

Conservation

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Conservation

Conservation 2018

Yong, D. L., Jain, A., Liu, Y., Iqbal, M., Choi, C.-Y., Crockford, N. J., Provencher, J. 2018. Challenges and opportunities for transboundary conservation of migratory birds in the East Asian-Australasian flyway. *Conservation Biology*.

Conservation 2016

Watson, J. E. M., E. S. Darling, O. Venter, M. Maron, J. Walston, H. P. Possingham, N. Dudley, M. Hockings, M. Barnes, and T. M. Brooks. 2016. Bolder science needed now for protected areas. *Conservation Biology* **30**:243–248.

(Abstract)

Recognizing that protected areas (PAs) are essential for effective biodiversity conservation action, the Convention on Biological Diversity established ambitious PA targets as part of the 2020 Strategic Plan for Biodiversity. Under the strategic goal to “improve the status of biodiversity by safeguarding ecosystems, species, and genetic diversity,” Target 11 aims to put 17% of terrestrial and 10% of marine regions under PA status by 2020. Additionally and crucially, these areas are required to be of particular importance for biodiversity and ecosystem services, effectively and equitably managed, ecologically representative, and well-connected and to include “other effective area-based conservation measures” (OECMs). Whereas the area-based targets are explicit and measurable, the lack of guidance for what constitutes important and representative; effective; and OECMs is affecting how nations are implementing the target. There is a real risk that Target 11 may be achieved in terms of area while failing the overall strategic goal for which it is established because the areas are poorly located, inadequately managed, or based on unjustifiable inclusion of OECMs. We argue that the conservation science community can help establish ecologically sensible PA targets to help prioritize important biodiversity areas and achieve ecological representation; identify clear, comparable performance metrics of ecological effectiveness so progress toward these targets can be assessed; and identify metrics and report on the contribution OECMs make toward the target. By providing ecologically sensible targets and new performance metrics for measuring the effectiveness of both PAs and OECMs, the science community can actively ensure that the achievement of the required area in Target 11 is not simply an end in itself but generates genuine benefits for biodiversity.

Conservation 2015

Di Marco, M., T. M. Brooks, A. Cuttelod, L. D. C. Fishpool, C. Rondinini, R. J. Smith, L. Bennun, S. H. M. Butchart, S. Ferrier, R. P. B. Foppen, L. N. Joppa, D. Juffe-Bignoli, A. T. Knight, J. F. Lamoreux, P. F. Langhammer, I. May, H. P. Possingham, P. Visconti, J. E. M. Watson, and S. Woodley. 2015. Quantifying the relative irreplaceability of important bird and biodiversity areas. *Conservation Biology* **30**:392–402.

(Abstract)

World governments have committed to increase the global protected areas coverage by 2020, but the effectiveness of this commitment for protecting biodiversity depends on where new protected areas are located. Threshold- and complementarity-based approaches have been independently used to identify important sites for biodiversity. We brought together these approaches by performing a complementarity-based analysis of irreplaceability in important bird and biodiversity areas (IBAs), which are sites identified using a threshold-based approach. We determined whether irreplaceability values are higher inside than outside IBAs and whether any observed difference depends on known characteristics of the IBAs. We focused on 3 regions with comprehensive IBA inventories and bird distribution atlases: Australia, southern Africa, and Europe. Irreplaceability values were significantly higher inside than outside IBAs, although differences were much smaller in Europe than elsewhere. Higher irreplaceability values in IBAs were associated with the presence and number of restricted-range species; number of criteria under which the site was identified; and mean geographic range size of the species for which the site was identified (trigger species). In addition, IBAs were characterized by higher irreplaceability values when using proportional species representation targets, rather than fixed targets. There were broadly comparable results when measuring irreplaceability for trigger species and when considering all bird species, which indicates a good surrogacy effect of the former. Recently, the International Union for Conservation of Nature has convened a consultation to consolidate global standards for the identification of key biodiversity areas (KBAs), building from existing approaches such as IBAs. Our results informed this consultation, and in particular a proposed irreplaceability criterion that will allow the new KBA standard to draw on the strengths of both threshold- and complementarity-based approaches.

Dallimer M, Strange N. 2015. Why socio-political borders and boundaries matter in conservation. *Trends in Ecology & Evolution* **30** (3):132-139.

(Abstract)

Acting to demarcate the spatial limits of decision-making processes, socio-political boundaries are an inevitable part of a human-dominated world. Rarely coincident with ecological

boundaries, and thus having no ecological functional role by themselves, they nevertheless impose substantial costs on biodiversity and ecosystem conservation by fragmenting ownership, governance, and management. Where boundaries are in place, a lack of coordination on either side of a boundary affects the efficiency and efficacy of ecosystem management. We suggest four research pathways which will enhance our ability to address the adverse effects of socio-political borders on conservation: (i) scale-matching, (ii) quantification of the mutual economic benefits of conservation across boundaries, (iii) determining transboundary societal values, and (iv) acknowledging the importance of stakeholder behaviour and incentives.

