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Supplementary material

Long-term ecological trends of flow-dependent ecosystems in a major regulated river basin

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Table S1. Long-term data sets and series on ecological condition of floodplains, wetlands and rivers in the Murray–Darling Basin

TS, time series; DP, number of data points in time series; IF, initial-final studies. Information in red are data sets based only on measures of occurrence, condition or diversity: all others contain direct or indirect measures of abundance. References are listed below

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Vegetation												
Condamine	Narran Lakes	All floodplain vegetation	Composition	Flooding	On-ground survey	2004	2009	5	2	IF	Two floods with similar responses	Capon 2010
Goulburn	Goulburn–Broken	All floodplain vegetation	NDVI	Rainfall, T°C	8-day MODIS satellite imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009
Gwydir	Gwydir Wetlands	Semi-permanent amphib. vegetation	Extent	Area inundated	Veg. areas 96, 08	1996	2008	12	3	TS	Increase extent terrestrial spp.	Bowen and Simpson 2010*b*
Gwydir	Gwydir Wetlands	Water couch *Paspalum distichum*	Extent	Area inundated	Veg. areas 96, 08	1996	2008	12	3	TS	Increase extent terrestrial spp.	Bowen and Simpson 2010*b*
Gwydir	Gwydir Wetlands	All floodplain vegetation	NDVI	Rainfall, T°C	8-day imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009
Gwydir	Gwydir Wetlands	Water couch *Paspalum distichum*	Extent	Discharge, grazing	Ground survey	1994	2007	13	6	TS	Extent linked to flows 3 mo. prior	Wilson *et al*. 2008
Lachlan	Gooloogong to below Hillston	*Vallisneria*, *Azolla*, *Potamogeton* and water lily	Occurrence	N/A	Oral history accounts ordered by decade	1925	1995	70	8	TS	Loss of *Vallisneria* (1990s) coincident with carp and turbidity	Roberts and Sainty 1997
Lachlan	Murrumbidgil Swamp	River red gum	Canopy cover	Discharge, flood area	Aerial photos, 73, 93, 98, 05, 08	1973	2008	35	5	TS	60% canopy reduction floodplain trees; no change in riverbank trees	Armstrong *et al*. 2009
Lachlan	Lower Gum Swamp	River red gum	Canopy cover	Discharge, flood area	Aerial photos, 73, 93, 98, 05, 08	1973	2008	35	5	TS	Twofold fall between 2005 and 2008; otherwise stable	Armstrong *et al*. 2009
Lachlan	Top Gum Swamp	River red gum	Canopy cover	Discharge, flood area	Aerial photos, 73, 93, 98, 05, 08	1973	2008	35	5	TS	Nearly threefold fall between 2005 and 2008; otherwise stable	Armstrong *et al*. 2009
Lachlan	Lachlan River	River red gum	Canopy cover	Discharge, flood area	Aerial photos, 73, 93, 98, 05, 08	1973	2008	35	5	TS	1.4-fold fall between 2005 and 2008; otherwise stable	Armstrong *et al*. 2009
Macquarie	Macquarie Marshes: Southern Nat. Res.	Semi-permanent wetland vegetation	Extent	Area inundated	Vegetation areas 1991, 2008, 2013	1991	2013	22	3	TS	90% decrease in extent by 2008; recovery by 2013, post-drought	Bowen and Simpson 2010*a*; Bowen *et al*. 2014
Macquarie	Macquarie Marshes: Pillicawarina	Semi-permanent wetland vegetation	Extent	Area inundated	Vegetation areas 1991, 2008, 2013	1991	2013	22	3	TS	3.7-fold decline in extent 1990-2010, then recovery 2010-2013	Bowen and Simpson 2010*a*; Bowen *et al*. 2014
Macquarie	Macquarie Marshes: Northern Nat. Res.	Semi-permanent wetland vegetation	Extent	Area inundated	Vegetation areas 1991, 2008, 2013	1991	2013	22	3	TS	Slow decline 1990-2010, then recovery 2010-2013	Bowen and Simpson 2010*a*; Bowen *et al*. 2014

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Macquarie	Macquarie Marshes	Wetland vegetation	NDVI	Rainfall, inflows	16-day MODIS satellite imagery	2000	2010	10	122	TS	Inflows correlated with spatial variation in NDVI	Wen *et al*. 2012
Murray, Central	Barmah Forest	Moira grass *Pseudoraphis spinescens*	Extent	Flood occurrence	Aerial photos, 1945, 57, 70, 85	1945	1985	40	4	TS	Decline linked to invasion of red gums and fewer long winter floods	Bren 1992
Murray, Central	Barmah Forest	Moira grass *Pseudoraphis spinescens*	Extent	Flood regime	Map areas, 1930, 1979, 2007	1930	2007	77	3	TS	Predicted local extinction by 2026	Colloff *et al*. 2014
Murray, Central	Barmah–Millewa	Giant rush *Juncus ingens*	Extent	N/A	Aerial photos, 41, 57, 70, 85, 96, 03–7	1941	2007	66	7	TS	Greatest increase between 1957-1985	DPI 2009
Murray, Central	Gulpa Island, Millewa Forest	Spikerush *Eleocharis pusilla*	Extent	Stock exclusion, flooding	Surveys in 90, 91, 92, 95, 98	1990	1998	8	5	TS	Flooding reduced annual, exotics but effect was short-lived	Lunt *et al*. 2012
Murray, Central	Gulpa Island, Millewa Forest	Flood-dependent understorey spp.	Extent	Stock exclusion, rainfall	Surveys in 90, 91, 92, 95, 98, 2002	1990	2002	12	6	TS	Rainfall had greater impact on than grazing exclusion	Lunt *et al*. 2007
Murray, Central	Barmah Forest	Understorey vegetation	Spp. richness	Flood frequency	Surveys 1993, 07, 08	1993	2008	15	3	TS	increased cover terrestrial spp.	Stokes *et al*. 2010*a*, 2010*b*
Murray, Central	Gunbower Forest	Vegetation, permanent wetlands	Extent	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Decline 06-8; increase 10	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Understorey, semi-perm. wetlands	Extent	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Decline 2006-8; increase 10	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Understorey, flood-dep. river gum	Extent	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Decline 06-8; increase 10-11	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Understorey, flood-tolerant RRG	Extent	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Decline 2006-8; increase 2010-12	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Understorey, black box woodland	Extent	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Stable 2006-8; increase 2010-12	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Flood-depend. river red gum	Crown condition score	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Decline 05-10, recovery to 2012	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Flood-tolerant river red gum	Crown condition score	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Decline 2005-10; recovery 11-12	Bennetts and Jolly 2012
Murray, Central	Gunbower Forest	Black box	Crown condition score	Flood frequency	2005–06, 08, 10–12	2005	2012	7	6	TS	Slight, steady decline since 2005	Bennetts and Jolly 2012
Murray, Lower	Chowilla Floodplain	Understorey vegetation	Composition	Flood frequency	Annual survey	2006	2011	5	6	TS	High spp. richness post-flood	Gehrig *et al*. 2012
Murray, Lower	Monoman Island, Chowilla Floodplain	Black box *E. largiflorens*	Health class score	Flood metrics, groundwater depth	Surveys in 1996, 2001, 2009	1996	2009	13	3	TS	Tree health linked to flood duration, frequency and salinity	Roberts *et al*. 2009
Murray, Lower	Pike Floodplain	River red gum, black box, river coobah	Tree and stand condition	Commence-to-flood volume	Comparison, 2002, 2009	2002	2009	7	2	IF	Epicormic growth of black box on upper floodplain following rain	Wallace 2009

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong	Ruppia *Ruppia tuberosa*	Extent, abundance of propagules and shoots,	Salinity, water level	1985, 1991, 1992 then annually	1985	2012	23	8	TS	Decline linked to high salinity and low water levels	Rogers and Paton 2009; Paton and Bailey 2012
Murray	Central Murray	River red gum and black box	Stand condition	N/A	03, 08, 09	2003	2009	19	5	TS	66% Stressed in 03; 79% in 09	Cunningham *et al*. 2009; Mac Nally *et al*. 2011
Murray	Murray	All floodplain vegetation	NDVI	Rainfall, T°C	8-day imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009
Murrumbidgee	Yanga National Park	Riparian forest	Canopy condition	Flooding	65, 73, 97 and 05	1965	2005	40	4	TS	Greatest decline 1997-2005,	Wen *et al*. 2009
Murrumbidgee	Yanga National Park	Wetland forest	Canopy condition	Flooding	65, 73, 97 and 05	1965	2005	40	4	TS	Greatest decline 1997-2005,	Wen *et al*. 2009
Murrumbidgee	Yanga National Park	Grassy woodland	Canopy condition	Flooding	65, 73, 97 and 05	1965	2005	40	4	TS	Greatest decline 1997-2005,	Wen *et al*. 2009
Murrumbidgee	Yanga National Park	Shrubby woodland	Canopy condition	Flooding	65, 73, 97 and 05	1965	2005	40	4	TS	Greatest decline 1997-2005,	Wen *et al*. 2009
Murrumbidgee	Murrumbidgee	All floodplain vegetation	NDVI	Rainfall, T°C	8-day imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009
Namoi	Namoi	All vegetation	NDVI	Rainfall, T°C	8-day imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009
Namoi	Gunnedah	Riparian vegetation	NDVI	Rainfall, T°C	Annual mean NDVI	1987	2010	23	24	TS	Declines 1994, 02, 05-06	Fu and Burgher 2015
Namoi	u/s Mollee	Riparian vegetation	NDVI	Rainfall, T°C	Annual mean NDVI	1987	2010	23	24	TS	Large declines 1994, 02, 07	Fu and Burgher 2015
Namoi	Bugilbone–Walgett	Riparian vegetation	NDVI	Rainfall, T°C	Annual mean NDVI	1987	2010	23	24	TS	Large declines in 2002 and 2007	Fu and Burgher 2015
Ovens	Ovens	All floodplain vegetation	NDVI	Rainfall, T°C	8-day imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009
Paroo	Paroo	All floodplain vegetation	NDVI	Rainfall, T°C	8-day imagery	2000	2009	9	460	TS	High temperature 2002-3, 06	Sims *et al*. 2009; Sims and Colloff 2012
Aquatic Macroinvertebrates Waterbirds												
Goulburn	Lake Nagambie	Murray crayfish *Euastacus armatus*	Population age structure	N/A	Data collated from previous studies	1984	1990	6	6	TS	Over 40% of population >90 mm in length between 1985-87	Gilligan *et al*. 2007
Kiewa	Wodonga Creek	Murray crayfish *Euastacus armatus*	Population age structure	N/A	Data collated from previous studies	1984	1990	6	6	TS	Over 40% of population >90 mm in length between 1985-87	Gilligan *et al*. 2007
Murray, Upper	Hume Dam–Yarrawonga Weir	*Corbiculina australis* (Bivalvia)	Abundance	Discharge	Monthly to quarterly	1980	1985	5	29	TS	Increased abundance in 1983 after high flows, and in 1985	Bennison *et al*. 1989
Murray, Upper	Hume Dam–Yarrawonga Weir	Glass shrimp *Paratya australiensis*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	45	TS	High abundance after high flows in 1983	Bennison *et al*. 1989
Murray, Upper	Hume Dam–Yarrawonga Weir	Freshwater prawn *Macrobrachium australiense*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	43	TS	Relatively low populations throughout period of record	Bennison *et al*. 1989
Murray, Upper	Hume Dam–Yarrawonga Weir	Freshwater yabby *Cherax destructor*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	37	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Upper	Hume Dam–Yarrawonga Weir	Mayfly *Tasmanocoenis* spp.	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Upper	Hume Dam–Yarrawonga Weir	Non-biting Midge *Procladius paludicola*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Highest populations 1983-6 after high flows in 1983	Bennison *et al*. 1989
Murray, Upper	Hume Dam–Yarrawonga Weir	Caddisfly, *Ecnomus pansus*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	*Corbiculina australis* (Bivalvia)	Abundance	Discharge	Monthly to quarterly	1980	1985	5	29	TS	Increased abundance 1983-6 after high flows in 1983	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	Glass shrimp *Paratya australiensis*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	45	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	Freshwater prawn *Macrobrachium australiense*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	43	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	Freshwater yabby *Cherax destructor*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	37	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	Mayfly *Tasmanocoenis* spp.	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	Non-biting Midge *Procladius paludicola*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating throughout period of record;	Bennison *et al*. 1989
Murray, Central	Yarrawonga Weir–Mildura	Caddisfly, *Ecnomus pansus*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating throughout period of record	Bennison *et al*. 1989
Murray, Lower	N/A	Freshwater snails	Occurrence	N/A	Collated reports	1930	1990	60	24	TS	Sharp declines 80s	Sheldon and Walker 1993, 1997
Murray, Lower	Wentworth–Morgan	*Corbiculina australis* (Bivalvia)	Abundance	Discharge	Monthly to quarterly	1980	1985	5	29	TS	Popn. max after high flows 83	Bennison *et al*. 1989
Murray, Lower	Wentworth–Morgan	Glass shrimp *Paratya australiensis*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	45	TS	Strongly fluctuating	Bennison *et al*. 1989
Murray, Lower	Wentworth–Morgan	Freshwater prawn *Macrobrachium australiense*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	43	TS	Strongly fluctuating	Bennison *et al*. 1989
Murray, Lower	Wentworth–Morgan	Freshwater yabby *Cherax destructor*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	37	TS	Strongly fluctuating	Bennison *et al*. 1989
Murray, Lower	Wentworth–Morgan	Mayfly *Tasmanocoenis* spp.	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating	Bennison *et al*. 1989
Murray, Lower	Wentworth–Morgan	Non-biting Midge *Procladius paludicola*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating	Bennison *et al*. 1989
Murray, Lower	Wentworth–Morgan	Caddisfly, *Ecnomus pansus*	Abundance	Discharge	Monthly to quarterly	1980	1985	5	48	TS	Strongly fluctuating	Bennison *et al*. 1989
Murray, Lower	SA Murray	Murray crayfish *Euastacus armatus*	Occurrence	N/A	Anecdotal data	1949	1990	41	4	TS	Declines from 1965	Gilligan *et al*. 2007
Murray, Lower	Coorong South Lagoon	Chironomid larvae *Tanytarsus barbitarsis*	Abundance	Salinity	Annual sampling	2001	2012	11	12	TS	2007 decline linked to high salinity	Paton 2010; Paton and Bailey 2011, 2012

