

# Underwater vehicle



## Research Projects

Rebuilding ecosystem resilience: Assessment of management options to minimise formation of 'Barrens' habitat by the long-spined sea urchin (*Centrostephanus rodgersii*) in Tasmania, University of Tasmania, Craig Johnson, 2007-2010, Partner Institution(s): DPIPWE

Autonomous Exploration and Characterization of Benthic Habitats Linked to Oceanographic Processes, University of Sydney, Stefan Williams, 2008-2010, Funding: ARC Discovery Project

Machine Assisted, Multi-scale Spatial and Temporal Observation and Modelling of Marine Benthic Habitats, University of Sydney, Stefan Williams, Maria Bryne, Will Figueria, Neville Barrett, 2010-2013, Partner Institution(s): University of Tasmania, Funding: ARC Super Science Fellowship

Stress, virulence and bacterial disease in temperate seaweeds: the rise of the microbes, University of New South Wales, Peter Steinberg, S Kjelleberg, T Thomas, S Egan, Melinda Coleman, 2010-2013, Funding: ARC Linkage Project

Establishment of a cost-effective monitoring program to detect changes in the structure of benthic invertebrate and macroalgae assemblages in the West Coast Bioregion, University of Western Australia, University of Sydney, Dan Smale, Gary Kendrick, Euan Harvey, 2010-2013, Funding: Western Australian Marine Science Institution

Autonomous repeatable surveys for long term monitoring of marine habitats, University of Sydney, Stefan Williams, Oscar Pizarro, Michael Jakuba, Mitchell Bryson, 2010-2013, Partner Institution(s): Thales Australia Pty. Ltd., Funding: ARC Linkage Project

Cost-effective autonomous systems for large scale monitoring of marine protected areas, University of Sydney, Oscar Pizarro, Stefan Williams, Michael Jakuba, Ryan Eustice, Louis Whitcomb, 2010-2014, Partner Institution(s): University of Michigan, Johns Hopkins University, Funding: ARC Discovery Project, QEII Fellowship

Integration of Autonomous Underwater Vehicles (AUVs) and Remote Satellite Sensing for Automated and Persistent monitoring, University of Queensland, Chris Roelfsema, Matthew Dunbabin, Russ Babcock, 2011-2013, Funding: CSIRO

NERP Flinders Island and CMR survey, University of Tasmania, Neville Barrett, Partner Institution(s): USyd

Virulence and bacterial disease in temperate seaweeds. The rise of the microbes, University of New South Wales, Ezequiel Marzinelli, Funding: NSW State Government, ARC Future Fellowship

Multi-Scale Recognition: Generating Meaning from Multi-Resolution Data, University of Sydney, Bertrand Douillard, Funding: ARC APD Fellow

Sand and granite reef communities revealed at Freycinet CMR, University of Tasmania, Neville Barrett, 2011-2015, Funding: National Environmental Research Program (NERP)

Marine monitoring blueprint: meeting a monumental challenge, Paul Hedge, 2011-2015, Funding: National Environmental Research Program (NERP)

Southern Rock Lobster thrive in Tasman Fracture CMR, University of Tasmania, Neville Barrett, 2011-2015, Funding: National Environmental Research Program (NERP)

Project 2: Analysis of approaches for monitoring biodiversity in Commonwealth waters, Commonwealth Scientific Industrial Research Organisation, University of Tasmania, Keith Hayes, Jeffrey Dambacher, Emma Lawrence, Russ Babcock, Rhys Leeming, Alan Williams, Neville Barrett, Nicole Hill, Vanessa Lucieer, Gary Kendrick, Euan Harvey, Scott Nichol, 2011-2014, Partner Institution(s): AIMS, CSIRO, GA, UTAS, UWA, Funding: National Environmental Research Program (NERP)

Analysis of approaches for monitoring biodiversity in the Commonwealth marine area: Houtman Abrolhos Islands, Keith Hayes, 2011-2015, Funding: National Environmental Research Program (NERP)

Collating existing survey data for Commonwealth marine waters, Jeffrey Dambacher, 2011-2015, Funding: National Environmental Research Program (NERP)

Image-based automated macrobenthic species identification, counting and sizing, University of Sydney, Commonwealth Scientific Industrial Research Organisation, University of Tasmania, Stefan Williams, Oscar Pizarro, Russ Babcock, Matthew Dunbabin, Neville Barrett, 2011-2014, Funding: SIEF Fellowship

Scientific Support for Managing Australia's Marine Biodiversity - a National Marine Biodiversity Hub, University of Tasmania, Nicholas Bax, Chris Austin, Russ Babcock, Neville Barrett, Mark Bravington, Brendan Brooke, Julian Michael Caley, Piers Dunstan, Karen Edyvane, Peter Harris, Sarah Jennings, Gary Kendrick, Tim O'Hara, Sean Pascoe, Bob Pressey, Wendy Proctor, Tony Smith, Chris Wilcox, 2011-2015, Partner Institution(s): AIMS, CDU, CSIRO, GA, Museum Victoria, JCU, UTAS, UWA, Funding: National Environmental Research Program (NERP)

Effects of climate change on temperate benthic assemblages on the continental shelf in eastern Australia, University of Tasmania, Craig Johnson, Neil Holbrook, Neville Barrett, Peter Steinberg, 2011-2014, Partner Institution(s): University of New South Wales, Funding: ARC Super Science Fellowship

Model benthic habitat and assemblage distribution using data derived from AUV, BUV and swath acoustic mapping in and around NSW marine parks, University of Sydney, Renata Ferrari, Partner Institution(s): NSW DPI, Funding: NSW State Government

Delivering information suitable for studying spatial and temporal variability in benthic habitats using autonomous underwater vehicles, University of Sydney, Stefan Williams, Funding: ARC Future Fellowship

NERP Solitary Island survey, Department of Primary Industries, NSW, Alan Jordan, Partner Institution(s): USyd, UTAS

Marine Video, University of Sydney, Stefan Williams, Partner Institution(s): UWA, UTAS, UNSW, CSIRO, AIMS, Funding: Australian National Data Service (ANDS)

Remotely Operated Vehicle, University of Sydney, Stefan Williams, Oscar Pizarro, I Manchester, Jody Webster, Renata Ferrari, Funding: University of Sydney

High quality benthic and demersal surveys from small form factor underwater robots, University of Sydney, Oscar Pizarro, Stefan Williams, Mathew Edmunds, 2013-2016, Partner Institution(s): Australian Marine Ecology Pty Ltd, Funding: ARC Linkage Project

Autonomous benthic observing system, University of Western Australia, University of Tasmania, Commonwealth Scientific Industrial Research Organisation, Australian Institute of Marine Science, Department of Primary Industries, NSW, Stefan Williams, Oscar Pizarro, Gary Kendrick, Neville Barrett, Russ Babcock, Andrew Heyward, Alan Jordan, Partner Institution(s): University of Sydney, Funding: ARC LIEF

Application of NERP Biodiversity Hub survey methodology to Geographe Bay Commonwealth Marine Reserve, University of Tasmania, Emma Lawrence, Stefan Williams, Gary Kendrick, Euan Harvey, 2014-2015, Partner Institution(s): CSIRO, UTAS, UWA, USyd, Funding: National Environmental Research Program (NERP)

Project D3: Evaluating and monitoring the status of marine biodiversity assets on the continental shelf, University of Tasmania, Neville Barrett, Vanessa Lucieer, 2015-2021, Funding: National Environmental Science Program (NESP)

Autonomous survey technologies for large scale ocean observing , Sydney Institute for Marine Science, Oscar Pizarro, Michael Jakuba, James Kinsey, Christopher Roman, Stefan Williams, Ryan Eustice, Thomas Bridge, Richard Camilli, 2015-2015, Funding: Schmidt Ocean Institute