Runge, C. A., J. E. M. Watson, S. H. M. Butchart, J. O. Hanson, H. P. Possingham, and R. A. Fuller. 2015. Protected areas and global conservation of migratory birds. *Science* **350**:1255-1258.

(Abstract)

Migratory species depend on a suite of interconnected sites. Threats to unprotected links in these chains of sites are driving rapid population declines of migrants around the world, yet the extent to which different parts of the annual cycle are protected remains unknown. We show that just 9% of 1451 migratory birds are adequately covered by protected areas across all stages of their annual cycle, in comparison with 45% of non-migratory birds. This discrepancy is driven by protected area placement that does not cover the full annual cycle of migratory species, indicating that global efforts toward coordinated conservation planning for migrants are yet to bear fruit. Better-targeted investment and enhanced coordination among countries are needed to conserve migratory species throughout their migratory cycle.

Conservation 2014

Palomo, I., C. Montes, B. Martín-López, J. A. González, M. García-Llorente, P. Alcorlo, and M. R. García Mora. 2014. Incorporating the Social–Ecological Approach in Protected Areas in the Anthropocene. *BioScience* **64**:181–191.

(Abstract)

Protected areas are the main strategy for the protection of ecosystems and biodiversity. However, changes occurring during the Anthropocene continue to threaten biodiversity and, therefore, the associated ecosystem services that maintain human well-being. Despite efforts to integrate protected areas into a wider landscape, most of these areas are still managed as

islands within a matrix of degraded territory; there is no clear conceptual framework that integrates them into the surrounding landscape. We first review the evolution of the protected-area concept. Then, we acknowledge the main limitations that protected areas face for long-term conservation. Next, we discuss how the ecosystem service approach could overcome some of these protected-area limitations. Finally, we propose a social–ecological approach for protected areas to maintain high biodiversity and its associated flow of ecosystem services in the context of uncertainty.

Iwamura T, Fuller RA, Possingham HP 2014. Optimal Management of a Multispecies Shorebird Flyway under Sea-Level Rise. *Conservation Biology* **28**:1710–1720.

(Abstract)

Every year, millions of migratory shorebirds fly through the East Asian–Australasian Flyway between their arctic breeding grounds and Australasia. This flyway includes numerous coastal wetlands in Asia and the Pacific that are used as stopover sites where birds rest and feed. Loss of a few important stopover sites through sea-level rise (SLR) could cause sudden population declines. We formulated and solved mathematically the problem of how to identify the most important stopover sites to minimize losses of bird populations across flyways by conserving land that facilitates upshore shifts of tidal flats in response to SLR. To guide conservation investment that minimizes losses of migratory bird populations during migration, we developed a spatially explicit flyway model coupled with a maximum flow algorithm. Migratory routes of 10 shorebird taxa were modeled in a graph theoretic framework by representing clusters of important wetlands as nodes and the number of birds flying between 2 nodes as edges. We also evaluated several resource allocation algorithms that required only partial information on flyway connectivity (node strategy, based on the impacts of SLR at nodes; habitat strategy, based on habitat change at sites; population strategy, based on population change at sites; and random investment). The resource allocation algorithms based on flyway information performed on average 15% better than simpler allocations based on patterns of habitat loss or local bird counts. The Yellow Sea region stood out as the most important priority for effective conservation of migratory shorebirds, but investment in this area alone will not ensure the persistence of species across the flyway. The spatial distribution of conservation investments differed enormously according to the severity of SLR and whether information about flyway connectivity was used to guide the prioritizations. With the rapid ongoing loss of coastal wetlands globally, our method provides insight into efficient conservation planning for migratory species.

Walsh, J. C., L. V. Dicks, and W. J. Sutherland. 2014. The Effect of Scientific Evidence on Conservation Practitioners' Management Decisions. *Conservation Biology* **29**:88–98.