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong, Lower Lakes	Goolwa cockle *Donax deltoides*	Catch per unit effort	Discharge	Annual catch returns	1985	2010	26	27	TS	Stable; decline since 2005	Ferguson *et al*. 2013
MDB	NSW	Freshwater yabby *Cherax destructor*	Catch per fisher/boat	N/A	Annual catch returns	1984	1995	11	12	TS	Increase after 1975	Reid *et al*. 1997
Ovens	Ovens River	Murray crayfish *Euastacus armatus*	Population structure	N/A	Collated data	1984	1990	6	6	TS	Decline in large individuals	Gilligan *et al*. 2007
NSW MDB	N/A	Macroinvertebrates: all spp.	Occurrence	Temperature, discharge, rainfall	6582 samples, from 1818 sites	1994	2007	13	14	TS	27% families increase, 30% decline, 44% no change	Chessman 2009
Victorian MDB	N/A	Macroinvertebrates: all spp.	Occurrence, condition index	Vegetation, T°C, discharge, rainfall	7372 samples from 2165 sites	1990	2009	19	20	TS	Riparian tree cover had positive effect on condition index	Thomson *et al*. 2012
Fishes												
Campaspe	Upper Campaspe	European carp *Cyprinus carpio*	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Popn max 2000; min in 1998	Humphries *et al*. 2008
Campaspe	Mid Campaspe	European carp *Cyprinus carpio*	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Popn max 2000; min in 1999	Humphries *et al*. 2008
Campaspe	Lower Campaspe	European carp *Cyprinus carpio*	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Population max 2000; min. 02	Humphries *et al*. 2008
Campaspe	Upper Campaspe	Flathead gudgeon *Phylipnodon grandiceps*	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Population max. 2002; min. 99	Humphries *et al*. 2008
Campaspe	Mid Campaspe	Flathead gudgeon	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Population max. 2002; min. 96	Humphries *et al*. 2008
Campaspe	Lower Campaspe	Flathead gudgeon	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Popn. max. 2002; min. 97, 01	Humphries *et al*. 2008
Campaspe	Upper Campaspe	Golden perch *Macquaria ambigua*	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Population maximum in 2001	Humphries *et al*. 2008
Campaspe	Mid Campaspe	Golden perch	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Population max. 1999; min. 01	Humphries *et al*. 2008
Campaspe	Lower Campaspe	Golden perch	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Steady decline from 1996	Humphries *et al*. 2008
Campaspe	Upper Campaspe	Redfin perch *Perca fluviatilis*	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Popn. max. 1999; decline to 02	Humphries *et al*. 2008
Campaspe	Mid Campaspe	Redfin perch	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Steady decline from 1996	Humphries *et al*. 2008
Campaspe	Lower Campaspe	Redfin perch	Abundance,	Flow, EC, T°C, pH	Bimonthly/quarterly	1996	2002	7	7	TS	Steady decline from 1996	Humphries *et al*. 2008
Goulburn	Lower Goulburn	All spp.	Composition	N/A	Fish survey data	1982	2004	22	2	IF	More natives in second survey	Crook and Koster 2006
Goulburn	Eildon to Murray	All spp.	Composition	N/A	Fisheries data	1970	2002	32	33	TS	Communities stable	Pollino *et al*. 2004, 2006

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Gwydir	Gwydir River	Freshwater catfish *Tandanus tandanus*	Occurrence	N/A	Oral history accounts	1935	1995	60	9	TS	Decline since 1970s linked to building of Copeton Dam in 1976	Copeland *et al*. 2003
Lachlan	Gooloogong–Hillston	Large-bodied spp.	Occurrence	N/A	Oral history accounts	1925	1995	70	8	TS	Native spp. decline since 1970s; redfin from 1940s, carp 1950s	Roberts and Sainty 1997
Loddon–Avoca	Kerang Lakes	Native spp.	Biomass	N/A	Fisheries data	1919	1949	30	25	TS	Abund. natives inverse of redfin	Cadwallader 1977
Loddon–Avoca	Kerang Lakes	Redfin perch *Perca fluviatilis*	Biomass	N/A	Fisheries data	1919	1949	30	25	TS	Increase to 1949	Cadwallader 1977
Loddon–Avoca	Kerang Lakes	Tench *Tinca tinca*	Biomass	N/A	Fisheries data	1919	1949	30	25	TS	Increase to 1949	Cadwallader 1977
Mitta Mitta	Lake Dartmouth	Macquarie perch *Macquaria australasica*	Catch per unit effort	N/A	3 periods	1984	2000	16	3	TS	Popn. decline 1985-2000	Hunt *et al*. 2011
Murray, Central	Gulf Creek	Golden perch *Macquaria ambigua*	Abundance,	Regulator ops.	2001, 03, 04, 06	2001	2006	5	5	TS	Floodplain use; not just channel	Jones and Stuart 2008
Murray, Central	Gulf Creek	Murray cod *Maccullochella peeli peeli*	Abundance,	Regulator ops.	2001, 03, 04, 06	2001	2006	5	5	TS	Floodplain use; not just channel	Jones and Stuart 2008
Murray, Central	Gulf Creek	Silver perch *Bidyanus bidyanus*	Abundance,	Regulator ops.	2001, 03, 04, 06	2001	2006	5	5	TS	Decline to 2005; recovery in 2006	Jones and Stuart 2008
Murray, Central	Gulf Creek	Trout cod *Macculochella macquariensis*	Abundance,	Regulator ops.	2001, 03, 04, 06	2001	2006	5	5	TS	Decline to 2003; recovery 2004-6	Jones and Stuart 2008
Murray, Central	Yarrawonga to Tocumwal	Trout cod *Macculochella macquariensis*	Catch per unit effort	N/A	Annual	1999	2011	12	13	TS	Monitoring as part of national recovery plan	Koehn *et al*. 2013
Murray, Lower	Lindsay Island	Australian smelt *Retropinna semoni*	Catch per unit effort	Discharge, T°C	Monthly sampling	2002	2007	5	61	TS	Increase 2002/3 and 06/7 spawning	Vilizzi 2012
Murray, Lower	Lindsay Island	Bony herring *Nematalosa erebi*	Catch per unit effort	Discharge, T°C	Annual abundance	2002	2007	5	5	TS	Population max. 2004; min.05	Vilizzi 2012
Murray, Lower	Lindsay Island	Carp gudgeon *Hypseleotris* spp.	Catch per unit effort	Discharge, T°C	Annual abundance	2002	2007	5	65	TS	Popn. increase to 04, then decline	Vilizzi 2012
Murray, Lower	Lindsay Island	Flathead gudgeon *Phylipnodon grandiceps*	Catch per unit effort	Discharge, T°C	Annual abundance	2002	2007	5	62	TS	Popn. max. in 2003 and 2005	Vilizzi 2012
Murray, Lower	Lindsay Island	Murray cod *Maccullochella peeli peeli*	Catch per unit effort	Discharge, T°C	Annual abundance	2002	2007	5	5	TS	Steady to 2005; decline in 2006	Vilizzi 2012
Murray, Lower	Lindsay Island	Un-specked hardyhead *Craterocephalus stercusmuscarum fulvus*	Catch per unit effort	Discharge, T°C	Annual abundance	2002	2007	5	61	TS	Population max. 2003, 05	Vilizzi 2012
Murray, Lower	SA Mallee region	European carp *Cyprinus carpio*	Catch per unit effort	Discharge	Annual sampling	2002	2009	7	8	TS	Popn. max. 06-07, then decline	Wallace 2010
Murray, Lower	SA Mallee region	Golden perch *Macquaria ambigua*	Catch per unit effort	Discharge	Annual sampling	2002	2009	7	8	TS	Popn. max. 06-07, then decline	Wallace 2010

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	SA Mallee region	Murray cod *Maccullochella peeli peeli*	Catch per unit effort	Discharge	Annual sampling	2002	2009	7	8	TS	Stable, fluctuating throughout	Wallace 2010
Murray, Lower	SA Mallee region	Redfin perch *Perca fluviatilis*	Catch per unit effort	Discharge	Annual sampling	2002	2009	7	8	TS	Popn. max. 06-07, then decline	Wallace 2010
Murray, Lower	SA Mallee region	Silver perch *Bidyanus bidyanus*	Catch per unit effort	Discharge	Annual sampling	2002	2009	7	8	TS	Stable, fluctuating	Wallace 2010
Murray, Lower	Morgan–Blanchetown	Golden perch *Macquaria ambigua*	Biomass	River Height	Quarterly returns	1939	1979	40	160	TS	Biomass linked to river height	Cadwallader and Lawrence 1990
Murray, Lower	Lower SA Murray	Golden perch *Macquaria ambigua*	Catch per unit effort	Discharge	Monthly returns	1983	2003	20	209	TS	Popn. max. 92-3; decline 2001	Ye *et al*. 2009
Murray, Lower	Middle SA Murray	Golden perch *Macquaria ambigua*	Catch per unit effort	Discharge	Monthly returns	1983	2003	20	222	TS	Link between CPUE and flood area	Ye *et al*. 2009
Murray, Lower	Upper SA Murray	Golden perch *Macquaria ambigua*	Catch per unit effort	Discharge	Monthly returns	1983	2003	20	227	TS	Link between CPUE and flood area	Ye *et al*. 2009
Murray, Lower	Lower SA Murray	Murray cod *Maccullochella peeli peeli*	Catch per unit effort	Discharge	Monthly returns	1985	2001	14	59	TS	CPUE and flood area: no link	Ye *et al*. 2009
Murray, Lower	Middle SA Murray	Murray cod *Maccullochella peeli peeli*	Catch per unit effort	Discharge	Monthly returns	1985	2003	49	59	TS	CPUE and flood area: no link	Ye *et al*. 2009
Murray, Lower	Upper SA Murray	Murray cod *Maccullochella peeli peeli*	Catch per unit effort	Discharge	Monthly returns	1984	2003	45	45	TS	CPUE and flood area: no link	Ye *et al*. 2009
Murray, Lower	Lower Lakes	Australian smelt *Retropinna semoni*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Bony herring *Nematalosa erebi*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Bridled goby *Arenigobius bifrenatus*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Carp gudgeon *Hypseleotris* spp	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Common galaxias *Galaxias maculatus*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Stable to 2008; then steep decline	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Congolli *Pseudaphritis urvilli*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Stable to 2008; decline in 2009	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Dwarf flathead gudgeon *Phylipnodon macrostomus*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2003, steep decline from 2008 to 2009	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	European carp *Cyprinus carpio*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Stable to 2008; decline in 2009	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Flathead gudgeon *Phylipnodon grandiceps*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2009	Wedderburn *et al*. 2012