Supervised autonomy for AUVs using limited bandwidth communication channels, Sydney Institute for Marine Science, Stefan Williams, Oscar Pizarro, 2015-2018, Partner Institution(s): Thales Australia Pty Ltd, Funding: ARC Linkage Project

A photometric imaging model for mobile underwater camera design, Sydney Institute for Marine Science, Stefan Williams, Oscar Pizarro, A Lumsdaine, Christopher Roman, Y Schechner, 2015-2017, Funding: ARC Discovery Project

Managing ecosystem interactions across differing environments: building flexibility and risk assurance into environmental management strategies, University of Tasmania, Commonwealth Scientific Industrial Research Organisation, C MacLeod, Neville Barrett, Karen Wild-Allen, 2015-2018, Funding: Fisheries Research and Development Corporation

Project D2: Analysis methods and software to support standard operating procedures for survey design, condition assessment and trend detection, University of Tasmania, Scott Foster, Neville Barrett, 2015-2021, Funding: National Environmental Science Program (NESP)

AUV-based monitoring of benthic habitats in the SE CMR Network, University of Tasmania, Neville Barrett, Jacquomo Monk, 2016-2016, Funding: Department of the Environment

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## Postgraduate Research Projects

Doctor of Philosophy (PhD), Large-scale multi-sensor 3D reconstructions and visualisations of unstructured underwater environments, University of Sydney; Matthew Johnson-Robertson, 2005-2009, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Efficient and featureless approaches to bathymetric simultaneous localisation and mapping, University of Sydney; Stephen Barkby, 2007-2011, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Habitats and ecological communities of the Great Barrier Reef, James Cook University; Thomas Bridge, 2007-2011, Supervisor(s): Jody Webster, Robin Beaman

Doctor of Philosophy (PhD), Non-extractive monitoring of biodiversity on temperate Australian deepwater reefs: Using advanced vision-processing techniques to develop and test reliable biodiversity metrics , University of Tasmania, Commonwealth Scientific Industrial Research Organisation; Jan Seiler, 2008-2011, Supervisor(s): Neville Barrett, Alan Williams, Neil Holbrook

Doctor of Philosophy (PhD), Water column current profile aided localisation for Autonomous Underwater Vehicles, University of Sydney; Lashika Medagoda, 2008-2012, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Bayesian non-parametric benthic habitat mapping, University of Sydney; Asher Bender, 2009-2013, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Predictive habitat modelling using Autonomous Underwater Vehicles, University of Sydney; Nasir Ahsan, 2009-2013, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Active learning using a variational Dirichlet process model for pre-clustering and classification of underwater stereo imagery, University of Sydney; Ariell Friedman, 2009-2013, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Dirichlet process mixture models for autonomous habitat classification, University of Sydney; Daniel Steinberg, 2009-2013, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Multi-vehicle habitat mapping using Autonomous Underwater vehicles, University of Sydney; Lachlan Toohey, 2010-2014, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Plenoptic flow: Closed-form visual odometry for light field camera, University of Sydney; Donald Dansereau, 2010-2014, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Hyperspectral imaging for classification of marine habitats, University of Sydney; Daniel Bongiorno, 2011-2015, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Automated interpretation of visual information from marine survey, University of Sydney; Michael Bewley, 2012-2015, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Effective visual survey using semantic scene understanding, University of Sydney; Dushyant Rao, 2012-2015, Supervisor(s): Stefan Williams, Oscar Pizarro

Doctor of Philosophy (PhD), Benthic habitat modeling using AUV imagery, University of Tasmania; Nicholas Perkins, 2012-2015, Supervisor(s): Neville Barrett

Doctor of Philosophy (PhD), Deep learning for underwater scene classifications, University of Western Australia; Ammar Mahmood, 2015-2018, Supervisor(s): Mohammed Bennamoun, Senijan An, Ferdous Sohel

Doctor of Philosophy (PhD), Autonomous underwater vehicles: a platform for investigating biophysical relationships in cross self-benthic communities, University of Tasmania; Lainey James, 2015-2019, Supervisor(s): Neville Barrett, Jacquomo Monk, Vanessa Lucieer, Martin Marzloff

Doctor of Philosophy (PhD), Demersal fish surveys from small form factor AUVs, University of Sydney; Nader Boutrous, 2016-2019, Supervisor(s): Stefan Williams, Oscar Pizarro

Masters degree, Response of Rottneest Island kelp habitats to the marine heatwave of 2010/2011, University of Western Australia; Tim Ward, 2016-2017, Supervisor(s): Leanne Ward

Doctor of Philosophy (PhD), Understanding the role of mid-shelf reefs in coastal ecology: can they act as refugia for shallow marine communities in an extreme climatic event?, University of Western Australia; Ana Ospina, 2016-2019, Supervisor(s): Gary Kendrick, Renae Hovey

Book

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Book Chapters

Williams, S, Pizarro, O, Mahon, I, Johnson-Robertson, M 2009, Simultaneous localisation and mapping and dense stereoscopic seafloor reconstruction using an AUV, in G Pappas, V Kumar, O Khatib (eds.), Experimental Robotics XI: The Eleventh International Symposium, Springer, Berlin, pp.407-416

Williams, S, Pizarro, O, Jakuba, M, Barrett, N 2010, AUV benthic habitat mapping in South Eastern Tasmania, in A Howard, K Lagnemma (eds.), AUV benthic habitat mapping in South Eastern Tasmania, Springer, Berlin, pp.275-284

Lucieer, V, Barrett, N, Hill, N 2010, Characterisation of shallow inshore coastal reefs on the Tasman Peninsula, South Eastern Tasmania, Australia, in P Harris, E Baker, SL Nichol (eds.), Seafloor Geomorphology as Benthic Habitat: GeoHab atlas of seafloor geomorphic features and benthic habitats, Elsevier

Beaman, R, Bridge, T, Done, T, Webster, J, Williams, S, Pizarro, O 2012, Habitats and benthos at Hydrographers Passage, Great Barrier Reef, Australia, in P Harris, E Baker (eds.), Seafloor Geomorphology as Benthic Habitat: GeoHab atlas of seafloor geomorphic features and benthic habitats, Elsevier

Woolsey, E, Byrne, M, Webster, J, Williams, S, Pizarro, O, Thornborough, K, Davies, P, Beaman, R, Bridge, T 2012, Ophiopsila pantherina beds on subaqueous dunes off the Great Barrier Reef, in C Johnson (eds.), Echinoderms in a Changing World, Taylor & Francis, pp.175-179

Bewley, M, Nourani-Vatani, N, Rao, D, Douillard, B, Pizarro, O, Williams, S 2015, Hierarchical Classification in AUV Imagery, in B Siciliano, O Khatib (eds.), Springer Tracts in Advanced Robotics, Vol. 105, pp.3-16

Book Chapters 6

Community White Papers / Technical Papers

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Conference Proceedings

Johnson-Robertson, M, Pizarro, O, Williams, S 2007, Towards Three-Dimensional Heterogeneous Imaging Sensor Correspondence and Registration for Visualization, Proceedings of the IEEE Oceans 2007 Conference, Aberdeen, May 2007, Aberdeen

Williams, S, Pizarro, O, Webster, J, Beaman, R, Johnson-Robertson, M, Mahon, I, Bridge, T 2008, AUV-assisted Surveying of Relic Reef Sites, Proceedings of the IEEE Oceans 2008 Conference, Quebec, Canada, September 2008, Quebec City

Williams, S, Pizarro, O, Mahon, I, Johnson-Robertson, M 2008, Simultaneous Localisation and Mapping and Dense Stereoscopic Seafloor Reconstruction using an AUV, Proceedings of the International Symposium on Experimental Robotics 2008, Athens, Greece, Athens