(Abstract)

A major justification of environmental management research is that it helps practitioners, yet previous studies show it is rarely used to inform their decisions. We tested whether conservation practitioners focusing on bird management were willing to use a synopsis of relevant scientific literature to inform their management decisions. This allowed us to examine whether the limited use of scientific information in management is due to a lack of access to the scientific literature or whether it is because practitioners are either not interested or unable to incorporate the research into their decisions. In on-line surveys, we asked 92 conservation managers, predominantly from Australia, New Zealand, and the United Kingdom, to provide opinions on 28 management techniques that could be applied to reduce predation on birds. We asked their opinions before and after giving them a summary of the literature about the interventions' effectiveness. We scored the overall effectiveness and certainty of evidence for each intervention through an expert elicitation process—the Delphi method. We used the effectiveness scores to assess the practitioners' level of understanding and awareness of the literature. On average, each survey participant changed their likelihood of using 45.7% of the interventions after reading the synopsis of the evidence. They were more likely to implement effective interventions and avoid ineffective actions, suggesting that their intended future management strategies may be more successful than current practice. More experienced practitioners were less likely to change their management practices than those with less experience, even though they were not more aware of the existing scientific information than less experienced practitioners. The practitioners' willingness to change their management choices when provided with summarized scientific evidence suggests that improved accessibility to scientific information would benefit conservation management outcomes.

van der Vliet, R. E., I. Oquiñena Valluerca, J. van Dijk, and M. J. Wassen. 2015. EU protection is inadequate for a declining flyway population of Black-tailed Godwit *Limosa limosa*: mismatch between future core breeding areas and existing Special Protection Areas. *Bird Conservation International* **25**:111-125.

(Abstract)

This study analyses whether effective conservation of Black-tailed Godwit *Limosa limosa* breeding populations in the Netherlands can be achieved through the EU network of Special Protection Areas (SPAs). An internationally important number of pairs of Black-tailed Godwit breeds in the Netherlands but the breeding population is declining steeply and is, in effect, unprotected, as the Netherlands has not designated SPAs for it. To contribute to firmer and more efficient protection of the Black-tailed Godwit, we set out to identify the core areas in the Netherlands where this species is expected to breed in 2020. On the basis of an optimal combination of three main habitat requirements (groundwater level, land-use and openness of the landscape) we identified five core areas in lower-lying (western) Netherlands: Zuidwest Friesland, Waterland, the IJssel delta area, Arkemheen and Eem polders, and Groene Hart. Because these areas are currently not designated for the breeding period of Black-tailed

Godwit within the SPA network, the protection of this flagship species of Dutch meadows could be at risk. It seems likely that the Black-tailed Godwit population will continue to decline, with the result that the Netherlands will breach several policy commitments for the conservation of this species.

Runge, C. A., T. G. Martin, H. P. Possingham, S. G. Willis, and R. A. Fuller. 2014. Conserving mobile species. *Frontiers in Ecology and the Environment* **12**:395–402.

(Abstract)

The distributions of many species are dynamic in space and time, and movements made by individuals range from regular and predictable migrations to erratic, resource-driven nomadism. Conserving such mobile species is challenging; the effectiveness of a conservation action taken at one site depends on the condition of other sites that may be geographically and politically distant (thousands of kilometers away or in another jurisdiction, for example). Recent work has shown that even simple and predictable linkages among sites caused by “to-and-fro” migration can make migratory species especially vulnerable to habitat loss, and substantially affect the results of conservation prioritizations. Species characterized by more erratic or nomadic movements are very difficult to protect through current conservation planning techniques, which typically view species distributions as static. However, collaborations between migration ecologists, conservation planners, and mathematical ecologists are paving the way for improvements in conservation planning for mobile species.

Van Colen C, Verbelen D, Devos K, Agten L, Van Tomme J, Vincx M, Degraer S (2014) Sediment-benthos relationships as a tool to assist in conservation practices in a coastal lagoon subjected to sediment change. *Biodiversity and Conservation* **23**, 877-889.

(Abstract)

This study explores the relation between sediment composition and intertidal macrobenthos populations in the Zwin nature reserve (Belgium and The Netherlands), a tidal lagoon that is included in the Ramsar list of wetlands of international importance and has been designated as Natura 2000 area, among others due to its function as wintering habitat for shorebirds that feed upon macrobenthic invertebrates. Species response models show highest biomass of these prey species in organically enriched cohesive sediments and a distinct decline in probability of occurrence for most species in coarse sediments. Further, the biomass of macrobenthos declined between 2003 and 2010 in the extensive low intertidal inlet channel concurrent with the coarsening of the sediment over time in this hydrodynamically stressed habitat. In contrast, macrobenthos biomass increased in a sheltered shallow intertidal habitat

that acted as a catchment area for finer sediments, therefore facilitating the succession towards a higher elevated habitat with salt marsh vegetation establishment. Hence, spatio-temporal sediment dynamics decreased site quality for intertidal predators due to a reduction in feeding areas over time, and a change in physical sediment properties that alter the macrobenthos species occurrence and population biomass. This study thus illustrates that sediment transport dynamics may affect the functioning of coastal shallow soft-sediment habitats, like coastal lagoons. The presented macrobenthos species response models provide a tool to assist in management actions that enable the conservation of cohesive low intertidal habitats that provide a high food supply to shorebirds, fish and macrocrustaceans

Kleijn D, Cherkaoui I, Goedhart PW, van der Hout J, Lammertsma D. 2014. Waterbirds increase more rapidly in Ramsar-designated wetlands than in unprotected wetlands. *Journal of Applied Ecology* **51**, 289-298.