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Lower Lakes	Gambusia *Gambusia holbrooki*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2009	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Golden perch *Macquaria ambigua*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Low popn. density throughout	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Goldfish *Carassius auratus*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Popn. max. 03, then decline	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Lagoon goby *Tasmanogobius lasti*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Murray hardyhead *Craterocephalus fluviatilis*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Redfin perch *Perca fluviatilis*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Steep increase 2008-09	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Sandy sprat *Hyperlophus vittatus*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Low popn. density throughout	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Small-mouthed hardyhead *Atherinosoma microstoma*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Southern pygmy perch *Nannoperca australis*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2003, then decline by 2008	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Tamar River goby *Afurcagobius tamarensis*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Major increase by 2008-09	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Unspecked hardyhead *Craterocephalus stercusmuscarum fulvus*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Population maximum in 2003, then decline by 2008-09	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Western blue spot goby *Pseudogobius olorum*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Stable to 2008, then decline in 2009	Wedderburn *et al*. 2012
Murray, Lower	Lower Lakes	Yarra pygmy perch *Nannoperca obscura*	Abundance	Depth, EC, cover	2003, 2008, 2009	2003	2009	6	3	TS	Popn. max. 03, then major decline	Wedderburn *et al*. 2012
Murray, Lower	Lake Albert	Golden perch *Macquaria ambigua*	Catch per unit effort	N/A	Catch returns	1984	2010	26	27	TS	Population max. 1994, 03, 06-08	Ferguson and Ye 2012
Murray, Lower	Coorong and Lakes	Black bream *Acanthopagrus butcheri*	Catch per unit effort	Discharge	Annual catch returns	1977	2011	34	35	TS	Decline 1980s; recovery 2003	Hall 1984; Geddes *et al*. 2009; Ferguson 2012; Ferguson *et al*. 2013
Murray, Lower	Coorong and Lakes	Bony herring *Nematalosa erebi*	Catch per unit effort	Discharge	Annual catch returns	1985	2011	21	22	TS	Abund. not linked to inflows	Ferguson *et al*. 2013
Murray, Lower	Coorong and Lakes	European Carp *Cyprinus carpio*	Catch per unit effort	Discharge	Annual catch returns	1985	2011	24	25	TS	Increase after high inflows 1980s	Ferguson *et al*. 2013
Murray, Lower	Coorong and Lakes	Golden perch *Macquaria ambigua*	Catch per unit effort	Discharge	Annual catch returns	1985	2011	26	27	TS	Increase in 1993 after flooding	Ferguson and Ye 2012; Ferguson *et al*. 2013

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong and Lakes	Greenback flounder *Rhombosolea tapirina*	Catch per unit effort	Discharge	Annual catch returns	1985	2010	26	27	TS	Population peak 1984-2004	Ferguson *et al*. 2013
Murray, Lower	Coorong and Lakes	Mulloway *Argyrosomus japonicus* (estuarine)	Catch per unit effort	Discharge	Annual catch returns	1985	2010	26	27	TS	Increase from 1984 to 2010	Ferguson *et al*. 2008, 2013
Murray, Lower	Coorong and Lakes	Mulloway *Argyrosomus japonicus* (marine)	Catch per unit effort	Discharge	Annual catch returns	1985	2010	26	27	TS	Increase to 05, then decline	Ferguson *et al*. 2008, 2013
Murray, Lower	Coorong and Lakes	Yellow-eye mullet *Aldrichetta forsteri*	Catch per unit effort	Discharge	Annual catch returns	1985	2010	26	27	TS	Increase from 1984 to 2010	Ferguson *et al*. 2013
Murray, Lower	Coorong S Lagoon	Small-mouthed hardyhead *Atherinosoma microstoma*	Abundance	Salinity	Annual sampling at 8 sites	2001	2012	11	12	TS	Decline from 2007 linked to salinity; recovery in 2012	Paton 2010; Paton and Bailey 2012
Murray, Lower	SA Murray wetlands	All spp.	Distribution	Drought, salinity	Early, mid/late and post–drought	2003	2012	9	3	TS	Some threatened spp. recovered post-drought, others did not	Wedderburn and Suitor 2012
NSW MDB	N/A	Murray cod *Maccullochella peeli peeli*	Catch per t	N/A	Annual catch returns	1944	1982	37	32	TS	Decline from 1958: over-fishing	Rowland 1989
NSW MDB	N/A	European Carp *Cyprinus carpio*	Catch per unit effort	Discharge	Annual catch returns	1962	2001	39	39	TS	No popn. growth after floods	Reid *et al*. 1997; Forsyth *et al*. 2013
NSW MDB	N/A	Freshwater catfish *Tandanus tandanus*	Catch per fisher	N/A	Annual catch returns	1947	1988	40	41	TS	Max 60, 74, 79; decline to 1998	Reid *et al*. 1997
NSW MDB	N/A	Golden perch *Macquaria ambigua*	Catch per fisher	N/A	Annual catch returns	1947	1989	41	42	TS	Decline, 1958-67; recovery to 82	Reid *et al*. 1997
NSW MDB	N/A	Redfin perch *Perca fluviatilis*	Catch per fisher	N/A	Annual catch returns	1949	1988	38	39	TS	Max. 1951; fluctuating since	Reid *et al*. 1997
NSW MDB	N/A	Silver perch *Bidyanus bidyanus*	Catch per fisher	N/A	Annual catch returns	1947	1989	41	42	TS	Max. 1958-61; decline 62-78	Reid *et al*. 1997
MDB	N/A	European Carp *Cyprinus carpio*	Distribution	N/A	1960, 70, 74, 99	1960	1999	39	4	TS	Increase due to floods in 1974/5	Shearer and Mulley 1978; Schiller and Harris 2001
Murrumbidgee	Yanga L., Barren Box	Bony herring *Nematalosa erebi*	Catch per fisher day	Discharge	Annual catch returns	1986	1996	10	11	TS	Decline post-1920, recovered 80s	Reid *et al*. 1997; Gilligan 2005
Murrumbidgee	Yanga L., Barren Box	European Carp *Cyprinus carpio*	Catch per fisher day	Discharge	Annual catch returns	1984	1995	11	12	TS	Sharp increase 1975-1985	Reid *et al*. 1997; Gilligan 2005
Murrumbidgee	Yanga L., Barren Box	Freshwater catfish *Tandanus tandanus*	Catch per fisher day	Discharge	Annual catch returns	1985	1993	8	9	TS	Peaked 74-82; gone by 1993	Reid *et al*. 1997; Gilligan 2005
Murrumbidgee	Yanga L., Barren Box	Golden perch *Macquaria ambigua*	Catch per fisher day	Discharge	Annual catch returns	1984	1995	11	12	TS	Decline 60s, increase 70s and 80s	Reid *et al*. 1997; Gilligan 2005
Murrumbidgee	Yanga L., Barren Box	Murray cod *Maccullochella peeli peeli*	Catch per fisher day	Discharge	Annual catch returns	1985	1996	11	12	TS	Catch low 1965-77; higher until 89	Reid *et al*. 1997; Gilligan 2005
Murrumbidgee	Yanga L., Barren Box	Redfin perch *Perca fluviatilis*	Catch per fisher day	Discharge	Annual catch returns	1986	1996	10	11	TS	Popn. fluct. on a 9-10 yr cycle	Reid *et al*. 1997; Gilligan 2005

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murrumbidgee	Yanga L., Barren Box	Silver perch *Bidyanus bidyanus*	Catch per fisher day	Discharge	Annual catch returns	1984	1995	11	12	TS	Decline by 1960s; corr. w. flow	Reid *et al*. 1997; Gilligan 2005
Reptiles and Amphibians Waterbirds												
Murray, Central	Murray floodplain d/s Yarrawonga	Turtles (*Emydura macquarii*, *Chelodina expansa*, *C. longicollis*)	Abundance, age structure	Rainfall, drought	1976–82 and 2009–11	1976	2011	36	2	IF	Declines likely due to drought-induced habitat loss and predation	Chessman 2011
Murrumbidgee	Lowbidgee	Southern bell frog *Litoria raniformis*	Occurrence	Flood frequency	2001, 02, 04, 07/08	2001	2008	7	4	TS	Increase due to env. watering	Wassens 2010
Waterbirds												
Border Rivers	Coolmundra Dam	All waterbird spp.	Abundance, richness	Discharge, flood area	Annual aerial survey	1983	2012	29	30	TS	Popn. max. 85, 93, 07	Kingsford and Thomas 1995; Kingsford *et al*. 2013
Campaspe	Corop Wetlands	All waterbird spp.	Abundance	Discharge, floods	Annual aerial survey	1983	2012	29	30	TS	Popn. max. 84, 92, 2005 and 2012	Kingsford *et al*. 2013
Condamine	Narran Lakes	Straw-necked, glossy and Australian white ibis	Frequency of breeding	Discharge	Collated observations	1971	2008	37	38	TS	Decline in breeding frequency in each decade from 1971	Brandis 2010
Darling	Menindee Lakes	All waterbird spp.	Abundance	Rainfall, flood area, discharge	Annual aerial survey	1983	2012	29	30	TS	Popn. Max. 1983, 85, 95; decline after 1996; slight recovery 2011	Kingsford and Thomas 2004; Kingsford *et al*. 2012, 2013
Darling	Talyawalka Anabranch Lakes	All waterbird spp.	Abundance	Rainfall, flood area, discharge	Annual aerial survey	1983	2012	29	30	TS	Population maxima, 1990 and 2012; 13 years with scores of zero	Kingsford *et al*. 2013
Goulburn	Lake Mokoan	All waterbird spp.	Abundance	Rainfall, flood area, discharge	Annual aerial survey	1983	2012	29	30	TS	Popn. Max. 1984, 1991 and 2012	Kingsford *et al*. 2004, 2013
Gwydir	Gwydir Wetlands	Colonial-nesting waterbirds	Abundance	Discharge, flood area	Collated counts	1983	2004	21	9	TS	Abundance correlated with flow discharge above threshold	Spencer 2010
Lachlan	Booligal Swamp	Straw-necked, glossy and Australian white ibis	Number of breeding pairs	Discharge, flow duration	Counts, 69, 84, 98, 00 breeding season	1969	2000	31	9	TS	Nesting events maintained with environmental flows	Chowdhury and Driver 2008; Driver *et al*. 2005, 2010
Lachlan, Macquarie	Mid-Lachlan, upper-Macquarie	Australasian grebe *Tachybaptus novaehollandiae*	Abundance	N/A	Ann. reporting rate	1981	2000	19	20	TS	One of only 5 of 46 spp. that increased in abundance	Reid *et al*. 2004
Lachlan, Macquarie	Mid-Lachlan, upper-Macquarie	Black-fronted dotterel *Elseyornis melanops*	Abundance	N/A	Ann. reporting rate	1981	2000	19	20	TS	One of 16 of 46 spp. that showed significant linear decline	Reid *et al*. 2004
Lachlan, Macquarie	Mid-Lachlan, upper-Macquarie	Straw-necked ibis *Threskiornis spinicollis*	Abundance	N/A	Ann. reporting rate	1981	2000	19	20	TS	One of 18 of 46 spp. that showed no significant trend	Reid *et al*. 2004
Lachlan, Macquarie	Mid-Lachlan, upper-Macquarie	Yellow-billed spoonbill *Platalea flavipes*	Abundance	N/A	Ann. reporting rate	1981	2000	19	20	TS	One of 7 of 46 spp. that showed humped decline	Reid *et al*. 2004
Macquarie	Macquarie Marshes	Australian white ibis *Threskicornis molucca*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Macquarie	Macquarie Marshes	Cattle egret *Ardea ibis*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Cormorant spp.	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Glossy ibis *Plegadis falcinellus*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Great egret *Ardea alba*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Intermediate egret *Ardea intermedia*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Little egret *Ardea garzetta*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Rufous night heron *Nycticorax caledonicus*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	Straw-necked ibis *Threskicornis spinicollis*	Freq. and magnitude of breeding events	Discharge, flood area	Annual nest count	1983	2001	15	16	TS	Breeding linked to prior flow, triggered by threshold volume	Kingsford and Auld 2005
Macquarie	Macquarie Marshes	All waterbird spp.	Abundance	Rainfall, flood area, discharge	Annual surveys	1983	2012	29	30	TS	Popn. m ax. 83, 84; decline 99; recovery 2011-2012	Kingsford and Thomas 1995; Kingsford *et al*. 2012, 2013
Macquarie	Burrendong Dam	All waterbird spp.	Abundance, richness	Rainfall, flood area	Annual surveys	1983	2012	29	30	TS	Popn. max. 85, 87 and 91	Kingsford and Thomas 1995; Kingsford *et al*. 2013
Murray, Central;	Barmah–Millewa	Australian darter *Anhinga melanogaster*	Breeding magnitude	Discharge	Annual records	1929	1996	67	14	TS	Breeding in most years of record; magnitude variable	Leslie 2001
Murray, Central;	Barmah–Millewa	Australian white ibis *Threskicornis molucca*	Breeding magnitude	Discharge	Annual records	1905	1996	91	32	TS	>10 prs. bed in most years of record	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Black swan *Cygnus atratus*	Breeding magnitude	Discharge	Annual records	1905	1996	91	20	TS	<10 pairs bred yearly 1986-96	Leslie 2001
Murray, Central;	Barmah–Millewa	Great cormorant *Phalacrocorax carbo*	Breeding magnitude	Discharge	Annual records	1905	1996	91	16	TS	No breeding during 1979, 1983-84	Leslie 2001
Murray, Central;	Barmah–Millewa	Great crested grebe *Podiceps cristatus*	Breeding magnitude	Discharge	Annual records	1905	1996	91	18	TS	<10 prs. bred 1986-96	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Great egret *Ardea alba*	Breeding magnitude	Discharge	Annual records	1906	1996	90	30	TS	>10 prs. bred in all years 64-95	Leslie 2001; Arthur *et al*. 2012