Pizarro, O, Colquhoun, J, Rigby, P, Johnson-Robertson, M, Williams, S 2008, Towards Image-based Marine Habitat Classification, Proceedings of the IEEE Oceans 2008 Conference, Quebec, Canada, September 2008, Quebec City

Williams, S, Pizarro, O, Jakuba, M, Barrett, N 2009, AUV benthic habitat mapping in south eastern Tasmania, Proceedings of the 7th International Conference on Field and Service Robotics, Cambridge

Pizarro, O, Williams, S, Colquhoun, J 2009, Topic-Based Habitat Classification Using Visual Data, Proceedings of the MTS/IEEE Oceans 2009, Bremen, Germany, May 2009, Bremen

Williams, S, Pizarro, O, How, M, Mercer, D, Powell, G, Marshall, J, Hanlon, R 2009, Surveying Nocturnal Cuttlefish Camouflage Behaviour using an AUV, Proceedings of the IEEE 2009 International Conference on Robotics and Automation Kobe, Japan, May 2009, Kobe

Rao, D, Williams, S 2009, Large-scale path planning for underwater gliders in ocean currents, Proceedings of the 2009 Australasian Conference on Robotics and Automation, Sydney

Barkby, S, Williams, S, Jakuba, M 2009, An efficient approach to bathymetric SLAM, Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems, St. Louis

Medagoda, L, Jakuba, M, Pizarro, O, Williams, S 2010, Water column current profile aided localisation for autonomous underwater vehicles, Proceedings of the IEEE Oceans 2010 Conference, Sydney, May 2010, Sydney, Presenter: Lashika Medagoda

Steinberg, D, Williams, S, Pizarro, O, Jakuba, M 2010, Towards autonomous habitat classification using Gaussian Mixture Model, Intelligent Robots and Systems (IROS), 2010 IEEE/RSJ International Conference, Taipei

Jakuba, M, Pizarro, O, Williams, S 2010, High resolution, consistent navigation and 3D optical reconstructions from AUVs using magnetic compasses and pressure-based depth sensors, Proceedings of the IEEE Oceans 2010, Sydney, May 2010, Sydney

Johnson-Robertson, M, Pizarro, O, Williams, S 2010, Saliency ranking for benthic survey using underwater images, Proceedings of the 11th International Conference on Control, Automation, Robotics and Vision, ICARCV 2010, Singapore

Barrett, N, Seiler, J, Anderson, T, Williams, S, Nicol, S, Hill, N 2010, Using an autonomous underwater vehicle to inform management of biodiversity in shelf waters, Proceedings of the IEEE Oceans 2010 Conference, Sydney, May 2010, Sydney

Williams, S, Pizarro, O, Jakuba, M, Mahon, I, Ling, S, Johnson, C 2010, Repeated AUV surveying of urchin barrens in North Eastern Tasmania, Proceedings of the IEEE 2010 International Conference on Robotics and Automation Anchorage, USA, May 2010, Anchorage

Steinberg, D, Pizarro, O, Williams, S, Jakuba, M 2010, Dirichlet process mixture models for autonomous habitat classification, Proceedings of the IEEE Oceans 2010, Sydney, Australia, May 2010, Sydney

Friedman, A, Pizarro, O, Williams, S 2010, Rugosity, slope and aspect from bathymetric Stereo image reconstructions, Proceedings of the IEEE Oceans 2010 Conference, Sydney, May 2010, Sydney, Presenter: Ariell Friedman

Steinberg, D, Friedman, A, Pizarro, O, Williams, S 2011, A Bayesian Nonparametric Approach to Clustering Data from Underwater Robotic Surveys, Proceedings of the 15th International Symposium on Robotics Research (ISRR) 2011, Flagstaff

Dansereau, D, Williams, S 2011, Seabed Modeling and Distractor Extraction for Mobile AUVs Using Light Field Filtering, Proceedings of the IEEE 2010 International Conference on Robotics and Automation Anchorage, USA, May 2010, Anchorage, Presenter: Donald Dansereau

Medagoda, L, Williams, S 2011, Water Column Current Profile Aided Localisation combined with View-based SLAM for Autonomous Underwater Vehicle Navigation, Proceedings of the IEEE 2010 International Conference on Robotics and Automation Anchorage, USA, May 2010, Anchorage, Presenter: Donald Dansereau

Mahon, I, Pizarro, O, Jakuba, M 2011, Reconstructing Pavlopetri: Mapping the World's Oldest Submerged Town using Stereo-vision, Proceedings of the IEEE 2010 International Conference on Robotics and Automation Anchorage, USA, May 2010, Anchorage, Presenter: Lashika Medagoda

Fang, C, Williams, S 2011, Probabilistic resurvey mission planning, Proceedings of the 2010 Australasian Conference on Robotics and Automation, Brisbane, Presenter: C Fang

Medagoda, L, Williams, S, Pizarro, O, Jakuba, M 2011, Localisation combined with view-based SLAM for Autonomous Underwater Vehicle navigation, Proceedings of the IEEE 2009 International Conference on Robotics and Automation Kobe, Japan, May 2009, Kobe

Beall, C, Dellaert, F, Mahon, I, Williams, S 2011, Bundle adjustment in large-scale 3D reconstructions based in underwater robotic surveys, Proceedings of IEEE/OES Oceans 2011, Santander, Spain 6-9 June 2011, Santander

Friedman, A, Steinberg, D, Pizarro, O, Williams, S 2011, Active learning using a Variational Dirichlet Process model for pre-clustering and classification of underwater stereo imagery., Proceedings of the 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), San Francisco

Dansereau, D, Mahon, I, Pizarro, O, Williams, S 2011, Plenoptic flow: Closed-form visual odometry for light field cameras, Proceedings of the 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), San Francisco

Jakuba, M, Steinberg, D, Kinsey, JC, Yoerger, DR, Camilli, R, Pizarro, O, Williams, S 2011, Toward automatic classification of chemical sensor data from autonomous underwater vehicles, Proceedings of the 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), San Francisco

Friedman, A, Pizarro, O, Williams, S 2011, Interpretation of benthic stereo imagery using 2D and 3D features in an active learning framework, Proceedings of GeoHab 2011, Bulletin of the Geological Society of Finland, Helsinki

Bender, A, Williams, S, Pizarro, O 2012, Classification with Probabilistic Targets, Proceedings of the 2012 IEEE/RJS International Conference on Intelligent Robots and Systems, Vila Moura, Presenter: Asher Bender

Bewley, M, Douillard, B, Nourani-Vatani, N, Friedman, A, Pizarro, O, Williams, S 2012, Automated species detection: an experimental approach to kelp detection from sea-floor AUV images, Proceedings of the 2012 Australasian Conference on Robotics and Automation (ACRA), Wellington, Presenter: Michael Bewley

Barkby, S, Williams, S, Pizarro, O, Jakuba, M 2012, Bathymetric SLAM with no map overlap using Gaussian Processes, Proceedings of the 2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), San Francisco

Warren, M, Corke, P, Pizarro, O, Williams, S, Upcroft, B 2012, Visual sea-floor mapping from low overlap imagery using bi-objective bundle adjustment and constrained motion, Proceedings of the 2012 Australasian Conference on Robotics and Automation (ACRA), Wellington, Presenter: M Warren

Bryson, M, Johnson-Robertson, M, Pizarro, O, Williams, S 2012, Proceedings of the 2012 Robotics: Science and Systems Conference, Colour-consistent structure-from-motion models using underwater imagery, Sydney, Presenter: Mitchell Bryson

Steinberg, D, Pizarro, O, Williams, S 2013, Synergistic clustering of image and segment descriptors for unsupervised scene understanding, Proceedings of 2013 IEEE International Conference on Computer Vision (ICCV), Sydney, Presenter: Daniel Steinberg