(Abstract)

1. There is a general lack of information on how international conservation treaties affect biodiversity. The Ramsar convention on the protection of internationally important wetlands is such an international conservation policy. It initiated the worldwide establishment of over 2000 protected areas currently covering more than 200 million ha. The convention came into force in 1975 but to date it remains unknown whether it actually produces biodiversity benefits.
2. We analysed 21 years of survey data from a wide range of waterbird species in over 200 Moroccan wetlands and examined whether Ramsar designation as well as a national protected areas program (SIBE) positively affected bird abundance. Furthermore, habitat characteristics of wetlands in protected areas and control sites were compared and bird abundance was related to habitat characteristics.
3. After designation, waterbird species richness and abundance increased more rapidly in Ramsar wetlands than in non-designated wetlands. In SIBE sites, increases in bird abundance were intermediate.
4. Waterbird abundance was significantly related to habitat characteristics, most importantly covered of water or bare ground. Compared to control sites, Ramsar sites had significantly higher cover of habitat types favoured by most waterbird species. It remained unclear, however, whether these differences were caused by conservation management or were already present prior to conservation designation.
5. Surprisingly, waterbird population trends in Moroccan wetlands were markedly positive. Trends were found to be related to precipitation levels in the Sahel which may have caused changes in migratory strategies.
6. Synthesis and applications. This study demonstrates a powerful approach to systematically evaluating biodiversity responses to major international conservation policies. The results highlight that data on management and habitat quality are critical for reaching general conclusions about the effectiveness of conservation instruments. Site managers or conservation authorities should be encouraged to collect standardized data on conservation

actions to help interpret the mechanisms behind population responses and thus extrapolate findings beyond the study system. These findings represent a first small step towards unravelling the contribution of international conservation tools towards global policy objectives of halting the biodiversity decline.

Conservation 2013

Redpath, S. M., J. Young, A. Evely, W. M. Adams, W. J. Sutherland, A. Whitehouse, A. Amar, R. A. Lambert, J. D. C. Linnell, A. Watt, and R. J. Gutiérrez. 2013. Understanding and managing conservation conflicts. *Trends in Ecology & Evolution*

(Abstract)

Conservation conflicts are increasing and need to be managed to minimise negative impacts on biodiversity, human livelihoods, and human well-being. Here, we explore strategies and case studies that highlight the long-term, dynamic nature of conflicts and the challenges to their management. Conflict management requires parties to recognise problems as shared ones, and engage with clear goals, a transparent evidence base, and an awareness of trade-offs. We hypothesise that conservation outcomes will be less durable when conservationists assert their interests to the detriment of others. Effective conflict management and long-term conservation benefit will be enhanced by better integration of the underpinning social context with the material impacts and evaluation of the efficacy of alternative conflict management approaches.

Park SH, Kim JO, Ji KJ, Lee DB. 2013. A study on the role of habitats of a tidal land reclamation area for winter migrants in Korea. *Irrigation and Drainage* **62**, 44-51.

(Abstract)

This study has been carried out to evaluate the habitat role for migratory birds in a tidal reclamation area in comparison with a river estuary in Korea. It also includes the contribution effect of the contract on the optional Choice of Paddy Field Management (CPFM) program to sustain biodiversity of winter migrants in Korea. The CPFM program has been practiced to attract winter migratory birds in cooperation with the farmers who spread rice straw, cultivate barley and provide shallow flooding paddy during the winter season in various reclaimed areas. The study result shows that a large number of winter migratory birds visited the tidal reclamation areas and the reason given is that wave intrusion was prevented by the sea dike and water level changes in the lake are less than tidal level changes in the estuary, as well as the irrigated paddy field supply of food and shelter for the birds in the reclaimed area. In the

tidal reclamation area, the dominant species are waterfowl such as geese and ducks, while waders, shore birds and other small birds have declined after reclamation in the area, as the freshwater lakes are rather deeper than coastal shorelines to attract them. In conclusion, tidal areas with large paddy fields and freshwater lakes have allowed not only an increase in food production but also have attracted winter migrants supported by farmers and government; however, more effort will be needed to provide habitats for rare and distinctive birds in the reclamation area.