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Central;	Barmah–Millewa	Intermediate egret *Ardea intermedia*	Breeding magnitude	Discharge	Annual records	1906	1996	90	30	TS	>10 prs. bred 1964-84; none 92-96	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Little black cormorant *Phalacrocorax sulcirostris*	Breeding magnitude	Discharge	Annual records	1905	1996	91	20	TS	<10 prs. bred 86, 89; none 93-6	Leslie 2001
Murray, Central;	Barmah–Millewa	Little egret *Ardea garzetta*	Breeding magnitude	Discharge	Annual records	1928	1996	68	30	TS	<10 prs. bred yearly 1978-96	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Little pied cormorant *Phalacrocorax melanoleucos*	Breeding magnitude	Discharge	Annual records	1905	1996	91	21	TS	Bred in all years of record	Leslie 2001
Murray, Central;	Barmah–Millewa	Nankeen night heron *Nycticorax caledonicus*	Breeding magnitude	Discharge	Annual records	1905	1996	91	21	TS	>10 prs. bred 1979, 1981, 1986, 1990-93	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Royal spoonbill *Platalea regia*	Breeding magnitude	Discharge	Annual records	1939	1996	57	17	TS	Bred in most years of record	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Straw-necked ibis *Threskicornis spinicollis*	Breeding magnitude	Discharge	Annual records	1905	1996	91	32	TS	Bred in all years of record	Leslie 2001; Arthur *et al*. 2012
Murray, Central;	Barmah–Millewa	Whiskered tern *Childonius hybridus*	Breeding magnitude	Discharge	Annual records	1905	1996	91	16	TS	No breeding 1993-96	Leslie 2001
Murray, Central;	Barmah–Millewa	White-necked heron *Ardea pacifica*	Breeding magnitude	Discharge	Annual records	1905	1996	91	21	TS	<10 prs. bred 1969-93	Leslie 2001
Murray, Lower	Noona Evap. Basin	All waterbird spp.	Abundance	Flood area, discharge	Annual aerial survey	1983	2012	29	30	TS	Population maxima, 1985; stable, <5000, ever since	Kingsford *et al*. 2013
Murray, Lower	Coorong and Lakes	Australian pelican *Pelecanus conspicillatus*	Breeding magnitude	N/A	Collated reports and annual monitoring	1910	2013	103	21	TS	Mean number of nests, nesting pairs and chicks reduced 2.4-fold by 2013	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Australian white ibis *Threskicornis molucca*	Breeding magnitude	N/A	Collated reports and annual monitoring	1962	1976	14	12	TS	Magnitude of breeding events highly variable	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Black swan *Cygnus atratus*	Breeding magnitude	N/A	Collated reports and annual monitoring	1910	2011	101	8	TS	Magnitude of breeding events highly variable	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Caspian tern *Sterna caspia*	Breeding magnitude	N/A	Collated reports and annual monitoring	1932	2013	80	12	TS	Magnitude of breeding events declined over five-fold	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Crested tern *Sterna bergii*	Breeding magnitude	N/A	Collated reports and annual monitoring	1964	2013	48	23	TS	Max. 3,300 breeding pairs in 2012; min. 656 in 1997	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Fairy tern *Sterna nereis*	Breeding magnitude	N/A	Collated reports and annual monitoring	1929	2013	84	21	TS	Mean number of nests, nesting pairs and chicks reduced 4.4-fold by 2013	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Glossy ibis *Plegadis falcinellus*	Breeding magnitude	N/A	Collated reports and annual monitoring	1962	1971	9	8	TS	Seven-fold reduction in mean breeding magnitude	O'Connor *et al*. 2013

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong and Lakes	Great cormorant *Phalacrocorax carbo*	Breeding magnitude	N/A	Collated reports and annual monitoring	1963	1979	16	13	TS	Max. breeding event 1320 nest in 1971	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Great egret *Ardea alba*	Breeding magnitude	N/A	Collated reports and annual monitoring	1963	1974	11	8	TS	Breeding very stable -50-100 nests and breeding pairs	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Little black cormorant *Phalacrocorax sulcirostris*	Breeding magnitude	N/A	Collated reports and annual monitoring	1962	1979	16	15	TS	Mean two-fold increase, but not statistically significant	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Little pied cormorant *Phalacrocorax melanoleucos*	Breeding magnitude	N/A	Collated reports and annual monitoring	1931	1976	45	14	TS	Max. breeding event 1000 nest in 1966	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Pied cormorant *Phalacrocorax varius*	Breeding magnitude	N/A	Collated reports and annual monitoring	1928	2011	82	16	TS	Largest breeding events 1966-1972	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Royal spoonbill *Platalea regia*	Breeding magnitude	N/A	Collated reports and annual monitoring	1962	1974	11	10	TS	Ca. 50 prs. nested on Salt Lagoon Islands each year 1962-1974	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Silver gull *Larus novaehollandiae*	Breeding magnitude	N/A	Collated reports and annual monitoring	1928	1968	40	7	TS	Largest number of breeding pairs 1967-8	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Straw-necked ibis *Threskiornis spinicollis*	Breeding magnitude	N/A	Collated reports and annual monitoring	1963	2011	48	10	TS	Largest number of nests 1965-71	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Yellow-billed spoonbill *Platalea flavipes*	Breeding magnitude	N/A	Collated reports and annual monitoring	1962	1979	17	11	TS	Breeding stable -50-100 nest sand breeding pairs	O'Connor *et al*. 2013
Murray, Lower	Coorong and Lakes	Sanderling *Calidris alba*	Occurrence	Water level, EC	20 site visits per year	2002	2012	8	9	TS	Low occurrence, peaking 2004-09	O'Connor and Rogers 2013
Murray, Lower	Coorong and Lakes	Pied oystercatcher *Haematopus ostralegus*	Occurrence	Water level, ECy	20 site visits per year	2000	2012	12	13	TS	Moderate occurrence, increasing sporadically 2003-10	O'Connor and Rogers 2013
Murray, Lower	Coorong S Lagoon	Australian pelican *Pelecanus conspicillatus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Mean annual count 3,500; range 1170-6200	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Australian shelduck *Tadorna tadornoides*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima (>16,000) in 2006, 2009 and 2011	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Australian white ibis *Threskicornis molucca*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Popn. max. 2001 and 2007	Paton and Rogers 2009; Paton and Bailey 2012

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong S Lagoon	Banded stilt *Cladorynchus leucocephalus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	<20,000 between 2000-04; >210,000 in 2009	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Black-faced cormorant *Phalacrocorax fuscescens*	Abundance	N/A	Annual counts	1985	2012	27	13	TS	Population maxima in 2005, 2009 and 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Black swan *Cygnus atratus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Sporadic decline: 2,600 in 2000 to 200 in 2011; recovery in 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Black-winged stilt *Himantopus himantopus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Sporadic increase to 2008; decline 2009-12	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Caspian tern *Sterna caspia*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima (>800) in 2001, 2006, 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Chestnut teal *Anas castanea*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Sporadic decline from 21,000 in 2002 to 5,000 in 2011	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Common greenshank *Tringa nebularia*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Stable 2000-06 then decline	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Crested tern *Sterna bergii*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Strongly fluctuating, 1300 in 2003 to 8600 in 2007	Paton *et al*. 2009; Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Curlew sandpiper *Calidris ferruginea*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Sporadic decline from 8,100 in 2000 to 50 in 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Fairy tern *Calidris ferruginea*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Sporadic decline to 2011, recovery 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Great cormorant *Phalacrocorax carbo*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Popn. max. 2002, 2007 and 2012	Paton and Rogers 2009; Paton and Bailey 2012

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong S Lagoon	Great crested grebe *Podiceps cristatus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Strongly fluctuating, 600 in 2007, 2 in 2011	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Grey teal *Anas gracilis*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population max. in 2002, decline to 2011, recovery in 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Hoary-headed grebe *Poliocephalus poliocephalus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Stable to 2008, population max. 2009, 0 in 2011, recovery 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Little black cormorant *Phalacrocorax sulcirostris*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Stable to 2009; population max in 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Little pied cormorant *Phalacrocorax melanoleucos*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Decline to 2011, recovery 2012	Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Masked lapwing *Vanellus miles*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Steady sporadic decline to 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Musk duck *Bizuria lobata*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Popn. max. 2000, 04, 07 and 2012	Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Pacific black duck *Anas superciliosa*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Popn. max. 2000, 2007 and 2012	Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Pied cormorant *Phalacrocorax varius*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Stable to 2009; max in 2012	Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Pied oystercatcher *Haematopus ostralegus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima in 2003, 2006 and 2009	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Pink-eared duck *Malacorhynchus membranaceus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maximum in 2006	Paton *et al*. 2009; Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Red-capped plover *Charadrius ruficapillus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Strongly fluctuating, 1640 in 2001, 71 in 2011, recovery in 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Red-necked avocet *Recurvirostra novaehollandae*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima in 2003, 2005, decline to 2011, recovery in 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murray, Lower	Coorong S Lagoon	Red-necked stint *Calidris ruficollis*	Abundance	N/A	Annual counts	2000	2012	11	12	TS	Decline to 2011, recovery 2012	Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Sharp-tailed sandpiper *Calidris acuminata*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima in 2003, 2006, decline to 2011, then recovery	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Silver gull *Larus novaehollandiae*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima in 2001, 2006, and 2011	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Straw-necked ibis *Threskiornis spinicollis*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima in 2001, 2006, and 2011	Paton *et al*. 2009; Paton and Rogers 2009; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	Whiskered tern *Childonius hybridus*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	12	13	TS	Population maxima in 2006, 2009 and 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong S Lagoon	White-faced heron *Egretta novaehollandiae*	Abundance	N/A	1985, then annual counts from 2000	1985	2012	27	13	TS	Population maxima in 2001, 2003, 2008 and 2012	Paton *et al*. 2009; Paton and Rogers 2009; Paton 2010; Paton and Bailey 2012
Murray, Lower	Coorong	Wader spp.	Abundance	N/A	Annual counts, 81, 82, 87, 00–08	1981	2008	27	13	TS	Abundance in 2008 reduced by 85% compared with early 1980s	Wainwright and Christie 2008
Murray, Lower	Coorong S Lagoon	Banded lapwing *Vanellus tricolor*	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Popn. max. 84, then decline	Nebel *et al*. 2008
Murray, Lower	Coorong S Lagoon	Banded stilt *Cladorynchus leucocephalus*	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Max. 1984, then sporadic decline	Nebel *et al*. 2008
Murray, Lower	Coorong S Lagoon	Black-winged stilt *Himantopus himantopus*	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Max.1984, then sporadic decline	Nebel *et al*. 2008
Murray, Lower	Coorong S Lagoon	Masked lapwing *Vanellus miles*	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Popn. max. 90, then decline	Nebel *et al*. 2008
Murray, Lower	Coorong S Lagoon	Pied oystercatcher *Haematopus ostralegus*	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Low counts throughout period of record; many zeros	Nebel *et al*. 2008
Murray, Lower	Coorong S Lagoon	Red-necked avocet *Recurvirostrata novaehollandiae*	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Population maximum 1984, then sporadic decline	Nebel *et al*. 2008
Murray, Lower	Coorong S Lagoon	All waterbird spp.	Abundance	Rainfall, flood area		1983	2012	29	30	TS	Popn. max. 1985, 1987, 2012	Kingsford *et al*. 2013
Murray, Lower	Dry Lake, Lake Benanee, Euston	All waterbird spp.	Abundance	Wetland area	Annual aerial survey	1983	2001	18	19	TS	Low density; maxima 1984, 1991	Kingsford *et al*. 2004