Bongiorno, D, Fairly, A, Bryson, M, Williams, S 2013, Automated spectrometer/RGB camera spatial calibration, Proceedings of 2013 IEEE International Geoscience and Remote Sensing Symposium (IGARSS) , Melbourne, Presenter: Daniel Bongiorno

Dansereau, D, Bongiorno, D, Pizarro, O, Williams, S 2013, Light field image denoising using a linear 4D frequency-hyperfan all-in-focus filter, Proceedings of the 2013 SPIE Electronic Imaging Conference, Burlingham, Presenter: Donald Dansereau

Bongiorno, D, Bryson, M, Dansereau, D, Williams, S 2013, Spectral characterisation of COTS RGB cameras using a linear variable edge filter, Proceedings of the 2013 SPIE Electronic Imaging Conference, Burlingham, Presenter: Daniel Bongiorno

Dansereau, D, Pizarro, O, Williams, S 2013, Decoding, calibration and rectification for lenselet-based plenoptic cameras, Proceedings of 26th IEEE Conference on Computer Vision and Pattern Recognition, Portland, Presenter: Donald Dansereau

Bryson, M, Johnson-Robertson, M, Pizarro, O, Williams, S 2013, Automated registration for multi-year robotic surveys of marine benthic habitats, Proceedings of 2013 IEEE/RSJ Intelligent Robots and Systems (IROS), Taipei, Presenter: Mitchell Bryson

Bewley, M, Nourani-Vatani, N, Rao, D, Douillard, B, Pizarro, O, Williams, S 2013, Hierarchical classification in AUV imagery, Proceeding of Field and Service Robotics, Results of the 9th International Conference, Brisbane, Presenter: Michael Bewley

Rao, D, Nourani-Vatani, N, Douillard, B, Williams, S, Pizarro, O 2014, Multimodal learning from visual and bathymetric data, Proceedings of the IEEE 2014 International Conference on Robotics and Automation, Hong Kong, Presenter: Dushyant Rao

Nourani-Vatani, N, Williams, S 2015, Structured output prediction with hierarchical loss functions for seafloor imagery taxonomic categorization, Proceedings of the 7th Iberian Conference on Pattern Recognition and Image Analysis, Santiago de compostela

Marzloff, M, Barrett, N, Holbrook, N, Oliver, N, James, L 2015, Distribution models of temperate habitat-forming species on the continental shelf in eastern Australia: setting the baseline to monitor and predict future changes, MODSIM2015 proceedings : 21st International Congress on Modelling and Simulation, Brisbane, Presenter: Martin Marzloff

Rao, D, Bender, A, Williams, S, Pizarro, O 2016, Multimodal information-theoretic measures for autonomous exploration, Proceedings of the IEEE 2016 International Conference on Robotics and Automation (ICRA), Stockholm

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**Journals**

Mahon, I, Williams, S, Pizarro, O, Johnson-Robertson, M 2008, Efficient view-based SLAM using visual loop closures, IEEE Transactions on Robotics, vol. 24, no. 5, pp. 1002-1014, doi:10.1109/TRO.2008.2004888

Webster, J, Beaman, R, Bridge, T, Davies, P, Bryne, M, Williams, S, Manning, P, Pizarro, O, Thornborough, K, Woolsey, E 2008, From corals to canyons: exploring the Great Barrier Reef margin, EOS Transactions, vol. 89, no. 24, pp. 217-218, doi:10.1029/2008EO240002



Johnson-Robertson, M, Pizarro, O, Williams, S, Mahon, I 2010, Generation and visualization of large scale three-dimensional reconstructions from underwater robotic surveys, *Journal of Field Robotics*, vol. 27, no. 1, pp. 21-51, doi:10.1002/rob.20324

Williams, S, Pizarro, O, Webster, J, Beaman, R, Mahon, I, Johnson-Robertson, M, Bridge, T 2010, AUV-assisted surveying of drowned reefs on the shelf edge of the Great Barrier Reef, Australia, *Journal of Field Robotics*, vol. 27, no. 5, pp. 675-697, doi:10.1002/106.20356

Stachniss, C, Williams, S, Neira, J 2010, Editorial: visual navigation and mapping outdoors, *Journal of Field Robotics*, vol. 27, no. 5, pp. 509-510, doi:10.1002/1.06.20358

Steinberg, D, Bender, A, Friedman, A, Jakuba, M, Pizarro, O, Williams, S 2010, Toward selection of a propulsion method for a long range benthic imaging AUV, *Marine Technology Society Journal*, vol. 44, no. 2, pp. 46-55, doi:10.4031/MTSJ.44.2.3

Bridge, T, Done, T, Beaman, R, Friedman, A, Williams, S, Pizarro, O, Webster, J 2010, Topography, substratum and benthic macrofaunal relationships on a tropical mesophotic shelf margin, Great Barrier Reef, Australia, *Coral Reefs*, vol. 30, no. 1, pp. 143-153, doi:10.1007/s00338-010-0677-3

Steinberg, D, Bender, A, Friedman, A, Jakuba, M, Pizarro, O, Williams, S 2010, Analysis of propulsion methods for long range AUVs, *Marine Technology Society Journal*, vol. 44, no. 2, pp. 46-55, doi:10.4031/MTSJ.44.2.3

Rigby, P, Williams, S, Pizarro, O 2010, Towards adaptive benthic habitat mapping using Gaussian Process Classification, *Journal of Field Robotics*, vol. 27, no. 6, pp. 741-758, doi:10.1002/rob.20372

Barkby, S, Williams, S, Pizarro, O, Jakuba, M 2011, A featureless approach to efficient bathymetric SLAM using distributed particle mapping, *Journal of Field Robotics*, vol. 28, no. 1, pp. 19-39, doi:10.1002/06.20372

Roman, CN, Inglis, G, Vaughn, I, Williams, S, Pizarro, O, Friedman, A, Steinberg, D 2011, Development of high-resolution underwater mapping techniques, *Oceanography*, vol. 24, no. 1, pp. 14-17

Earp, A, Hanson, CE, Ralph, P, Brando, V, Allen, S, Baird, ME, Clementson, L, Daniel, P, Dekker, AG, Fearn, PRCS, Parslow, J, Strutton, P, Thompson, P, Underwood, M, Weeks, S, Doblin, MA 2011, Review of fluorescent standards for calibration of in situ fluorometers: recommendations applied in coastal and ocean observing programs, *Optics Express*, vol. 19, no. 27, pp. 26768-26782, doi:10.1364/OE.19.026768

Bridge, T, Done, T, Friedman, A, Beaman, R, Williams, S, Pizarro, O, Webster, J 2011, Variability in mesophotic coral reef communities along the Great Barrier Reef, Australia, *Marine Ecology Progress Series*, vol. 428, pp. 63-75, doi:10.3354/meps09046

Bridge, T, Beaman, R, Done, T, Webster, J 2012, Predicting the location and spatial extent of submerged coral reef habitat in the Great Barrier Reef world heritage area, Australia, *PLoS One*, vol. 7, no. 10, doi:10.1371/journal.pone.0048203

Smale, DA, Wernberg, T 2012, Ecological observations associated with an anomalous warming event at the Houtman Abrolhos Islands, Western Australia, *Coral Reefs*, vol. 31, no. 2, pp. 441-441, doi:10.1007/s00338-012-0873-4

Smale, DA, Kendrick, G, Harvey, ES, Langlois, TJ, Hovey, RK, Van Niel, KP, Waddington, KI, Bellchambers, LM, Babcock, R, Vanderklift, MA, Thomson, D, Jakuba, M, Pizarro, O, Williams, S, Pember, MB 2012, Regional-scale benthic monitoring for Ecosystem-Based Fisheries Management (EBFM) using an Autonomous Underwater Vehicle (AUV), *ICES Journal of Marine Science*, vol. 69, no. 6, pp. 1108-1118, doi:10.1093/icesjms/fss082