Sala E, Costello C, Dougherty D, Heal G, Kelleher K, Murray JH, Rosenberg AA, Sumaila UR. 2013. A General Business Model for Marine Reserves. *PLoS ONE* **8**, e58799.

(Abstract)

Marine reserves are an effective tool for protecting biodiversity locally, with potential economic benefits including enhancement of local fisheries, increased tourism, and maintenance of ecosystem services. However, fishing communities often fear short-term income losses associated with closures, and thus may oppose marine reserves. Here we review empirical data and develop bioeconomic models to show that the value of marine reserves (enhanced adjacent fishing + tourism) may often exceed the pre-reserve value, and that economic benefits can offset the costs in as little as five years. These results suggest the need for a new business model for creating and managing reserves, which could pay for themselves and turn a profit for stakeholder groups. Our model could be expanded to include ecosystem services and other benefits, and it provides a general framework to estimate costs and benefits of reserves and to develop such business models.

Vilkov EV. 2013. Population Trends in Regular Migrants As the Basis for a Prediction Model for Conservation of the Birds of Eurasia. *Russian Journal of Ecology* **44**, 142–157.

(Abstract)

The results of censuses taken in 1995 to 2011 along two key routes in the areas of the Sulakskaya and Turalinskaya Lagoons, Dagestan (the western coast of the Middle Caspian Sea), are summarized. The state of the populations of regularly migrating birds and causes of long-term fluctuations in their abundance have been assessed by the method of long-term series of observations on trajectories of active migration along stationary routes. The results show that the abundance of 46 out of the 116 background taxa has decreased, while that of 70 taxa has increased or remained unchanged. The key regulatory factors include hydroclimatic conditions, anthropogenic impact, food supply, synurbanization, and weather. The results provide a basis for developing a unified strategy for the conservation of the birds

of Eurasia.

Danielsen F, Pirhofer-Walzl K, Adrian TP, Kapijimpanga DR, Burgess ND, Jensen PM, Bonney R, Funder M, Landa A, Levermann N, Madsen J. 2013. Linking public participation in scientific research to the indicators and needs of international environmental agreements. *Conservation Letters* **early online**.

(Abstract)

Different monitoring approaches collect data that can measure progress toward achieving global environmental indicators.

These indicators can:(1) Audit management actions; (2) Inform policy choices; and (3) Raise awareness among the public and policy makers. We present a generic, empirically based, framework of different environmental monitoring approaches, ranging from scientist-driven to those undertaken by local people. This framework is used to assess monitoring possibilities for the Convention on Biological Diversity “2020” indicators, and those of 11 other international environmental agreements.

Of the 186 indicators in these 12 environmental agreements, 69 (37%) require monitoring by professional scientists, whereas 117 (63%) can involve community members as “citizen scientists.” Promoting “community-based” and “citizen science” approaches could significantly enrich monitoring progress within global environmental conventions. It would also link environmental monitoring to awareness raising and enhanced decision-making at all levels of resource management.

Neßhöver C, Timaeus J, Wittmer H, Krieg A, Geamana N, van den Hove S, Young J, Watt A. 2013. Improving the Science-Policy Interface of Biodiversity Research Projects. *GAIA* **22** 99–103.

(Abstract)

Against the background of a continuing biodiversity loss there is a strong need to improve the interfaces between science and policy. Many approaches for such interfaces exist, the most recent being the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). A less prominent approach to interface science with policy consists of research projects directly linking with decision makers. Here we present insights and recommendations on how to do this successfully, highlighting among others the role of facilitating mutual learning and enhancing interface expertise in institutions.

Waldron A, Mooers AO, Miller DC, Nibbelink N, Redding DW, Kuhn TS, Roberts JT, Gittleman JL. 2013. Targeting global conservation funding to limit immediate biodiversity declines. *PNAS* **110**, 12144–12148.

(Abstract)

Inadequate funding levels are a major impediment to effective global biodiversity conservation and are likely associated with recent failures to meet United Nations biodiversity targets. Some countries are more severely underfunded than others and therefore represent urgent financial priorities. However, attempts to identify these highly underfunded countries have been hampered for decades by poor and incomplete data on actual spending, coupled with uncertainty and lack of consensus over the relative size of spending gaps. Here, we assemble a global database of annual conservation spending. We then develop a statistical model that explains 85% of variation in conservation expenditures, and use this to identify countries where funding is robustly below expected levels. The 40 most severely underfunded countries contain 32% of all threatened mammalian diversity and include neighbors in some of the world's most biodiversity-rich areas (Sundaland, Wallacea, and Near Oceania). However, very modest increases in international assistance would achieve a large improvement in the relative adequacy of global conservation finance. Our results could therefore be quickly applied to limit immediate biodiversity losses at relatively little cost.