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
MDB	N/A	All spp.	Occurrence	N/A	Annual report rate	1977	2001	24	2	IF	Comparison of reporting periods	Barrett *et al*. 2002
MDB	N/A	Australian pelican *Pelecanus conspicillatus*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	Max. 1984, 1993, 2008, 2012	Kingsford *et al*. 2013
MDB, SE Lake Eyre Basin	N/A	Australasian shoveler *Anas rhynchotis*	Abundance	N/A	Annual aerial survey	1983	2011	28	29	TS	High popn. 1984 skew trend	Porter and Kingsford 2011
MDB	N/A	Australian shelduck *Tadorna tadornoides*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	High popn. 1984 skew trend	Kingsford *et al*. 2013
Murray	N/A	Australian wood duck *Chenonetta jubata*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	High popn. 1984 skew trend	Kingsford *et al*. 2013
Murray	N/A	Black swan *Cygnus atratus*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	High popn. 1984 skew trend	Kingsford *et al*. 2013
MDB, SE Lake Eyre Basin	N/A	Chestnut teal *Anas castanea*	Abundance	N/A	Annual aerial survey	1983	2011	28	29	TS	Maxima in 1984 and 1991	Porter and Kingsford 2011
MDB	N/A	Eurasian coot *Fulica atra*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	Maxima 85, 95, 12	Kingsford *et al*. 2013
MDB, SE Lake Eyre Basin	N/A	Freckled duck *Stictonetta naevosa*	Abundance	N/A	Annual aerial survey	1983	2011	28	29	TS	Fluctuating; max. 84, 92-4, 2000-3	Porter and Kingsford 2011
MDB	N/A	Grey teal *Anas gracilis*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	High popn. 1984 skew trend	Kingsford *et al*. 2013
MDB	N/A	Hardhead *Aythya australis*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	High popn. 1984 skew trend	Kingsford *et al*. 2013
MDB	N/A	Pacific black duck *Anas superciliosa*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	High popn. 1984 skew trend	Kingsford *et al*. 2013
MDB	N/A	Pink-eared duck *Malacorhynchus membranaceus*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	Large fluctuations in numbers. Maxima in 1984, 91, 94, 03, 08, 11	Kingsford *et al*. 2013
MDB, SE Lake Eyre Basin	N/A	Plumed whistling-duck *Dendrocygna eytoni*	Abundance	N/A	Annual aerial survey	1983	2011	28	29	TS	Large fluctuations in numbers. Maxima in 1984, 2008, 2010	Porter and Kingsford 2011
MDB	N/A	Straw-necked ibis *Threskiornis spinicollis*	Abundance	N/A	Annual aerial survey	1983	2012	29	30	TS	Popn. max. 84, 86, 1990-93, 2010	Kingsford *et al*. 2013
Murrumbidgee	Tombullen	Australian darter *Anhinga melanogaster*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Stable 1983-08, then decline	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Australian grebe *Tachybaptus novaehollandiae*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Sporadic decline	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Australian pelican *Pelecanus conspicillatus*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Steady decline from 1985	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Australian white ibis *Threskicornis molucca*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Popn. max. 83, 87-88, 1990	Briggs *et al*. 1994

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murrumbidgee	Tombullen	Black swan *Cygnus atratus*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Sporadic decline from 1984	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Eurasian coot *Fulica atra*	Abundance	N/A	2–7 counts per year	1981	1991	10	11	TS	Decline to 1989 then recovery	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Freckled duck *Stictonetta naevosa*	Abundance	N/A	2–7 counts per year	1981	1991	10	11	TS	Fluctuating to 84, then stable	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Great cormorant *Phalacrocorax carbo*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Popn. max 82, then decline, stable	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Great crested grebe *Podiceps cristatus*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Zero counts from 1987	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Great egret *Ardea alba*	Abundance	N/A	2–7 counts per year	1983	1991	8	9	TS	Max 1985-86 then decline	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Grey teal *Anas gracilis*	Abundance	N/A	2–7 counts per year	1981	1991	10	11	TS	Sporadic decline to 1986	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Intermediate egret *Ardea intermedia*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Popn max 83, then decline, stable	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Little black cormorant *Phalacrocorax sulcirostris*	Abundance	N/A	2–7 counts per year	1983	1991	8	9	TS	Strongly fluctuating	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Little egret *Egretta garzetta*	Abundance	N/A	2–7 counts per year	1983	1991	8	9	TS	Popn max 84, then stable, low	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Little pied cormorant *Microcarbo melanoleucos*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Population max in 1982, then stable, low-level	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Pacific black duck *Anas superciliosa*	Abundance	N/A	2–7 counts per year	1981	1991	10	11	TS	Strongly fluctuating	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Pacific heron *Ardea pacifica*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Exponential growth from 1984	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Royal spoonbill *Platalea regia*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Strongly fluctuating	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Straw-necked ibis *Threskiornis spinicollis*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Fluctuating, increasing from 1985	Briggs *et al*. 1994
Murrumbidgee	Tombullen	White-faced Heron *Egretta novaehollandiae*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Strongly fluctuating	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Wood duck *Chenonetta jubata*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Exponential decrease	Briggs *et al*. 1994
Murrumbidgee	Tombullen	Yellow-billed spoonbill *Platalea flavipes*	Abundance	N/A	2–7 counts per year	1982	1991	9	10	TS	Strongly fluctuating	Briggs *et al*. 1994
Murrumbidgee	Fivebough Swamp	All waterbird spp.	Abundance, richness	Wetland area	Annual aerial survey	1983	2012	29	30	TS	Popn. max. 85, 95, 2003-06, 2012	Kingsford and Thomas 2004; Kingsford *et al*. 2013
Murrumbidgee	Lowbidgee	All waterbird spp.	Abundance	Rainfall, floods	Annual aerial survey	1983	2012	29	30	TS	Decline 97-98: low wetland area recovery 2010-12	Kingsford and Thomas 2004; Kingsford *et al*. 2012, 2013

Catchment	Location	Species or group	Response variable(s)	Predictor variable(s)	Frequency of data collection	Start	End	Years	DP	TS IF	Notes	Reference
Murrumbidgee	Lowbidgee	Grazing waterfowl	Abundance	T°C, rainfall	Annual aerial survey	1982	2007	25	26	TS	Decline 1983-89; stable 91-07	Wen *et al*. 2011
Murrumbidgee	Lowbidgee	Small waders	Abundance	Wetland area	Annual aerial survey	1983	2001	18	19	TS	Decline 83-9, low wetland area	Kingsford and Thomas 2004
Murrumbidgee	Lowbidgee	Ducks	Abundance	Wetland area	Annual aerial survey	1983	2001	18	19	TS	Decline linked to low wetland area	Kingsford and Thomas 2004
Murrumbidgee	Lowbidgee	Large waders	Abundance	Wetland area	Annual aerial survey	1983	2001	18	19	TS	Maxima 84, 86, 91	Kingsford and Thomas 2004
Murrumbidgee	Lowbidgee	Piscivorous waterbirds	Abundance	Wetland area	Annual aerial survey	1983	2001	18	19	TS	Decline linked to low wetland area	Kingsford and Thomas 2004
Murrumbidgee	Lowbidgee	Herbivorous waterbirds	Abundance	Wetland area	Annual aerial survey	1983	2001	18	19	TS	Strongly fluctuating	Kingsford and Thomas 2004
Paroo	Paroo Overflow	43 waterbird spp.	Abundance	Wetland area	Quarterly surveys	1987	1993	6	17	TS	Abund. linked to wetland distrib.	Roshier *et al*. 2002
Paroo	Paroo Overflow	All waterbird spp.	Abundance	Discharge, floods	Annual aerial survey	1983	2001	18	19	TS	Pop. max., 85, 95, 1999, 2001	Kingsford and Thomas 1995, 2004
Paroo	Paroo Overflow	All shorebird spp.	Abundance	Rainfall, floods	Annual aerial survey	1983	2006	23	24	TS	Population maxima, 1985, 1995	Nebel *et al*. 2008
Paroo	Paroo River	All waterbird spp.	Abundance	Rainfall, discharge	Annual aerial survey	1983	2008	25	26	TS	Pop. max. 1983; otherwise stable	Kingsford *et al*. 2012
Paroo	Cuttaburra Channels	All waterbird spp.	Abundance	Rainfall, flood area, discharge	Annual aerial survey	1983	2012	29	30	TS	Population maxima in 1983, 1989, 2010, 2012	Kingsford *et al*. 2013

Table S2. Long-term trends of population time series based on the state-space model (SS; *n* = 198) and log-linear regression of abundance (log; *n* = 239)

I, invasive species. *r*, value of exponential rate of increase; CI, credibility interval; Sig, significance level: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$

I?	Species or group	Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
	Vegetation									
	Water couch	Gwydir	Bowen and Simpson 2010*b*	–0.064	–0.314	0.185	n.s.	–0.0641	0.0877	n.s.
	Amphibious vegetation	Gwydir	Bowen and Simpson 2010*b*	–0.054	–0.281	0.163	n.s.	–0.0577	0.0245	*
	Semi-permanent wetland veg.	Macquarie Marshes 1	Bowen *et al* 2014	–0.015	–0.339	0.328	n.s.	–0.0214	0.7579	n.s.
	Semi-permanent wetland veg.	Macquarie Marshes 2	Bowen *et al* 2014	0.000	–0.109	0.109	n.s.	–0.0060	0.8058	n.s.
	Semi-permanent wetland veg.	Macquarie Marshes 3	Bowen *et al* 2014	–0.003	–0.623	0.616	n.s.	–0.0380	0.7813	n.s.
	Moira grass	Barmah	Bren 1992	–0.024	–0.152	0.106	n.s.	–0.0247	0.0801	n.s.
	Moira grass	Barmah	Colloff *et al* 2014	–0.019	–0.123	0.09	n.s.	–0.0193	0.0022	**
I	Giant rush	Barmah-Millewa	DPI 2009	0.049	–0.054	0.168	n.s.	0.0486	0.0025	**

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I?	Species or group	Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
	Understorey vegetation	Gulpa Creek	Lunt *et al* 2007	0.020	–0.058	0.099	n.s.	0.0175	0.1223	n.s.
	Spike rush	Gulpa Creek	Lunt *et al* 2007	–0.067	–0.598	0.511	n.s.	–0.0953	0.3084	n.s.
	Ruppia	Coorong	Rogers and Paton 2009	–0.066	–0.212	0.065	n.s.	–0.0581	0.0048	**
	Water couch	Gwydir	Wilson *et al* 2008	NA	NA	NA	NA	–0.0159	0.3727	n.s.
	Macroinvertebrates									
	Freshwater yabby	Central Murray	Bennison *et al* 1989	0.144	–0.552	0.936	n.s.	0.0804	0.5235	n.s.
	Freshwater yabby	Lower Murray	Bennison *et al* 1989	0.096	–0.816	1.284	n.s.	–0.0306	0.8234	n.s.
	Freshwater yabby	Upper Murray	Bennison *et al* 1989	–0.060	–0.504	0.372	n.s.	–0.0862	0.3232	n.s.
	Corbiculina australis	Central Murray	Bennison *et al* 1989	0.288	–0.492	1.332	n.s.	0.3828	0.0662	n.s.
	Corbiculina australis	Lower Murray	Bennison *et al* 1989	0.204	–0.828	1.224	n.s.	0.2332	0.1984	n.s.
	Corbiculina australis	Upper Murray	Bennison *et al* 1989	0.096	–0.612	0.840	n.s.	0.0065	0.9661	n.s.
	Caddisfly	Central Murray	Bennison *et al* 1989	–0.036	–1.512	1.272	n.s.	–0.0993	0.7274	n.s.
	Caddisfly	Lower Murray	Bennison *et al* 1989	0.120	–1.272	1.332	n.s.	0.0586	0.8272	n.s.
	Caddisfly	Upper Murray	Bennison *et al* 1989	0.084	–1.164	1.704	n.s.	–0.0199	0.9267	n.s.
	Freshwater prawn	Central Murray	Bennison *et al* 1989	–0.120	–2.040	1.500	n.s.	–0.1765	0.3397	n.s.
	Freshwater prawn	Lower Murray	Bennison *et al* 1989	0.048	–0.180	0.384	n.s.	–0.1233	0.4402	n.s.
	Freshwater prawn	Upper Murray	Bennison *et al* 1989	–0.132	–1.524	1.008	n.s.	0.0518	0.1861	n.s.
	Glass shrimp	Central Murray	Bennison *et al* 1989	–0.240	–1.644	1.128	n.s.	–0.1068	0.5974	n.s.
	Glass shrimp	Lower Murray	Bennison *et al* 1989	0.240	–0.348	0.960	n.s.	–0.3066	0.0897	n.s.
	Glass shrimp	Upper Murray	Bennison *et al* 1989	–0.228	–1.464	0.996	n.s.	0.2694	0.0279	*
	Procladius paludicola	Central Murray	Bennison *et al* 1989	–0.300	–2.100	1.416	n.s.	–0.1443	0.5612	n.s.
	Procladius paludicola	Lower Murray	Bennison *et al* 1989	0.168	–0.396	0.696	n.s.	–0.2393	0.3138	n.s.
	Procladius paludicola	Upper Murray	Bennison *et al* 1989	–0.156	–2.088	1.968	n.s.	0.1587	0.1836	n.s.
	Mayfly	Central Murray	Bennison *et al* 1989	–0.132	–1.476	1.452	n.s.	–0.2227	0.4560	n.s.
	Mayfly s	Lower Murray	Bennison *et al* 1989	0.360	–1.044	1.776	n.s.	–0.1683	0.5282	n.s.
	Mayfly	Upper Murray	Bennison *et al* 1989	0.288	–0.492	1.332	n.s.	0.2705	0.3667	n.s.
	Freshwater yabby	NSW MDB	Reid *et al* 1997	0.072	–0.348	0.417	n.s.	0.0842	0.0848	n.s.
	Macroinvertebrates	VIC MDB	Thomson *et al* 2012	–0.005	–0.025	0.014	n.s.	–0.0042	0.0183	*
	Pipi	Coorong and Lakes	Ferguson *et al* 2013	–0.020	–0.124	0.085	n.s.	–0.0096	0.3575	n.s.
	Chironomids	Coorong	Paton and Bailey (2011)	–0.011	–1.772	1.744	n.s.	–0.1257	0.5654	n.s.
	Fishes									
	Native spp.	Kerang Lakes	Cadwallader 1977	0.099	–0.237	0.436	n.s.	0.0123	0.7064	n.s.
I	Redfin	Kerang Lakes	Cadwallader 1977	0.226	–0.088	0.541	n.s.	0.0943	0.0050	**
I	Tench	Kerang Lakes	Cadwallader 1977	0.105	–0.162	0.413	n.s.	0.0498	0.0382	*
	Golden perch	Lower Murray	Cadwallader and Lawrence 1990	NA	NA	NA	NA	–0.0041	0.6179	n.s.
	Black bream	Coorong and Lakes	Ferguson *et al* 2013	0.028	–0.083	0.141	n.s.	0.0170	0.0251	*
	Bony herring	Coorong and Lakes	Ferguson *et al* 2013	0.017	–0.007	0.043	n.s.	0.0168	0.0006	***
I	European carp	Coorong and Lakes	Ferguson *et al* 2013	0.039	–0.137	0.213	n.s.	0.0449	0.0050	**