Barkby, S, Williams, G, Pizarro, O, Jakuba, M 2012, Bathymetric particle filter SLAM using trajectory maps, *International Journal of Robotics Research*, vol. 31, no. 11, doi:10.1177/0278364912459666

Seiler, J, Friedman, A, Steinberg, C, Barrett, N, Williams, A, Holbrook, N 2012, Image-based continental shelf habitat mapping using novel automated data extraction techniques, *Continental Shelf Research*, vol. 45, pp. 87-97, doi:10.1016/j.csr.2012.06.003

Williams, S, Pizarro, O, Jakuba, M, Johnson, C, Barrett, N, Babcock, R, Kendrick, G, Steinberg, C, Heyward, A, Doherty, P, Mahon, I, Johnson-Robertson, M, Steinberg, D, Friedman, A 2012, Monitoring of benthic reference sites: using an Autonomous Underwater Vehicle, *IEEE Robotics & Automation Magazine*, vol. 19, no. 1, pp. 73-84, doi:10.1109/MRA.2011.2181772

Bridge, T, Steinberg, D, Scott, A 2012, Abundance and diversity of anemonefishes and their host sea anemones at two mesophotic sites on the Great Barrier Reef, Australia, *Coral Reefs*, vol. 31, no. 4, pp. 1057-1062, doi:10.1007/s00338-012-0916.x

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## Reports

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**Reports 9**

## Thesis

Johnson-Robertson, M 2011, Large-scale multi-sensor 3D reconstructions and visualisations of unstructured underwater environments, Doctor of Philosophy (PhD), University of Sydney, Sydney

Bender, A 2013, Bayesian non-parametric benthic habitat mapping, Doctor of Philosophy (PhD), University of Sydney, Sydney

Friedman, A 2013, Active learning using a variational dirichlet process model for pre-clustering and classification of underwater stereo imagery, Doctor of Philosophy (PhD), University of Sydney, Sydney

Steinberg, D 2013, Dirichlet process mixture models for autonomous habitat classification., Doctor of Philosophy (PhD), University of Sydney, Sydney

Bridge, T 2013, Habitats and sessile benthic megafaunal communities in the mesophotic zone of the Great Barrier Reef world heritage area, Australia, Doctor of Philosophy (PhD), James Cook University, Townsville

Barkby, S 2013, Efficient and featureless approaches to bathymetric simultaneous localisation and mapping, Doctor of Philosophy (PhD), University of Sydney, Sydney

Medagoda, L 2013, Water column current profile aided localisation for Autonomous Underwater Vehicles, Doctor of Philosophy (PhD), University of Sydney, Sydney

Seiler, J 2013, Non-extractive monitoring of biodiversity on temperate Australian deepwater reefs: using advanced vision-processing techniques to develop and test reliable biodiversity metrics, Doctor of Philosophy (PhD), University of Tasmania, Hobart

Ahsan, N 2013, Combining exploration and exploitation in active learning, Doctor of Philosophy (PhD), University of Sydney, Sydney

Bongiorno, D 2015, Hyperspectral benthic mapping from underwater robotic platforms, Doctor of Philosophy (PhD), University of Sydney, Sydney

Perkins, N 2016, The application of benthic imagery from an Autonomous Underwater Vehicle to broad-scale ecological monitoring, Doctor of Philosophy (PhD), University of Tasmania, Hobart

**Thesis 11**

## Data Products

**Data Products null**

## Public Seminars

Williams, S; Marine Life through the eyes of a remote operated, deep sea, autonomous vehicle; SIMS Open Day, 15/03/2009 - 15/03/2009, Sydney Institute for Marine Science, Sydney, Presenter(s): Stefan Williams

Williams, S; Simultaneous Localisation and Mapping and Dense Stereoscopic Seaoor Reconstruction using an AUV; University of Southern California Open Forum, 01/04/2010 - 01/04/2010, Los Angeles, Presenter(s): Stefan Williams

Williams, S; High-resolution benthic survey using Autonomous Underwater Vehicles; Inspiring Australia Seminar, 06/05/2013 - 06/05/2013, Sydney, Presenter(s): Stefan Williams

Jakuba, M; Invited seminar for Deep Submergence Lab; Woods Hole Oceanographic Institute Seminar, 03/06/2013 - 03/06/2013, Woods Hole Oceanographic Institute, Woods Hole, Presenter(s): Michael Jakuba

Huveneers, C; The truth about sharks: how can science help manage shark-related issues; Biology Society of South Australia, 06/03/2014 - 06/03/2014, University of Adelaide, Adelaide, Presenter(s): Charlie Huveneers

Pizarro, O; Advanced coral reef mapping and monitoring with divers and robotic platforms; Sesoko Station Seminar, 28/07/2015 - 28/07/2015, Okinawa, Presenter(s): Oscar Pizarro

Marzinelli, EM; The ecology of SE Australian underwater forests: declines and potential solutions; SIMS Seminar Series & Topics in Australian Marine Science Seminar Program, 31/05/2016 - 31/05/2016, Sydney, Presenter(s): Ezequiel Marzinelli

Ferrari, R; Assessing coral reef habitat structural complexity in a warming ocean; Marine Spatial Ecology Lab Seminar, University of Queensland, Brisbane, Presenter(s): Renata Ferrari

Jakuba, M, Williams, S; Simultaneous Localisation and Mapping and Dense Stereoscopic Seaoor Reconstruction using an AUV; Centre for Marine Studies and Centre for Remote Sensing and Spatial Information Science Seminar, University of Queensland, Brisbane

Williams, S; Simultaneous Localisation and Mapping and Dense Stereoscopic Seaoor Reconstruction using an AUV; Monterey Bay Aquarium Research Institute Seminar, Monterey Bay Aquarium Research Institute, Moss Landing, Presenter(s): Stefan Williams

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## Conferences, Symposia or Workshops

### Conference Oral Presentation

Johnson-Robertson, M, Pizarro, O, Williams, S, Rees, M; Identifying novel benthic habitats in high resolution AUV imagery; Australian Marine Science Association Conference, 09/07/2007 - 13/07/2007, University of Melbourne, Melbourne

Williams, S, Pizarro, O, Johnson-Robertson, M, Mahon, I, Rigby, P, Barkby, S; IMOS—Integrated Marine Observing System: Integrating IMOS with underwater cultural heritage research; New Ground: Australian Archaeological Conference, 21/09/2007 - 26/09/2007, Sydney

Johnson-Robertson, M, Mahon, I, Pizarro, O, Williams, S; Generating Visually Consistent Benthic Surface Meshes Using Visual Features Matthew; OCEANS 2007 MTS/IEEE, 29/09/2007 - 04/10/2007, Vancouver

Rigby, P, Pizarro, O, Williams, S, Colquhoun, J; Effective Benthic Surveying with Autonomous Underwater Vehicles; OCEANS 2007 MTS/IEEE, 29/09/2007 - 04/10/2007, Vancouver

Pizarro, O, Seiler, J, Bridge, T, Colquhoun, J, Barrett, N, Williams, S; Towards image-based habitat classification; GeoHab 2009, 05/05/2008 - 08/05/2009, Trondheim

Williams, S, Pizarro, O, Mahon, I, Johnson-Robertson, M; Habitat mapping using AUVs; Australia-Japan Marine Science Forum, 27/10/2008 - 30/10/2008, Australian Institute of Marine Science, Townsville

Johnson-Robertson, M, Pizarro, O, Williams, S; Towards Large Scale, Integrated Optical And Acoustic AUV Survey; Underwater Acoustic Measurements (UAM): Technologies and Results, 3rd International Conference, 21/06/2009 - 26/06/2009, Nafpilon, Presenter(s): Stefan Williams