Game ET, Kareiva PM, Possingham HP. 2013. Six Common Mistakes in Conservation Priority Setting. *Conservation Biology* **27**, 480–485.

(Abstract)

A vast number of prioritization schemes have been developed to help conservation navigate tough decisions about the allocation of finite resources. However, the application of quantitative approaches to setting priorities in conservation frequently includes mistakes that can undermine their authors' intention to be more rigorous and scientific in the way priorities are established and resources allocated. Drawing on well-established principles of decision science, we highlight 6 mistakes commonly associated with setting priorities for conservation: not acknowledging conservation plans are prioritizations; trying to solve an ill-defined problem; not prioritizing actions; arbitrariness; hidden value judgments; and not acknowledging risk of failure. We explain these mistakes and offer a path to help conservation planners avoid making the same mistakes in future prioritizations.

Conservation 2012 and earlier

2012

Kushlan, J. A. 2012. A History of Conserving Colonial Waterbirds in the United States. *Waterbirds* **35**:608-625.

(Abstract)

The commentary follows the story of colonial waterbird conservation in the United States over the past 150 years. Colonial waterbirds, especially egrets and pelicans, played an important role in the founding of the American bird conservation movement. At the beginning of the 20th Century, bird conservation activity self-organized, inspired creation of refuges for colonial waterbirds, protected colonies with wardens, and secured passage of conservation laws. Thereafter Federal and state governments slowly grew in their authorities and commitment to bird conservation. Successes achieved, colonial waterbirds fell from priority during the remainder of the first half of the 20th Century, although legislative, administrative and academic progress was made of considerable subsequent value. In the 1960s and 1970s, colonial waterbirds resumed a significant role, first in contaminant studies and then in population inventories. This engagement encouraged maturation of a colonial waterbird research and conservation agenda in the United States, including founding of the Waterbird Society, which facilitated a blossoming of colonial waterbird research in the succeeding decades. In the national conservation planning initiatives of the 1990s, colonial waterbirds were represented by the North American Waterbird Conservation Plan, later Waterbird Conservation for the Americas. Waterbirds are now well integrated in bird conservation planning and action at multiple scales in the United States. Conservation biology, assessment, protection and site management have progressed well, while population estimation, monitoring and data archiving have not. Appropriate direction seems clear, involving regional coordination of the actions of local stakeholders.

Suazo CG, Arriagada AM, Rau JR. 2012. Ephemeral Aquatic Bird Assemblages in Estuarine Wetlands from South-Central Chile: Using an Intertidal Flat Habitat During the Austral Summer. *Estuaries and Coasts* **35**, 1137–1143.

(Abstract)

The use of intertidal environments by aquatic birds is an important topic of study in the northern hemisphere, grouping baseline distributional descriptions to assess human–bird interactions during shellfish harvesting in soft substrates. However, patterns of tidal regime plus human and natural disturbances may differ in areas in the southern hemisphere. We studied the use of an intertidal flat by a temporary (i.e., ephemeral) assemblage of migratory and resident shorebirds and waterbirds in the Queule River Estuary (39° S), in south-central Chile, during the summers of 2003 and 2008. Migrant species such as Whimbrel *Numenius phaeopus*

Numenius phaeopus and resident Southern Lapwing *Vanellus chinesis* positively selected sandy substrates when feeding during both spring (periods with stronger tidal range) and neap tides (periods with weaker tides). The resident Yellow-billed Pintail *Anas georgica* only positively selected the muddy–sandy bottom during spring tides. The predominant activity of resident species was feeding during both tides, except for the Yellow-billed Pintail which rested during neap tides. We highlight the importance of microhabitats such as the intertidal flats system as feeding and resting areas for migratory and resident species. We also comment on their conservation and natural modification by mega earthquake and tsunami effects that may result in the future destruction or generation of these key environments.

Higuchi H. 2012. Bird migration and the conservation of the global environment. *Journal of Ornithology* **153**, 3-14.

(Abstract)

I have collaborated with Asian and American scientists on satellite-tracking the migration of birds in East Asia for nearly 20 years. We have tracked the migration of about 20 bird species, including cranes, storks, swans and hawks. We have used the results in a variety of applications, from showing migration routes and the relative importance of each staging site to more advanced analyses including using various data overlays to examine habitat use and the connectivity and network structure of migration pathways. We have also studied the effects of climate change on population trends of swans satellite-tracked from their wintering areas in Japan to their breeding ground in Russia. Satellite-tracking is a powerful research tool to study the detailed migration routes, seasonal differences in migration pattern, locations of important sites, and the conservation issues that migratory birds encounter. Migratory birds establish a link not only among natural environments in different countries along their migration routes but also among people in different countries. Further interdisciplinary cooperation is needed to develop tracking technology, and more international collaboration is required to promote migration studies.