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	Golden perch	Coorong and Lakes	Ferguson *et al* 2013	0.020	–0.116	0.149	n.s.	0.0307	0.0053	**
	Greenback flounder	Coorong and Lakes	Ferguson *et al* 2013	0.001	–0.145	0.148	n.s.	0.0067	0.5974	n.s.
	Mulloway (estuarine)	Coorong and Lakes	Ferguson *et al* 2013	0.047	–0.083	0.165	n.s.	0.0506	0.0001	***
	Mulloway (marine)	Coorong and Lakes	Ferguson *et al* 2013	0.046	–0.134	0.22	n.s.	0.0420	0.0189	*
	Yellow-eye mullet	Coorong and Lakes	Ferguson *et al* 2013	0.029	–0.016	0.083	n.s.	0.0286	0.0000	***
	Golden perch	Lake Albert	Ferguson andYe 2012	0.021	–0.067	0.089	n.s.	0.0193	0.0216	*
I	European carp	NSW MDB	Forsyth *et al* 2013	0.206	0.014	0.395	*	0.1485	0.0000	***
	Catfish	NSW MDB	Forsyth *et al* 2013	–0.042	–0.341	0.265	n.s.	–0.0817	0.0631	n.s.
	Bony herring	Murrumbidgee	Gilligan 2005	0.091	–0.152	0.371	n.s.	0.0691	0.0660	n.s.
I	European carp	Murrumbidgee	Gilligan 2005	–0.064	–0.421	0.227	n.s.	–0.0420	0.2980	n.s.
	Freshwater catfish	Murrumbidgee	Gilligan 2005	–0.042	–0.341	0.265	n.s.	–0.0817	0.0631	n.s.
	Golden perch	Murrumbidgee	Gilligan 2005	–0.019	–0.197	0.138	n.s.	–0.0126	0.5218	n.s.
	Murray cod	Murrumbidgee	Gilligan 2005	–0.037	–0.256	0.164	n.s.	–0.0353	0.1875	n.s.
I	Redfin perch	Murrumbidgee	Gilligan 2005	–0.089	–0.492	0.321	n.s.	–0.0936	0.0808	n.s.
	Silver perch	Murrumbidgee	Gilligan 2005	–0.014	–0.050	0.016	n.s.	–0.0146	0.0056	**
I	European carp	Lower Campaspe	Humphries *et al* 2008	–0.051	–1.037	0.799	n.s.	–0.0018	0.9907	n.s.
	Golden perch	Lower Campaspe	Humphries *et al* 2008	–0.254	–0.545	0.058	n.s.	–0.2666	0.0004	***
	Gudgeon	Lower Campaspe	Humphries *et al* 2008	0.141	–0.588	0.92	n.s.	0.0958	0.4491	n.s.
I	Redfin perch	Lower Campaspe	Humphries *et al* 2008	–0.222	–0.391	–0.03	*	–0.2275	0.0001	***
I	European carp	Mid Campaspe	Humphries *et al* 2008	–0.098	–0.616	0.369	n.s.	–0.0989	0.2386	n.s.
	Golden perch	Mid Campaspe	Humphries *et al* 2008	–0.039	–0.435	0.386	n.s.	–0.0675	0.3016	n.s.
	Gudgeon	Mid Campaspe	Humphries *et al* 2008	0.215	–0.567	1.104	n.s.	0.0899	0.5061	n.s.
I	Redfin perch	Mid Campaspe	Humphries *et al* 2008	–0.236	–0.450	–0.011	*	–0.2402	0.0002	***
I	European carp	Upper Campaspe	Humphries *et al* 2008	0.036	–0.689	0.676	n.s.	0.0701	0.5398	n.s.
	Golden perch	Upper Campaspe	Humphries *et al* 2008	0.047	–0.220	0.306	n.s.	0.0489	0.2334	n.s.
	Gudgeon	Upper Campaspe	Humphries *et al* 2008	0.105	–0.426	0.678	n.s.	0.0545	0.5527	n.s.
I	Redfin perch	Upper Campaspe	Humphries *et al* 2008	–0.003	–0.634	0.546	n.s.	0.0297	0.7662	n.s.
	Macquarie perch	Lake Dartmouth	Hunt *et al* 2011	–0.030	–0.255	0.185	n.s.	–0.0261	0.6052	n.s.
	Golden perch	Gulf Creek	Jones and Stuart 2008	–0.212	–1.275	0.926	n.s.	–0.2554	0.2666	n.s.
	Murray cod	Gulf Creek	Jones and Stuart 2008	0.165	–1.149	1.494	n.s.	0.0770	0.8075	n.s.
	Silver perch	Gulf Creek	Jones and Stuart 2008	–0.212	–1.275	0.926	n.s.	–0.2554	0.2666	n.s.
	Trout cod	Gulf Creek	Jones and Stuart 2008	–0.151	–1.569	1.226	n.s.	–0.1878	0.5517	n.s.
	Trout cod	Central Murray	Koehn *et al* 2013	0.030	–0.316	0.378	n.s.	0.0236	0.5658	n.s.
	Catfish	NSW MDB	Reid *et al* 1997	0.021	–0.145	0.186	n.s.	0.0315	0.0029	**
	Golden perch	NSW MDB	Reid *et al* 1997	0.034	–0.094	0.162	n.s.	0.0209	0.0224	*
I	Redfin perch	NSW MDB	Reid *et al* 1997	0.117	–0.136	0.373	n.s.	0.0239	0.0871	n.s.
	Silver perch	NSW MDB	Reid *et al* 1997	–0.016	–0.186	0.154	n.s.	–0.0302	0.0025	**
	Murray cod	NSW MDB	Rowland 1989	–0.053	–0.121	0.020	n.s.	–0.0633	0.0000	***

I?	Species or group	Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
	Australian smelt	Lindsay Island	Vilizzi 2012	NA	NA	NA	NA	0.0173	0.4368	n.s.
	Bony herring	Lindsay Island	Vilizzi 2012	0.026	–1.919	2.014	n.s.	–0.2000	0.6504	n.s.
	Carp gudgeon	Lindsay Island	Vilizzi 2012	NA	NA	NA	NA	–0.0041	0.8005	n.s.
	Flathead gudgeon	Lindsay Island	Vilizzi 2012	NA	NA	NA	NA	0.0326	0.1037	n.s.
	Murray cod	Lindsay Island	Vilizzi 2012	–0.586	–3.230	1.883	n.s.	–0.6400	0.2522	n.s.
	Unspecked hardyhead	Lindsay Island	Vilizzi 2012	NA	NA	NA	NA	0.0053	0.6934	n.s.
I	European carp	Lower Murray	Wallace 2010	0.029	–0.535	0.555	n.s.	0.0381	0.6389	n.s.
	Golden perch	Lower Murray	Wallace 2010	–0.057	–0.711	0.542	n.s.	–0.0345	0.7123	n.s.
	Murray cod	Lower Murray	Wallace 2010	–0.059	–0.951	0.724	n.s.	0.0452	0.7257	n.s.
I	Redfin perch	Lower Murray	Wallace 2010	0.358	–1.130	1.758	n.s.	0.3262	0.1458	n.s.
	Silver perch	Lower Murray	Wallace 2010	0.235	–0.610	0.991	n.s.	0.275	0.0443	*
	Australian smelt	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.2228	0.5507	n.s.
	Bony herring	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.0984	0.4851	n.s.
	Bridled goby	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.6124	0.1763	n.s.
I	European carp	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.2311	0.5974	n.s.
	Carp gudgeon	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.4021	0.2967	n.s.
	Common galaxias	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.2415	0.4817	n.s.
	Congolli	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.2839	0.4458	n.s.
	Dwarf flathead gudgeon	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.5161	0.2592	n.s.
	Flathead gudgeon	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.0684	0.2143	n.s.
I	Gambusia	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.0415	0.7857	n.s.
	Golden perch	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.1668	0.3792	n.s.
I	Goldfish	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.5637	0.0459	*
	Lagoon goby	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.0280	0.9068	n.s.
	Murray hardyhead	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.1575	0.4316	n.s.
I	Redfin perch	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.1378	0.5800	n.s.
	Sandy sprat	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	NA	NA	NA
	Small-mouthed hardyhead	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.2228	0.5507	n.s.
	Southern pygmy perch	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.3368	0.1261	n.s.
	Tamar river goby	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	0.8104	0.0684	n.s.
	Unspecked hardyhead	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.6062	0.3946	n.s.
	Western blue spot goby	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.0394	0.7202	n.s.
	Yarra pygmy perch	Lower Lakes	Wedderburn *et al* 2012	NA	NA	NA	NA	–0.9782	0.0459	*
	Golden perch	Lower SA Murray	Ye *et al* 2009	NA	NA	NA	NA	–0.0278	0.0218	*
	Golden perch	Mid SA Murray	Ye *et al* 2009	NA	NA	NA	NA	–0.0745	0.6131	n.s.
	Golden perch	Upper SA Murray	Ye *et al* 2009	NA	NA	NA	NA	0.0073	0.3316	n.s.
	Murray cod	Lower SA Murray	Ye *et al* 2009	NA	NA	NA	NA	–0.0385	0.3622	n.s.
	Murray cod	Mid SA Murray	Ye *et al* 2009	NA	NA	NA	NA	–0.0234	0.3250	n.s.