Jakuba, M, Johnson-Robertson, M, Pizarro, O, Williams, S; Co-registered multibeam acoustic and photographic mapping of benthic environments with an AUV; Australian Marine Science Association Conference, 05/07/2009 - 09/07/2009, Adelaide

Barkby, S, Williams, S, Pizarro, O, Jakuba, M; Incorporating prior bathymetric maps with distributed particle bathymetric SLAM for improved AUV navigation and mapping; OCEANS 2009 MTS/IEEE Biloxi Conference and Exhibition, 26/10/2009 - 29/10/2009, Biloxi

Baird, ME, Roughan, M, Morris, BD, Suthers, I; An Integrated Marine Observing System for southeastern Australia: the East Australian Current and its interaction with coastal environments; Ocean Sciences Meeting, 22/02/2010 - 26/02/2010, Portland

Pizarro, O, Colquhoun, J, Moore, C, Radford, B, Williams, S, Jakuba, M, Heyward, A; Automated Benthic Habitat Classification from Optical Imagery; Ocean Sciences Meeting, 22/02/2010 - 26/02/2010, Portland

Ahsan, N, Williams, S, Jakuba, M, Pizarro, O, Radford, B; Predictive habitat models from AUV-based multibeam and optical imagery; OCEANS 2010 MTS/IEEE , 20/09/2010 - 23/09/2010, Seattle

Bender, A, Williams, S, Pizarro, O, Radford, B; Adaptive exploration of benthic habitats using gaussian processes; OCEANS 2010 MTS/IEEE , 20/09/2010 - 23/09/2010, Seattle

Hill, N, Lucieer, V, Barrett, N, Anderson, T; Predicting temperate deep-reef benthos with high-resolution multibeam data; World Conference on Marine Biodiversity , 26/09/2011 - 30/09/2011, Aberdeen

Bewley, M, Pizarro, O, Williams, S; Automated classification of benthic imagery content using a hierarchical classification scheme; Australian Marine Science Association Conference, 07/07/2013 - 11/07/2013, Gold Coast, Presenter(s): Michael Bewley

Edwards, L, Williams, S, Wyatt, M, Harrison, J, Toohey, L, Gray, M, Marrable, D, Friedman, A, Steinberg, D; CATAMI (Collaborative and Annotation Tools for the Analysis of Marine Imagery and video) - Unlocking the potential of marine imagery; Australian Marine Science Association Conference, 07/07/2013 - 11/07/2013, Gold Coast, Presenter(s): Luke Edwards

Ferrari, R, Malcolm, HA, Byrne, M, Williams, S, Jordan, A, Friedman, A, Figueria, W; Habitat structural complexity drives fish spatial distribution at multiple scales; Australian Marine Science Association Conference, 07/07/2013 - 11/07/2013, Gold Coast, Presenter(s): Renata Ferrari

Ingleton, T, Davies, P, Jordan, A, Williams, S; Hydrographic observations, towed video and relationships to benthic habitat: recent surveys in NSW's marine protected areas; Australian Marine Science Association Conference, 07/07/2013 - 11/07/2013, Gold Coast, Presenter(s): T Ingleton

Marzinelli, EM, Campbell, AH, Verges, A, Wernberg, T, Thomas, T, Steinberg, P; Continental patterns of kelp condition and associated bacterial communities; Australian Marine Science Association Conference, 07/07/2013 - 11/07/2013, Gold Coast, Presenter(s): Ezequiel Marzinelli

Verges, A, Campbell, AH, Marzinelli, EM, Ballesteros, E, Steinberg, P; A novel herbivore-mediated community phase shift and the tropicalisation of temperate marine ecosystems; Australian Marine Science Association Conference, 07/07/2013 - 11/07/2013, Gold Coast, Presenter(s): Adriana Verges

Pizarro, O, Williams, S, Johnson-Robertson, M, Steinberg, C, Bryson, M; Reef mapping and monitoring assisted by machines; Ocean Sciences Meeting, 23/02/2014 - 28/02/2014, Honolulu, Presenter(s): Oscar Pizarro

Friedman, A, Williams, S, Pizarro, O; Automated estimation of benthic coverage - a superpixel based approach; GeoHab 2014, 05/05/2014 - 09/05/2014, Melbourne, Presenter(s): Ariell Friedman

Hovey, RK, Pember, MB, Bellchambers, LM, Williams, S, Kendrick, G; Investigating lobsters and their habitats through the eyes of robots; 10th International Conference and Workshop on Lobster Biology and Management, 18/05/2014 - 23/05/2014, Cancun, Presenter(s): Renae Hovey

Ferrari, R, Malcolm, HA, Verges, A, Figueria, W, Byrne, M, Williams, S, Jordan, A; Importance of 3D structural complexity as a driver of fish abundance across depth and spatial scales; Australian Marine Science Association Conference, 07/07/2014 - 11/07/2014, Canberra, Presenter(s): Renata Ferrari

Friedman, A; Multi-scale measures of rugosity, slope and aspect from benthic stereo image reconstructions; Australian Marine Science Association Conference, 07/07/2014 - 11/07/2014, Canberra, Presenter(s): Ariell Friedman

Ferrari, R, Bryson, M, Bridge, T, Williams, S, Byrne, M, Harborne, AR, Figueria, W; Coral reef structural complexity increases after bleaching event; 88th Australian Coral Reef Society Conference, 27/08/2014 - 29/08/2014, Brisbane, Presenter(s): Renata Ferrari

Jordan, A; Recent advances in the mapping and monitoring of marine habitats that aim to improve mangement effectiveness; Australian Marine Science Association Conference, 05/07/2015 - 09/07/2015, Geelong, Presenter(s): Alan Jordan

Potter, A, Lewis, A; Geoscience Australia's support in the search for Malaysia airlines flight MH370; Australian Marine Science Association Conference, 05/07/2015 - 09/07/2015, Geelong, Presenter(s): Adam Lewis

Ferrari, R, Byrne, M, Williams, S, Figueria, W; Disentangling the relationship between community composition and habitat structural complexity: what is the best metric?; 89th Australian Coral Reef Society Conference, 28/07/2015 - 31/07/2015, Day Dream Island, Presenter(s): Renata Ferrari

Ferrari, R, Figueria, W, Williams, S, Byrne, M; Bridging the gap between small-scale high-resolution and large-scale low-resolution marine studies; 27th International Congress for Conservation Biology, 02/08/2015 - 07/08/2015, Montpellier, Presenter(s): Renata Ferrari

Ferrari, R, Malcolm, HA, Hill, N, Lucieer, V, Figueria, W; Predicting fish distributions for marine spatial planning in Marxan; Australian Society for Fish Biology Conference, 11/10/2015 - 14/10/2015, Sydney, Presenter(s): Renata Ferrari

Williams, S; High-resolution marine survey: applications in engineering science, ecology, archaeology and geology; IEEE International Conference on Robotics and Automation , 16/05/2016 - 21/05/2016, Stockholm, Presenter(s): Stefan Williams

Friedman, A, Pizarro, O, Williams, S; Online framework for collaborative annotation of underwater imagery and video; 13th International Coral Reef Symposium (ICRS), 19/06/2016 - 24/06/2016, Hawaii, Presenter(s): Ariell Friedman

Williams, S, Pizarro, O, Bryson, M; Multi-year surveying of coral reefs using Autonomous Underwater Vehicles; 13th International Coral Reef Symposium (ICRS), 19/06/2016 - 24/06/2016, Hawaii, Presenter(s): Stefan Williams

Perkins, N; Detecting change in benthic ecosystems with digital imagery: monitoring design in a challenging environment; International Statistical Ecological Conference, 28/06/2016 - 01/07/2016, Seattle