Murray NJ, Fuller RA. 2012. Coordinated effort to maintain East Asian–Australasian Flyway.

Boere GC, Piersma T. 2012. Flyway protection and the predicament of our migrant birds: A critical look at international conservation policies and the Dutch Wadden Sea. *Ocean & Coastal Management* **68**, 157-168.

(Abstract)

The nomination of the Dutch and German parts of the Wadden Sea as a World Heritage Site within the framework of the World Heritage Convention (WHC) represents high-level

recognition of the global importance of this area for millions of migratory birds. It was not the first accolade for the unique wilderness area, but arguably the most prestigious. In its nomination, the World Heritage Convention requests the two countries to strengthen cooperation within the African-Eurasian Flyways, a system of global connectedness by migrant waterbirds in which the Wadden Sea plays a vital role. Here we review the origin and (lack of) implementation of the international conservation instruments available to protect values that are easily undervalued and forgotten, instruments that involve cooperation along the flyway axes. We describe how scientific information sometimes helps governments to implement their obligations, but also how, in spite of indisputable scientific data, governments take decisions contrary to their obligations under international conservation instruments. In some cases such decisions are reversed after scientists have shown measurable declines in the global populations of the migratory waterbirds and established the causality of such declines. At a global level, a few more regional flyway conservation instruments may be needed, but for most parts of the world the instrumentation to secure the well-being of the flyways are in place. It boils down to the determination by governments, informed by good science and under close scrutiny by NGOs, to put them into concrete action.

Kabat P, Bazelmans J, van Dijk J, Herman PMJ, van Oijen T, Pejrup M, Reise K, Speelman H, Wolff WJ. 2012. The Wadden Sea Region: Towards a science for sustainable development. *Ocean & Coastal Management* **68**, 4-17.

(Abstract)

The Wadden Sea is one of the largest intertidal areas in the world and has been designated as a UNESCO World Heritage Site in recognition of its unique natural features. Major changes in the morphology and ecology of the Wadden Sea over the past millennium resulted from increasing anthropogenic influences such as coastal protection, land claim from the sea and drainage of wetland for agriculture, exploitation of natural resources from hunting and fishing to the extraction of groundwater, gas and oil, industrialisation at port locations and tourism at the islands. A sustainable future can only be achieved if policy and management are backed by solid science. Many of the anticipated changes result from the upscaling of pressures on the Wadden Sea system. Economic globalization leads to upscaling of fisheries, tourism and industrial activities, and thus to changed pressures on space and nature. Climate change will lead to changes in hydrographic patterns, species distribution and possibly tourism; through sea-level rise it will put pressure on coastal protection and the extent of intertidal areas. Invasions of exotic species will transform the ecosystem. There are three major related challenges to management:1. Nature conservation in a changing system requires a focus on preservation of the values and not the state of the system;2. The adaptation of the management structure to the scale increase of the pressures, so that local and regional management becomes better nested in transregional and transnational governance structures;3. Finally, the management approach needs to deal with increasing uncertainty in external forcing of the system, as well as with nonlinearities in system dynamics when it is pushed outside its normal range of operation. Based on these pressures and management

challenges, we advocate an integrated social-ecological systems approach for the scientific study and the science-based management of the Wadden Sea Region. The essential characteristics of this approach are strong interdisciplinarity and a focus on aspects of scale and cumulative processes.

Albanese G, Davis CA, Compton BW (2012) Spatiotemporal scaling of North American continental interior wetlands: implications for shorebird conservation. *Landscape Ecology* **27**, 1465–1479.

(Abstract)

Within interior North America, erratic weather patterns and heterogeneous wetland complexes cause wide spatio-temporal variation in the resources available to migrating shorebirds. Identifying the pattern-generating components of landscape-level resources and the scales at which shorebirds respond to these patterns will better facilitate conservation efforts for these species. We constructed descriptive models that identified weather variables associated with creating the spatio-temporal patterns of shorebird habitat in ten landscapes in north-central Oklahoma. We developed a metric capable of measuring the dynamic composition and configuration of shorebird habitat in the region and used field data to empirically estimate the spatial scale at which shorebirds respond to the amount and configuration of habitat. Precipitation, temperature, solar radiation and wind speed best explained the incidence of wetland habitat, but relationships varied among wetland types. Shorebird occurrence patterns were best explained by habitat density estimates at a 1.5 km scale. This model correctly classified 86 % of shorebird observations. At this scale, when habitat density was low, shorebirds occurred in 5 % of surveyed habitat patches but occurrence reached 60 % when habitat density was high. Our results suggest scale dependence in the habitat-use patterns of migratory shorebirds. We discuss potential implications of our results and how integrating this information into conservation efforts may improve conservation strategies and management practices.