I?	Species or group	Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
	Murray cod	Upper SA Murray	Ye *et al* 2009	NA	NA	NA	NA	–0.0118	0.6632	n.s.
	Small-mouthed hardyhead	Coorong	Paton and Bailey 2012	0.060	–1.238	1.477	n.s.	–0.1892	0.3049	n.s.
	Waterbirds									
	Australian darter	Murrumbidgee	Briggs *et al* 1994	0.088	–0.406	0.667	n.s.	0.0121	0.8586	n.s.
	Australian pelican	Murrumbidgee	Briggs *et al* 1994	–0.381	–1.178	0.430	n.s.	–0.3936	0.0034	**
	Australian white Ibis	Murrumbidgee	Briggs *et al* 1994	–0.005	–0.538	0.453	n.s.	0.0168	0.7992	n.s.
	Australasian grebe	Murrumbidgee	Briggs *et al* 1994	–0.256	–1.429	1.013	n.s.	–0.3515	0.0531	n.s.
	Eurasian coot	Murrumbidgee	Briggs *et al* 1994	–0.217	–1.706	1.232	n.s.	–0.2742	0.1879	n.s.
	Freckled duck	Murrumbidgee	Briggs *et al* 1994	–0.123	–0.901	0.677	n.s.	–0.1569	0.1655	n.s.
	Great cormorant	Murrumbidgee	Briggs *et al* 1994	–0.041	–0.813	0.582	n.s.	–0.0124	0.8853	n.s.
	Great crested grebe	Murrumbidgee	Briggs *et al* 1994	–0.327	–1.035	0.451	n.s.	–0.3517	0.0054	**
	Great egret	Murrumbidgee	Briggs *et al* 1994	–0.396	–1.857	1.118	n.s.	–0.5728	0.0194	*
	Grey teal	Murrumbidgee	Briggs *et al* 1994	–0.188	–0.957	0.528	n.s.	–0.1900	0.0653	n.s.
	Intermediate egret	Murrumbidgee	Briggs *et al* 1994	0.002	–1.027	1.089	n.s.	–0.0602	0.6599	n.s.
	Little black cormorant	Murrumbidgee	Briggs *et al* 1994	–0.032	–1.616	1.607	n.s.	–0.1347	0.5608	n.s.
	Little egret	Murrumbidgee	Briggs *et al* 1994	–0.214	–1.282	0.937	n.s.	–0.2910	0.0573	n.s.
	Little pied cormorant	Murrumbidgee	Briggs *et al* 1994	–0.561	–1.518	0.321	n.s.	–0.5292	0.0018	**
	Pacific black duck	Murrumbidgee	Briggs *et al* 1994	–0.048	–0.442	0.372	n.s.	–0.0548	0.3093	n.s.
	Pacific heron	Murrumbidgee	Briggs *et al* 1994	0.355	0.065	0.609	*	0.3579	0.0000	***
	Royal spoonbill	Murrumbidgee	Briggs *et al* 1994	–0.115	–0.925	0.727	n.s.	–0.1557	0.1433	n.s.
	Straw necked Ibis	Murrumbidgee	Briggs *et al* 1994	0.752	–0.495	1.990	n.s.	0.6430	0.0016	**
	White faced heron	Murrumbidgee	Briggs *et al* 1994	0.061	–0.854	1.040	n.s.	–0.0331	0.7687	n.s.
	Wood duck	Murrumbidgee	Briggs *et al* 1994	–0.352	–0.790	0.090	n.s.	–0.3708	0.0001	***
	Yellow-billed spoonbill	Murrumbidgee	Briggs *et al* 1994	–0.127	–0.817	0.668	n.s.	–0.1678	0.0907	n.s.
	Ibis nests	Booligal Swamp	Driver *et al* 2010	–0.072	–0.996	0.958	n.s.	–0.0999	0.4440	n.s.
	Australian white ibis nests	Macquarie Marshes	Kingsford and Auld 2005	–0.122	–2.029	1.466	n.s.	–0.1181	0.5760	n.s.
	Cattle egret nests	Macquarie Marshes	Kingsford and Auld 2005	0.039	–1.187	0.889	n.s.	0.0995	0.4541	n.s.
	Cormorant nests	Macquarie Marshes	Kingsford and Auld 2005	–0.073	–1.674	1.231	n.s.	–0.0334	0.8368	n.s.
	Glossy ibis nests	Macquarie Marshes	Kingsford and Auld 2005	0.033	–1.704	1.309	n.s.	0.0602	0.7543	n.s.
	Great egret nests	Macquarie Marshes	Kingsford and Auld 2005	0.039	–1.205	0.958	n.s.	0.0465	0.7557	n.s.
	Intermediate egret nests	Macquarie Marshes	Kingsford and Auld 2005	0.018	–1.961	1.543	n.s.	0.0107	0.9645	n.s.
	Little egret nests	Macquarie Marshes	Kingsford and Auld 2005	0.028	–1.386	0.984	n.s.	0.1164	0.4326	n.s.
	Rufous night heron nests	Macquarie Marshes	Kingsford and Auld 2005	–0.053	–1.591	1.405	n.s.	–0.1048	0.5918	n.s.
	Straw necked ibis nests	Macquarie Marshes	Kingsford and Auld 2005	0.233	–1.818	2.282	n.s.	0.1637	0.5100	n.s.
	Ducks	Lowbidgee	Kingsford and Thomas 2004	–0.183	–0.744	0.310	n.s.	–0.1863	0.0031	**
	Herbivorous waterbirds	Lowbidgee	Kingsford and Thomas 2004	–0.181	–0.899	0.563	n.s.	–0.1895	0.0613	n.s.
	Large waders	Lowbidgee	Kingsford and Thomas 2004	–0.332	–1.130	0.301	n.s.	–0.3060	0.0020	**
	Piscivorous waterbirds	Lowbidgee	Kingsford and Thomas 2004	–0.144	–0.460	0.171	n.s.	–0.1488	0.0044	**

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	Small waders	Lowbidgee	Kingsford and Thomas 2004	–0.311	–1.049	0.175	n.s.	–0.2898	0.0017	**
	Waterbirds	Paroo Overflow	Kingsford and Thomas 2004	0.039	–0.486	0.576	n.s.	0.0365	0.6202	n.s.
	Waterbirds	Dry Lake	Kingsford *et al* 2004	–0.012	–0.134	0.117	n.s.	–0.0136	0.3183	n.s.
	Waterbirds	Paroo River	Kingsford *et al* 2012	–0.092	–0.567	0.465	n.s.	–0.1140	0.0096	**
	Australian pelican	MDB	Kingsford *et al* 2013	0.000	–0.230	0.273	n.s.	–0.0347	0.0670	n.s.
	Australian shelduck	MDB	Kingsford *et al* 2013	–0.108	–0.372	0.147	n.s.	–0.1075	0.0001	***
	Australian wood duck	MDB	Kingsford *et al* 2013	–0.064	–0.254	0.128	n.s.	–0.0743	0.0001	***
	Black swan	MDB	Kingsford *et al* 2013	–0.050	–0.196	0.111	n.s.	–0.0710	0.0000	***
	Eurasian coot	MDB	Kingsford *et al* 2013	–0.006	–0.415	0.42	n.s.	–0.0371	0.1981	n.s.
	Grey teal	MDB	Kingsford *et al* 2013	–0.049	–0.316	0.244	n.s.	–0.0798	0.0003	***
	Hardhead	MDB	Kingsford *et al* 2013	–0.023	–0.431	0.458	n.s.	–0.0298	0.3400	n.s.
	Pacific black duck	MDB	Kingsford *et al* 2013	–0.071	–0.218	0.114	n.s.	–0.0844	0.0000	***
	Pink eared duck	MDB	Kingsford *et al* 2013	–0.049	–0.201	0.102	n.s.	–0.0510	0.0391	*
	Straw necked ibis	MDB	Kingsford *et al* 2013	–0.063	–0.24	0.144	n.s.	–0.0755	0.0030	**
	Waterbirds	Burrendong Dam	Kingsford *et al* 2013	–0.146	–0.338	0.103	n.s.	–0.1570	0.0000	***
	Waterbirds	Coolmundra Dam	Kingsford *et al* 2013	–0.038	–0.187	0.115	n.s.	–0.0385	0.0512	n.s.
	Waterbirds	Coorong	Kingsford *et al* 2013	0.043	–0.307	0.592	n.s.	–0.0281	0.4624	n.s.
	Waterbirds	Corop	Kingsford *et al* 2013	0.004	–0.378	0.43	n.s.	–0.0689	0.0340	*
	Waterbirds	Cuttaburra Basin	Kingsford *et al* 2013	–0.039	–0.97	0.937	n.s.	–0.1265	0.1741	n.s.
	Waterbirds	Fivebough Swamp	Kingsford *et al* 2013	–0.022	–0.639	0.643	n.s.	–0.0715	0.2689	n.s.
	Waterbirds	Lowbidgee	Kingsford *et al* 2013	–0.079	–0.448	0.359	n.s.	–0.1326	0.0007	***
	Waterbirds	Macquarie Marshes	Kingsford *et al* 2013	–0.043	–1.019	0.938	n.s.	–0.2410	0.0009	***
	Waterbirds	Menindee Lakes	Kingsford *et al* 2013	–0.104	–0.973	0.758	n.s.	–0.2623	0.0004	***
	Waterbirds	Lake Mokoan	Kingsford *et al* 2013	–0.035	–0.267	0.213	n.s.	–0.0474	0.0312	*
	Waterbirds	Noona Basin	Kingsford *et al* 2013	–0.075	–0.451	0.353	n.s.	–0.0937	0.1208	n.s.
	Waterbirds	Paroo River	Kingsford *et al* 2013	–0.018	–0.244	0.245	n.s.	–0.0162	0.4606	n.s.
	Waterbirds	Talyawalka	Kingsford *et al* 2013	0.035	–1.489	1.572	n.s.	–0.1327	0.1755	n.s.
	Waterbirds	MDB	Kingsford *et al* 2013	–0.033	–0.226	0.171	n.s.	–0.0666	0.0001	***
	Australian darter	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Australian white ibis	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Black swan	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Great cormorant	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Intermediate egret	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Little black cormorant	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Little egret	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Little pied cormorant	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Nankeen night heron	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Royal spoonbill	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA

I?	Species or group	Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
	Straw necked ibis	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Whiskered tern	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	White necked heron	Barmah Forest	Leslie 2001	NA	NA	NA	NA	NA	NA	NA
	Banded lapwing	Barmah Forest	Nebel *et al* 2008	–0.153	–0.487	0.209	n.s.	–0.1714	0.0034	**
	Banded stilt	Barmah Forest	Nebel *et al* 2008	–0.189	–0.933	0.525	n.s.	–0.1223	0.0343	*
	Black winged stilt	Barmah Forest	Nebel *et al* 2008	–0.090	–0.250	0.063	n.s.	–0.0926	0.0005	***
	Masked lapwing	Barmah Forest	Nebel *et al* 2008	–0.067	–0.343	0.208	n.s.	–0.0689	0.0050	**
	Pied oystercatcher	Barmah Forest	Nebel *et al* 2008	–0.046	–0.454	0.251	n.s.	–0.0327	0.3883	n.s.
	Red necked avocet	Barmah Forest	Nebel *et al* 2008	–0.107	–0.438	0.233	n.s.	–0.1037	0.0007	***
	Shorebirds	Paroo Overflow	Nebel *et al* 2008	–0.070	–0.739	0.528	n.s.	–0.0626	0.4754	n.s.
	Australian pelican	Coorong	Paton and Rogers 2009	–0.006	–0.179	0.171	n.s.	–0.0284	0.1530	n.s.
	Australian shelduck	Coorong	Paton and Rogers 2009	0.026	–0.165	0.204	n.s.	0.0275	0.3236	n.s.
	Australian white ibis	Coorong	Paton and Rogers 2009	–0.039	–0.317	0.293	n.s.	–0.0480	0.2052	n.s.
	Banded stilt	Coorong	Paton and Rogers 2009	0.058	–0.380	0.447	n.s.	0.0871	0.0906	n.s.
	Black faced cormorant	Coorong	Paton and Rogers 2009	0.031	–0.147	0.227	n.s.	0.0205	0.4710	n.s.
	Black swan	Coorong	Paton and Rogers 2009	0.007	–0.256	0.293	n.s.	–0.0078	0.8131	n.s.
	Black winged stilt	Coorong	Paton and Rogers 2009	0.042	–0.286	0.365	n.s.	0.0497	0.273	n.s.
	Chestnut teal	Coorong	Paton and Rogers 2009	0.087	–0.155	0.337	n.s.	0.0641	0.0968	n.s.
	Common greenshank	Coorong	Paton and Rogers 2009	–0.021	–0.150	0.107	n.s.	–0.0087	0.6538	n.s.
	Crested tern	Coorong	Paton and Rogers 2009	–0.001	–0.187	0.182	n.s.	–0.0026	0.9186	n.s.
	Curlew sandpiper	Coorong	Paton and Rogers 2009	–0.188	–0.530	0.139	n.s.	–0.1491	0.0081	**
	Great cormorant	Coorong	Paton and Rogers 2009	0.159	–0.553	0.983	n.s.	0.1229	0.2057	n.s.
	Great crested grebe	Coorong	Paton and Rogers 2009	–0.019	–0.469	0.469	n.s.	–0.0277	0.6703	n.s.
	Grey teal	Coorong	Paton and Rogers 2009	–0.102	–0.475	0.360	n.s.	–0.1081	0.0668	n.s.
	Hoary headed grebe	Coorong	Paton and Rogers 2009	–0.095	–0.879	0.733	n.s.	–0.1307	0.2199	n.s.
	Little black cormorant	Coorong	Paton and Rogers 2009	0.049	–0.414	0.586	n.s.	0.0184	0.7639	n.s.
	Little pied cormorant	Coorong	Paton and Rogers 2009	–0.195	–1.233	0.993	n.s.	–0.2202	0.1138	n.s.
	Masked lapwing	Coorong	Paton and Rogers 2009	0.004	–0.085	0.095	n.s.	0.0012	0.9176	n.s.
	Musk duck	Coorong	Paton and Rogers 2009	–0.088	–0.703	0.525	n.s.	–0.1061	0.1666	n.s.
	Pacific black duck	Coorong	Paton and Rogers 2009	–0.053	–0.517	0.394	n.s.	–0.0417	0.4551	n.s.
	Pied cormorant	Coorong	Paton and Rogers 2009	0.076	–0.232	0.488	n.s.	0.0435	0.3125	n.s.
	Pied oystercatcher	Coorong	Paton and Rogers 2009	–0.001	–0.084	0.080	n.s.	–0.0003	0.9762	n.s.
	Pink eared duck	Coorong	Paton and Rogers 2009	0.028	–0.617	0.752	n.s.	0.0727	0.4291	n.s.
	Red capped plover	Coorong	Paton and Rogers 2009	–0.053	–0.300	0.213	n.s.	–0.0553	0.1345	n.s.
	Red necked avocet	Coorong	Paton and Rogers 2009	–0.054	–0.604	0.554	n.s.	–0.0796	0.2203	n.s.
	Red necked stint	Coorong	Paton and Rogers 2009	–0.055	–0.305	0.259	n.s.	–0.0802	0.0327	*
	Sharp tailed sandpiper	Coorong	Paton and Rogers 2009	–0.028	–0.506	0.467	n.s.	–0.0333	0.5715	n.s.
	Silver gull	Coorong	Paton and Rogers 2009	0.029	–0.083	0.145	n.s.	0.0300	0.0653	n.s.