Barrett, N; Baited underwater video for an integrated monitoring network: developing indicators and an appropriate national framework; Australian Society for Fish Biology (ASFB) and Oceania Chondrichthyan Society (OCS) 2016, 04/09/2016 - 07/09/2016, Hobart, Presenter(s): Neville Barrett

### **Conference Poster**

Bridge, T, Bongaerts, P, Englebert, N, Sampayo, E, Ridgway, K, Rodriguez-Lanetty, M, Williams, S, Pizarro, O, Webster, J, Hoegh-Guldberg, O; Scleractinian Corals and their associated Symbiodinium on Mesophotic Coral Ecosystems of the Great Barrier Reef; 11th International Coral Reef Symposium, 07/07/2008 - 11/07/2008, Fort Lauderdale

Bridge, T, Webster, J, Beaman, R, Abbey, E, Williams, S, Pizarro, O, Woolsey, E, Thornborough, K, Done, T; Hexacoral and Octocoral Communities on the Unexplored Great Barrier Reef Shelf-Edge; Deepsea Coral Symposium 2008, 01/12/2008 - 05/12/2008, Wellington

Johnson-Robertson, M, Pizarro, O, Williams, S; Large Scale Optical and Acoustic Sensor Integration for Visualization; IEEE Oceans 2009, 11/05/2009 - 14/05/2009, Bremen

Williams, S, Pizarro, O, Jakuba, M, Mahon, I, Johnson-Robertson, M; Australia's Integrated Marine Observing System Autonomous Underwater Vehicle Facility; OceanObs'09 Conference, 21/09/2009 - 25/09/2009, Venice

Friedman, A, Pizarro, O, Williams, S; Rugosity, slope and aspect from bathymetric Stereo image reconstructions; IEEE Oceans 2010, 24/05/2010 - 27/05/2010, Sydney

Medagoda, L, Jakuba, M, Pizarro, O, Williams, S; Water column current profile aided localisation for autonomous underwater vehicles; IEEE Oceans 2010, 24/05/2010 - 27/05/2010, Sydney

Ahsan, N, Jakuba, M, Pizarro, O, Williams, S, Radford, B; Learning Predictive Habitat Models using Bathymetry, Seabed Terrain Features and Optical Imagery; OCEANS 2010 MTS/IEEE , 20/09/2010 - 23/09/2010, Seattle

Bender, A, Williams, S, Pizarro, O, Jakuba, M; Adaptive Exploration Of Benthic Habitats Using Gaussian Processes; OCEANS 2010 MTS/IEEE , 20/09/2010 - 23/09/2010, Seattle

Bongiorno, D, Bryson, M, Williams, S; Dynamic spectral-based underwater colour correction; OCEANS 2013 MTS/IEEE, 10/06/2013 - 13/06/2013, Bergen, Presenter(s): Daniel Bongiorno

Moltmann, T, Proctor, R, Donoghue, S; The Integrated Marine Observing System: observations to support research and applications in the coastal zone; Ocean Sciences Meeting, 23/02/2014 - 28/02/2014, Honolulu, Presenter(s): Tim Moltmann

### **Course Presentation**

Marzinelli, EM; Seaweed declines: causes, consequences and solutions; Topics in Australian Marine Science (TAMS) Workshop, 06/03/2014 - 30/05/2014, Sydney Institute for Marine Science, Sydney, Presenter(s): Ezequiel Marzinelli

Williams, S; Robotic vision for marine survey: applications in engineering science, ecology, archaeology and geology; Robot Vision Summer School (RVSS), 18/04/2016 - 22/04/2016, Kioloa, Presenter(s): Stefan Williams

Ferrari, R; Marine spatial ecology: incorporating 3D models into marine research; 3rd Year Undergraduate Seminar, University of Sydney, Sydney, Presenter(s): Renata Ferrari

### **Key Note Speaker**



Williams, S; High-resolution benthic survey using Autonomous Underwater Vehicle; Breaking the Surface, 30/09/2012 - 08/10/2012, Murter, Presenter(s): Stefan Williams

Williams, S; Autonomous Underwater Vehicles for Environmental Monitoring; Tenth Conference on Computer and Robot Vision, 28/05/2013 - 31/05/2013, Regina, Presenter(s): Stefan Williams

Williams, S; Autonomous Underwater Vehicles for environmental survey; Japan-Australia Marine Science Workshop, 11/07/2013 - 12/07/2013, Tokyo, Presenter(s): Stefan Williams

Williams, S; Applications in marine imaging: engineering science, ecology, archaeology and geology; IEEE Underwater Technology Conference, 23/02/2017 - 23/02/2017, Busan, Presenter(s): Stefan Williams

### **Meeting Presentation**

Williams, S, Pizarro, O; High Resolution Optical Surveying using an AUV; Australasian Hydrographic Society and The Society for Underwater Technology Technical Seminar - AUVs: Future Technologies & Emerging Markets, 30/10/2008 - 30/10/2008, Perth

Pattiaratchi, C; Integrated Marine Observing System and climate change; Shark Bay World Heritage Meeting, 18/08/2009 - 18/08/2009, Shark Bay, Presenter(s): Charitha Pattiaratchi

Steinberg, P; IMOS AUV Facility Update; NSW-IMOS Node Meeting, 21/05/2010 - 21/05/2010, Sydney Institute for Marine Science, Sydney, Presenter(s): Peter Steinberg

Williams, S; High-resolution benthic survey using Autonomous Underwater Vehicles; Presentation at University of Rhode Island Graduate School of Engineering, 10/04/2012 - 10/04/2012, Kingston, Presenter(s): Stefan Williams

Kendrick, G, Hovey, RK, Van Niel, KP, Smale, DA, Bellchambers, LM, Pember, MB, Babcock, R, Thomson, D, Jakuba, M, Pizarro, O, Williams, S; Utility of the IMOS AUV facility for regional-scale monitoring of change in benthos; WAIMOS Annual Science Meeting, 05/11/2012 - 05/11/2012, University of Western Australia, Perth, Presenter(s): Gary Kendrick

Radford, B, Steinberg, D, Pizarro, O, Williams, S, Colquhoun, J, Heyward, A, Moore, C, Jakuba, M, Sexton, M, Cooper, T; Quantifying spatial and temporal dynamics of mesophotic coral ecosystems using AUV technology; WAIMOS Annual Science Meeting, 05/11/2012 - 05/11/2012, University of Western Australia, Perth, Presenter(s): Ben Radford

Williams, S; The Australian Centre for Field Robotics Marine Robotics Program; Presentation at Woods Hole Oceanographic Institution Marine Robotics Centre, 12/06/2013 - 12/06/2013, Woods Hole Oceanographic Institute, Massachusetts, Presenter(s): Stefan Williams

Thornton, B; Habitat mapping using multi-resolution 3D visual seafloor reconstructions; Scientific Use of 3D Visual Seafloor Reconstructions (JAMSTEC), 12/03/2015 - 12/03/2015, James Cook University, Tokyo, Presenter(s): B Thornton

Williams, S; Monitoring changes in benthic ecosystems off the Australian coast using robotic platforms; Scientific Use of 3D Visual Seafloor Reconstructions (JAMSTEC), 12/03/2015 - 12/03/2015, James Cook University, Tokyo, Presenter(s): Stefan Williams

### **Symposium Presentation**

Steinberg, D, Bender, A, Friedman, A; Analysis of propulsion methods for long range AUVs; International Symposium on Unmanned Untethered Submersible Technology (UUST), 23/08/2009 - 26/08/2009, Durham

Williams, S; Autonomous Underwater Vehicle Support for Marine Science Projects around Australia; Society for Underwater Technology and Australian Hydrographic Office Autonomous Underwater Vehicle Symposium, 28/10/2010 - 28/10/2010, Perth, Presenter(s): Stefan Williams