2011

Gilman EL, Dunn D, Read AF, Hyrenbach KD, Warner R. 2011. Designing criteria suites to identify discrete and networked sites of high value across manifestations of biodiversity. *Biodiversity and Conservation* **20**, 3363–3383.

(Abstract)

Suites of criteria specifying ecological, biological, social, economic, and governance properties enable the systematic identification of sites and networks of high biodiversity value,

and can support balancing ecological and socioeconomic objectives of biodiversity conservation in terrestrial and marine spatial planning. We describe designs of suites of ecological, governance and socioeconomic criteria to comprehensively cover manifestations of biodiversity, from genotypes to biomes; compensate for taxonomic and spatial gaps in available datasets; balance biases resulting from conventionally-employed narrow criteria suites focusing on rare, endemic and threatened species; plan for climate change effects on biodiversity; and optimize the ecological and administrative networking of sites. Representativeness, replication, ecological connectivity, size, and refugia are identified as minimum ecological properties of site networks. Through inclusion of a criterion for phylogenetic distinctiveness, criteria suites identify sites important for maintaining evolutionary processes. Criteria for focal species are needed to overcome data gaps and address limitations in knowledge of factors responsible for maintaining ecosystem integrity.

Sheehy J, Taylor CM, Norris DR. 2011. The importance of stopover habitat for developing effective conservation strategies for migratory animals. *Journal of Ornithology* **152**, S161-S168.

(Abstract)

Although stopover habitats are used by many species as refuelling stations during migration and can be critical for survival and successful reproduction, they are rarely incorporated in year-round population models and conservation strategies. We incorporate stopover habitat into a density-dependent population model and then use this model to examine how optimizing one-time land purchase strategies for a migratory population is influenced by variation in the quality and the strength of density-dependence in a stopover habitat used for both fall and spring migration. As the strength of the density-dependence in the stopover habitat increases, the optimal amount of stopover habitat purchased increases while the amount of habitat during the stationary periods of the annual cycle (breeding and wintering) decreases. Any change in the cost of purchasing stopover habitat affects investment strategies in all three periods of the annual cycle. When the quality of the stopover habitat is high, the optimal strategy is to invest in low-quality habitat during breeding and wintering and when the stopover habitat quality is low, the optimal strategy switches to investing in high-quality habitat during the stationary periods. We apply this model to a threatened warbler population and demonstrate how purchase decisions to conserve stopover habitat that are not coordinated with conservation actions on the breeding and wintering grounds can potentially result in a lower population carrying-capacity compared to considering habitat in all three periods of the annual cycle simultaneously. Our model provides potential guidelines for developing conservation strategies for animals that rely on fueling habitats between the stationary breeding and non-breeding periods of the migratory cycle.

Sripanomyom S, Round PD, Savini T, Trisurat Y, Gale GA. 2011. Traditional salt-pans hold major concentrations of overwintering shorebirds in Southeast Asia. *Biodiversity and Conservation* **144**, 526-537.

(Abstract)

Shorebirds are declining worldwide due to loss and degradation of critical breeding and wintering habitats. Some human-modified habitats, particularly salt-pans which are used by shorebirds in many regions of the world, may help substitute for natural habitats lost for a wide range of species during migration. We studied the influence of landscape characteristics on species richness, abundance, and diversity of shorebirds at 20 sites covering most of the Inner Gulf of Thailand, a landscape with a long history of salt farming. Sites with salt-pans present held significantly higher species richness, abundance and diversity of shorebirds. Areas with larger proportions given over to aquaculture tended to have lower species richness, abundance and diversity. Generalized additive models indicated that landscapes with a larger proportion of tidal flats in conjunction with salt-pans were the best predictors of sites with higher species richness, abundance and diversity. Landscape configurations with higher richness, abundance and diversity of shorebirds also tended to be less fragmented and contained slightly larger patches. Shorebirds appeared to use ponds with exposed mud in salt-pans as both roosting sites and supplementary feeding grounds during high tide. Traditional salt-pans therefore proved to contribute significantly to maintenance of overwintering shorebird populations in this landscape and should be investigated elsewhere in Asian coastal zones. Collaboration between researchers, salt farmers and planning authorities as to how best to maintain salt-pans as potential shorebird roost sites such as in the Inner Gulf of Thailand is urgently needed in order to maintain habitat for shorebird populations in critical wintering and staging areas of this flyway.