D |
| Banded Lapwing | 178 | 1092 | 2 | D |
| Pacific Golden Plover | 26 | 50 | 0 | D |
| Red-capped Plover | 2729 | 1596 | 73 | D |
| Black-winged Stilt | 732 | 621 | 51 | D |
| Banded Stilt | 213109 | 49448 | 18054 | D |
| Red-necked Avocet | 474 | 1193 | 162 | D |
| Silver Gull | 14017 | 13621 | 17658 | I |
| Whiskered Tern | 14718 | 9103 | 235 | D |
| Caspian Tern | 550 | 455 | 561 | |
| Fairy Tern | 347 | 326 | 168 | D |
| Crested Tern | 7719 | 11958 | 4090 | D |
| Total | 418458 | 281429 | 116526 | D |

19

Management implications of bird declines

Interpretation:

- birds moved to other inland wetlands
- but this is not known for sure

Investment needed:

- to understand bird movements
(where did the birds go?)

Implications:

- manage wetland systems at those scales

20

But why should the birds move away?

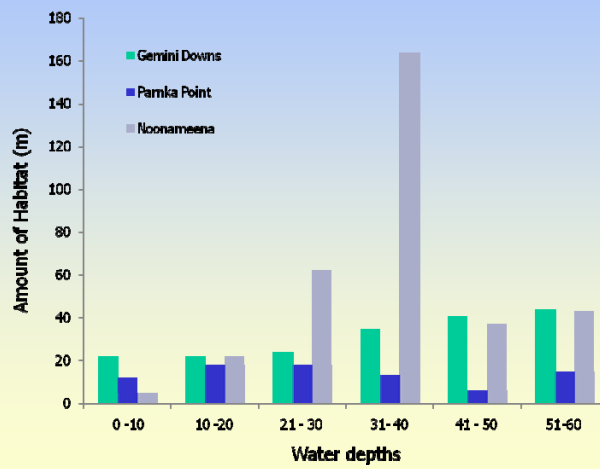
or

Were they forced to leave?

Excessively high water levels may have rendered the region poor habitat for many species

21

Habitat (water depth) availability January 2011



22

Conclude

Water levels affect availability of habitat for waterbirds

Failed to provide adequate suitable habitat for many waterbirds in 2010-11

Must manage water levels in the future

Need

- fine scale bathymetry around shorelines
- detailed information on habitat use by birds
- detailed information on water level fluctuations and productivity
- knowledge of bird movements and drivers of those movements

23

Despite the significant changes:

CLLMM is still a Wetland of International Importance

- still supports >20,000 waterbirds
- >1% global populations of nine species

24

