7. Research and knowledge gaps

Listed here are the significant gaps identified during the drafting of this Assessment. Many of these gaps, whilst important for the Clyde Marine Region (CMR), may well link into projects and research from other regions or at a national level. It is not intended to discount the importance of any other projects and research which may be ongoing or undertaken in the future to improve our understanding of human activities and impacts in the CMR.

Ecosystem Services

- Mapping and valuation of Ecosystem Services provided by the CMR.
- Cumulative impacts on ecosystem functioning.

Future changes due to climate change

- Impact on marine ecosystems particularly changes in acidity and on ecosystem services provision for fishing, aquaculture, recreation and tourism (including risk assessment).
- Roll-out of Sea-Level Rise project to the whole of the CMR. A better understanding of wave overtopping, increased fluvial input and the funnelling effect linked to the depth and shape of the seabed in the sea lochs and estuary.
- Increased storm water run-off and the impact this will have on the release of untreated waste water from sewage treatment plants.

Noise

- No published data available about levels of noise, changes in levels of noise over time or impacts on marine species. The Marine Noise Registry (MNR) records human activities in UK seas that produce loud, low to medium frequency (10Hz – 10kHz) impulsive noise.
- Impact on fish and invertebrates from the particle motion component of underwater noise production.

Marine Litter

- Seabed and water column analysis. Analysis of Clyde area ongoing by MSS. Surface litter is trawled by manta ray tow for MSS input to MSFD.
- A better understanding of the significance of concentrations of microplastics. Work is ongoing at the University of the West of Scotland into mussels, sediment and fish.

Mobile species

- Populations and distribution of sharks, skates and rays, cetaceans, in particular Harbour porpoise use of the Inner Firth area as highlighted by the Clyde Marine Mammal Project.

Fish and shellfish

- Stock assessments for pelagic and demersal fish and scallops.
- A better understanding of the impact of the Hematodinium parasite on Nephrops stocks.

Seabirds and waterbirds

- Understanding the reasons for the decline in some seabird and waterbird species.

Priority Marine Features

- The location of these features outside the MPA search areas where more detailed surveys have already been undertaken.

Marine Protected Areas

- The effects of nature conservation MPAs on species diversity, reproduction and survival.
- Examine the ecological connectivity of features within and between sites and between sites and the wider marine environment. This may provide opportunities to enhance of better protect connectivity and therefore, ecosystem services, resilience and services.

Shipping and transport

- The potential impacts of increased marine traffic. A recent report issued by CalMac has highlighted a potential increase in marine traffic due to the likely development of commercial deep water berths for both industrial and tourist (cruise ship) use.

Sport, Recreation and Tourism

- A more accurate analysis of the true economic contribution of marine sport, recreation and tourism is required for the CMR.
- Study needed of the current capacity of marinas in the CMR and likely future levels of demand for sail and power boating.

8. References

Adams, T., Black, K., MacIntyre, C., MacIntyre, I., Dean, R., (2012) Connectivity modelling and network analysis of sea lice infection in Loch Fyne, west coast of Scotland, *Aquatic Environment Interactions* 3:51-63.

Adaptation sub-committee (2016) UK Climate Change Risk Assessment 2017. Evidence Report – Summary for Scotland, *Adaptation Sub-Committee on Climate Change*, London. [Online] Available at http://documents.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Scotland-National-Summary.pdf (Accessed October 2016)

Ainslie, M.A., Jong, C.A.F. de, Dol, H.S., Blacquière, G., Marasini (2009). Assessment of natural and anthropogenic sound sources and acoustic propagation in the North Sea. *The Netherlands Ministry of Transport, Public Works and Water Affairs*; Directorate- General for Water Affairs. http://publications.tno.nl/publication/34618532/Zby01E/TNO-DV2009C085.pdf (Accessed August 2016)

Andrew, R.K., Howe, B.M., and Mercer J.A., (2002). Ocean ambient sound: Comparing the 1960s with the 1990s for a receiver off the California coast. *Acoustics Research Letters Online* 3, 65. http://dx.doi.org/10.1121/1.1461915

AquaNIS. Information system on aquatic non-indigenous and cryptogenic species. [Online] Available at: www.corpi.ku.lt/databases/index.php/aquanis (Accessed August 2016)