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I?	Species or group	Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
	Straw necked ibis	Coorong	Paton and Rogers 2009	–0.084	–0.809	0.618	n.s.	–0.0963	0.2093	n.s.
	Whiskered tern	Coorong	Paton and Rogers 2009	0.008	–0.403	0.445	n.s.	0.0017	0.9729	n.s.
	White faced heron	Coorong	Paton and Rogers 2009	0.003	–0.088	0.104	n.s.	–0.0010	0.9392	n.s.
	Australasian shoveller	MDB	Porter and Kingsford 2011	–0.119	–0.300	0.069	n.s.	–0.1188	0.0000	***
	Chestnut teal	MDB	Porter and Kingsford 2011	–0.020	–0.324	0.386	n.s.	–0.0465	0.1896	n.s.
	Freckled duck	MDB	Porter and Kingsford 2011	–0.065	–0.487	0.354	n.s.	–0.0534	0.1222	n.s.
	Plumed whistling duck	MDB	Porter and Kingsford 2011	–0.032	–0.493	0.362	n.s.	–0.0199	0.5216	n.s.
	Australasian grebe	Mid Lachlan	Reid *et al* 2004	0.019	–0.024	0.066	n.s.	0.0182	0.0019	**
	Black fronted dotterel	Mid Lachlan	Reid *et al* 2004	–0.057	–0.150	0.050	n.s.	–0.0656	0.0000	***
	Straw necked ibis	Mid Lachlan	Reid *et al* 2004	–0.007	–0.078	0.063	n.s.	–0.0075	0.405	n.s.
	Yellow-billed spoonbill	Mid Lachlan	Reid *et al* 2004	–0.030	–0.184	0.113	n.s.	–0.0235	0.1122	n.s.
	Waterbirds	Paroo Overflow	Roshier *et al* 2002	NA	NA	NA	NA	0.2317	0.0220	*
	Waterbirds	Gwydir	Spencer 2010	0.058	–0.844	0.899	n.s.	0.0707	0.5258	n.s.
	Waders	Coorong	Wainwright and Christie 2008	–0.056	–0.203	0.096	n.s.	–0.0531	0.0026	**
	Grazing waterfowl	Lowbidgee	Wen *et al* 2011	–0.106	–0.331	0.109	n.s.	–0.1058	0.0059	**

Table S3. Long-term trends of non-population time series: proportion data analysed by logit-linear regression (LR; *n* = 37)

r, value of exponential rate of increase; CI, credibility interval; Sig, significance level: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$

Species or group	Location	Reference	***r*** LR	CI low	CI high	Sig. LR
Vegetation						
Canopy cover	Lachlan River	Armstrong *et al* 2009	–0.008	–0.072	0.054	n.s.
Canopy cover	Lower Gum Swamp	Armstrong *et al* 2009	–0.036	–0.339	0.264	n.s.
Canopy cover	Murrumbidgil Swamp	Armstrong *et al* 2009	–0.027	–0.255	0.188	n.s.
Canopy cover	Top Gum Swamp	Armstrong *et al* 2009	–0.035	–0.303	0.224	n.s.
Black Box Condition	Gunbower	Bennetts and Jolly 2012	–0.134	–0.452	0.176	n.s.
River red gum (flood-dependent) condition	Gunbower	Bennetts and Jolly 2012	–0.163	–0.824	0.505	n.s.
River red gum (flood-tolerant) condition	Gunbower	Bennetts and Jolly 2012	–0.156	–0.765	0.418	n.s.
Permanent wetland proportional understorey extent	Gunbower	Bennetts and Jolly 2012	–0.109	–1.481	1.197	n.s.
Semi-permanent wetland proportional understorey extent	Gunbower	Bennetts and Jolly 2012	–0.110	–1.636	1.359	n.s.
River red gum (flood-dependent) understorey extent	Gunbower	Bennetts and Jolly 2012	0.116	–0.928	1.08	n.s.
River red gum condition	Victorian Murray	Cunningham *et al* 2009	–0.086	–0.371	0.21	n.s.
Black box condition	Monoman	Roberts *et al* 2009	–0.176	–0.908	0.533	n.s.
Grassy woodland crown condition	Yanga National Park	Wen *et al* 2009	0.150	–0.726	0.984	n.s.
Riparian forest crown condition	Yanga National Park	Wen *et al* 2009	0.031	–0.207	0.269	n.s.
Shrubby woodland crown condition	Yanga National Park	Wen *et al* 2009	0.149	–0.835	1.103	n.s.
Wetland forest crown condition	Yanga National Park	Wen *et al* 2009	0.054	–0.243	0.348	n.s.
Macroinvertebrates						
Freshwater cray size structure	Lake Nagambie	Gilligan *et al* 2007	0.038	–0.642	0.79	n.s.
Freshwater cray size structure	Ovens River	Gilligan *et al* 2007	–0.214	–2.139	1.886	n.s.
Freshwater cray size structure	Wodonga Creek	Gilligan *et al* 2007	–0.054	–0.533	0.451	n.s.
Waterbirds						
Pied sandpiper reporting rate	Coorong and Lower Lakes	O'Connor and Rogers 2013	0.013	–0.323	0.327	n.s.
Sanderling reporting rate	Coorong and Lower Lakes	O'Connor and Rogers 2013	–0.017	–0.44	0.412	n.s.
Australian pelican proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.087	–0.334	0.145	n.s.
Australian white Ibis proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.036	–2.073	2.157	n.s.
Black swan proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.026	–0.687	0.705	n.s.
Caspian tern proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.115	–0.459	0.208	n.s.
Crested tern proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.037	–0.411	0.397	n.s.
Fairy tern proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.077	–0.439	0.36	n.s.
Glossy ibis proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.639	–4.013	2.947	n.s.
Great cormorant proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.017	–1.633	1.71	n.s.
Great egret proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.125	–3.016	3.092	n.s.

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Species or group	Location	Reference	***r*** LR	CI low	CI high	Sig. LR
Little black cormorant proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.249	–1.260	1.544	n.s.
Little pied cormorant proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.002	–0.949	0.946	n.s.
Pied cormorant proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.038	–0.222	0.304	n.s.
Royal spoonbill proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.234	–2.206	2.461	n.s.
Silver gull proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	0.088	–1.942	2.145	n.s.
Straw necked ibis proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.046	–0.853	0.841	n.s.
Yellow-billed spoonbill proportional magnitude of breeding events	Coorong and Lower Lakes	O'Connor *et al* 2013	–0.129	–1.626	1.303	n.s.

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Table S4. Long-term trends of non-population time series: sighting (occurrence) data analysed by logit-linear regression (LR; *n* = 18)

r, value of exponential rate of increase; CI, credibility interval; Sig, significance level: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$

Species or group	Location	Reference	***r*** LR	CI low	CI high	Sig. LR
Vegetation						
Aquatic plants	Lachlan	Roberts and Sainty 1997	–0.071	–0.174	–0.002	*
Macroinvertebrates						
Freshwater snails	Lower Murray	Sheldon and Walker 1993	–0.149	–0.292	–0.073	*
Freshwater cray	Lower Murray	Gilligan *et al* 2007	–0.177	–0.540	–0.015	*
Fishes						
Large-bodied native fishes	Lachlan	Roberts and Sainty 1997	–0.099	–0.234	–0.020	*
Freshwater catfish	Gwydir	Copeland *et al* 2003	–0.078	–0.224	0.015	n.s.
Waterbirds						
Australian darter breeding	Barmah Forest	Leslie 2001	–0.024	–0.078	0.021	n.s.
Australian white ibis breeding	Barmah Forest	Leslie 2001	0.032	–0.021	0.099	n.s.
Black swan breeding	Barmah Forest	Leslie 2001	–0.064	–0.114	–0.025	*
Great cormorant breeding	Barmah Forest	Leslie 2001	0.006	–0.036	0.042	n.s.
Intermediate egret breeding	Barmah Forest	Leslie 2001	–0.040	–0.089	0.003	n.s.
Little black cormorant breeding	Barmah Forest	Leslie 2001	–0.031	–0.081	0.004	n.s.
Little egret breeding	Barmah Forest	Leslie 2001	–0.090	–0.149	–0.043	*
Little pied cormorant breeding	Barmah Forest	Leslie 2001	0.213	0.120	0.709	*
Nankeen night heron breeding	Barmah Forest	Leslie 2001	–0.027	–0.079	0.007	n.s.
Royal spoonbill breeding	Barmah Forest	Leslie 2001	0.024	–0.046	0.092	n.s.
Straw necked ibis breeding	Barmah Forest	Leslie 2001	0.223	0.142	0.717	*
Whiskered tern breeding	Barmah Forest	Leslie 2001	–0.028	–0.068	0.005	n.s.
White necked heron breeding	Barmah Forest	Leslie 2001	–0.045	–0.089	–0.009	*

Table S5. Long-term trends of normalised difference vegetation index (NDVI) time series (*n* = 11), analysed by the state-space model (SS) and log-linear regression of abundance (log)

I, invasive species; *r*, value of exponential rate of increase; CI, credibility interval; Sig., significance level: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$

Location	Reference	***r*** SS	CI low	CI high	Sig. SS	***r*** log.	***P*** null log.	Sig. log.
Namoi (Bugilbone to Walgett)	Fu and Burgher 2015	0.002	–0.003	0.007	n.s.	0.0023	0.0370	*
Namoi (Gunnedah)	Fu and Burgher 2015	0.002	–0.006	0.011	n.s.	0.0023	0.1970	n.s.
Namoi (u/s Mollee)	Fu and Burgher 2015	0.001	–0.005	0.010	n.s.	0.0012	0.2773	n.s.
Goulburn	Sims *et al* 2009	–0.004	–0.019	0.009	n.s.	–0.0059	0.0542	n.s.
Gwydir	Sims *et al* 2009	0.000	–0.015	0.016	n.s.	0.0001	0.9586	n.s.
Murray	Sims *et al* 2009	–0.004	–0.016	0.007	n.s.	–0.0048	0.0380	*
Murrumbidgee	Sims *et al* 2009	–0.005	–0.019	0.008	n.s.	–0.0059	0.0403	*
Namoi	Sims *et al* 2009	–0.001	–0.017	0.015	n.s.	–0.0013	0.6441	n.s.
Ovens	Sims *et al* 2009	–0.009	–0.040	0.022	n.s.	–0.0146	0.0334	*
Paroo	Sims *et al* 2009	–0.009	–0.027	0.007	n.s.	–0.0084	0.0266	*
Macquarie Marshes	Wen *et al* 2012	–0.003	–0.046	0.037	n.s.	–0.0032	0.7177	n.s.

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