Radford, B, Pizarro, O, Colquhoun, J, Moore, C, Williams, S, Jakuba, M, Cooper, T, Heyward, A, Sexton, M, Burq, S; Predictive habitat mapping of deep water coral reefs using data from Multibeam and AUV machine auto-classified data and an Ecological Modelling approach; Euro ISRS Symposium, 13/12/2010 - 17/12/2010, Wageningen

Radford, B; Predictive habitat mapping of deep lagoonal reefs using data collected by multibeam sonar and autonomous underwater vehicle; Euro ISRS Symposium, 13/12/2010 - 17/12/2010, Wageningen, Presenter(s): Ben Radford

Babcock, R, Shears, N, Morrison, M; AUV Observations. The role of ocean climate in coastal ecosystems: sustained observing of benthic habitats; The New Zealand-Australia Symposium in Ocean Observing and Data Management, 05/12/2011 - 06/12/2011, Hobart, Presenter(s): Russ Babcock

Babcock, R, Haywood, M, Williams, S; Submerged subtropical kelp habitat and the seasonal dynamics of the EAC; AMSA-NZMSS (Australian Marine Sciences Association and New Zealand Marine Science Society) Conference, 01/07/2012 - 07/07/2012, Hobart, Presenter(s): Russ Babcock

Barrett, N; Developing a non-intrusive monitoring approach for describing deep water habitats and biodiversity within Australia's new commonwealth MPA network and collecting the information necessary for optimal on-reserve and off-reserve management; AMSA-NZMSS (Australian Marine Sciences Association and New Zealand Marine Science Society) Conference, 01/07/2012 - 07/07/2012, Hobart, Presenter(s): Neville Barrett

Marzinelli, EM, Williams, S, Babcock, R, Barrett, N, Johnson, C, Jordan, A, Kendrick, G, Hill, N, Pizarro, O, Smale, DA, Steinberg, P; AUV surveys of deep-water kelp across Australia; AMSA-NZMSS (Australian Marine Sciences Association and New Zealand Marine Science Society) Conference, 01/07/2012 - 07/07/2012, Hobart, Presenter(s): Ezequiel Marzinelli

Pizarro, O; Benthic monitoring with robotic platforms - the experience of Australia's Integrated Marine Observing System AUV Facility; International Symposium on Underwater Technology 2013, 05/03/2013 - 08/03/2013, Tokyo, Presenter(s): Oscar Pizarro

Hovey, RK, Van Niel, KP, Bellchambers, LM, Pember, MB, Kendrick, G, Williams, S; Modeling an inscrutable species: a case study of the Western Rock Lobster; 10th International Temperate Reefs Symposium, 12/01/2014 - 17/01/2014, Perth, Presenter(s): Renae Hovey

Kendrick, G, Hovey, RK, Bellchambers, LM, Williams, S, Babcock, R, Smale, DA, Hayes, K, Pember, MB; Remotely studying shifts in dominant marine species through the eyes of robots (AUVs); 10th International Temperate Reefs Symposium, 12/01/2014 - 17/01/2014, Perth, Presenter(s): Gary Kendrick

Ferrari, R, Boubee, T, Adam, A, Kobelkowsky-Vidrio, T, Byrne, M, Figueria, W; Quantifying coral growth and erosion using 3D models; 13th International Coral Reef Symposium (ICRS), 19/06/2016 - 24/06/2016, Hawaii, Presenter(s): Renata Ferrari

## **Workshop Presentation**

Johnson-Robertson, M, Pizarro, O, Williams, S, Mahon, I; Large Scale 3D Reconstruction and Visualization of Stereo Surveys; GeoHab 2009 Video Workshop, 03/05/2009 - 04/05/2009, Trondheim

Williams, S, Pizarro, O, Jakuba, M, Mahon, I, Johnson-Robertson, M, Rigby, P, Barkby, S; Autonomous Marine Systems for Navigation, Mapping and Data Interpretation; GeoHab 2009 Video Workshop, 03/05/2009 - 04/05/2009, Trondheim

Marzinelli, EM, Steinberg, P; Kelp cover and distribution in deep water temperate reefs.; 10th GHRSS Science Team Meeting, 01/06/2009 - 01/06/2009, Santa Rosa

Pizarro, O; Simultaneous Localisation and Mapping and Dense Stereoscopic Seafloor Reconstruction using an AUV; Office of Naval Research Workshop on Machine Intelligence, 07/10/2009 - 08/10/2009, Lerici, Presenter(s): Oscar Pizarro

Williams, S, Pizarro, O, Jakuba, M, Steinberg, D, Friedman, A, Ahsan, N; Autonomous Underwater Vehicle monitoring of benthic reference sites; IEEE/RSJ International Conference on Intelligent Robots and Systems, 11/10/2009 - 15/10/2009, St. Louis, Presenter(s): Stefan Williams

Marzloff, M, Oliver, ECJ, Barrett, N, Holbrook, N, James, L, Wotherspoon, S, Johnson, C; Differential vulnerability of deep-reef habitat-forming organisms to climate change; Australian Coastal Ocean Modelling and Observations - ACOMO, 03/10/2012 - 04/10/2012, Canberra, Presenter(s): Craig Johnson

Williams, S, Pizarro, O, Bryson, M, Johnson-Robertson, M, Steinberg, D, Friedman, A; Autonomous Underwater Vehicle monitoring of benthic reference sites; Workshop on Marine Robotics: Looking into the Crystal Ball: 20 years hence in Marine Robotics, 11/02/2013 - 13/02/2013, Canary Islands, Presenter(s): Stefan Williams

Williams, S; AUVs for Environmental Monitoring; Workshop on Acoustic and Automated Video Processing, 11/06/2013 - 12/06/2013, Commonwealth Scientific Industrial Research Organisation, Hobart, Presenter(s): Stefan Williams

Kendrick, G, Hovey, RK, Bellchambers, LM, Babcock, R, Williams, S; AUV surveys in WA; NERP Marine Biodiversity Hub: Annual Researcher Workshop, 04/11/2013 - 08/11/2013, Hobart, Presenter(s): Gary Kendrick

Tran, M, Anderson, T, Booth, D, Althaus, F, et. al.; A review of scoring methods for underwater video and still imagery; Marine Imaging Workshop, 07/04/2014 - 10/04/2014, Southampton, Presenter(s): M Tran

Friedman, A; Developments in marine image processing - standards, automated, data management; GeoHab 2014 Workshop: Ground-validation for remotely sensed marine habitat mapping and species distribution modelling, 05/05/2014 - 05/05/2014, Melbourne, Presenter(s): Ariell Friedman

Pizarro, O, Williams, S; Developments in sampling tools and techniques; GeoHab 2014 Workshop: Ground-validation for remotely sensed marine habitat mapping and species distribution modelling, 05/05/2014 - 05/05/2014, Melbourne, Presenter(s): Oscar Pizarro, Stefan Williams

Williams, S; Reflections on a decade of Autonomous Underwater Vehicles for marine survey; IFAC workshop on navigation, guidance, control of underwater vehicles, 28/04/2015 - 30/04/2015, Girona, Presenter(s): Stefan Williams

Pizarro, O; Autonomous benthic monitoring downunder; Marine Imaging Workshop, 21/02/2017 - 21/02/2017, Kiel, Presenter(s): Oscar Pizarro

Friedman, A; An online platform for exploration, management and annotation of georeferenced images and videos; Marine Imaging Workshop, 22/02/2017 - 22/02/2017, Kiel, Presenter(s): Ariell Friedman

Williams, S; Applications in marine imaging: engineering science, ecology, archaeology and geology; Singapore AUV Challenge, 13/03/2017 - 13/03/2017, Singapore, Presenter(s): Stefan Williams