Ardrossan and Saltcoats Herald (2014). *Torpedo cash secures Beith jobs*. [Online] Available at: www.ardrossanherald.com/news/13725727.Torpedo_cash_secures_Beith_jobs (Accessed June 2016)

Argyll and Bute Council (2009). Loch Fyne Integrated Coastal Zone Management Plan. A Spatial Planning Framework for Future Development. *Marine & Coastal Development Unit, Planning Services, Argyll & Bute Council* [Online] Available at: www.argyll-bute.gov.uk/lochfyne (Accessed June 2016)

Argyll and Bute Council (2015). Historic Environment Strategy 2015-2020. [Online] Available at: www.argyll-bute.gov.uk/sites/default/files/hist_env_strat_combined.pdf (Accessed December 2016)

Argyll and Bute Council. *Campbeltown, Helensburgh, Oban, Rothesay, and Dunoon (CHORD), Town Centre Regeneration Project*. [Online] Available at: www.argyll-bute.gov.uk/content/chord-town-centre-regeneration-projects (Accessed June 2016)

Argyll and Bute Economic Forum (2016). Argyll and Bute Economic Forum Report. Available at www.argyll-bute.gov.uk/sites/default/files/argyll_report_260216-v2.pdf (Accessed October 2015)

Arran Birding. *Gull Colour ringing project*. [Online] Available at: www.arranbirding.co.uk/gull_colour_ringing_project.html (Accessed May 2016)

Ayrshire Economic Partnership (2011). Ayrshire & Arran Tourism Strategy 2012-17 [Online] Available at www.south-ayrshire.gov.uk/documents/sac_tourism_strat.pdf (Accessed June 2016)

Bailey, N., and Barreto, E., (2015) Fish and Shellfish Stocks 2015 Edition. *Marine Scotland Science*. [Online] Available at www.gov.scot/Resource/0047/00477088.pdf (Accessed August 2016)

Bailey, N., Howard, F.G., and Chapman, C.J., (1986) Clyde *Nephrops*, biology and fisheries. *Proceedings of the Royal Society of Edinburgh* 90B, 501-518.

Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C., Silliman, B.R. (2011). The value of estuarine and coastal ecosystem services, *Ecological Monographs*, 81(2), 169-193.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. *Marine Scotland*, Edinburgh. pp.191 [Online] Available at www.scotland.gov.uk/Topics/marine/science/atlas (Accessed February 2015)

BBC News (2012a). *Hunterston B power station will run until 2023*. [Online] Available at www.bbc.co.uk/news/uk-scotland-glasgow-west-20590915 (Accessed November 2016)

BBC News (2012b). *Hunterston power station plans withdrawn by Ayrshire Power*. [Online] Available at www.bbc.co.uk/news/uk-scotland-scotland-business-18602532 (Accessed June 2016)

Bergmann, M., Wieczorek, S.K., Moore, P.G., Atkinson, R.J.A. (2002). Discard Composition of the *Nephrops* fishery in the Clyde Sea area, Scotland. Fisheries Research 57: 169-183.

Beveridge, C., Cook, E.J., Brunner, L., MacLeod, A., Black, K. Brown, C. & Manson, F.J. (2011). Initial response to the invasive carpet sea squirt, *Didemnum vexillum*, in Scotland. *Scottish Natural Heritage Commissioned Report No. 413*.

Boulcott, P., Howell, T.R.W. (2011) The impact of scallop dredging on rocky-reef substrata. Fisheries Research, 110, 415-420.

Brandanii Archaeology and Heritage [Online] Available at www.discoverbutearchaeology.co.uk/ (Accessed June 2016)

Breen, M., Howell, T., and Copland, P. (2011). Marine Scotland Science Report 03/11. A report of electrical fishing for razor clams (Ensis Sp.) and it likely effects on the marine environment. Marine Scotland Science. [Online] Available at www.seagrant.umaine.edu/files/Dana%20Morse/Electrofishing%20razors.pdf (Accessed October 2016)

Bresnan, E., Cook, K., Hindson, J., Hugues, S., Lacaze, J-P., Walsham, P., Webster, L., and Turrell, W.R. (2016). Marine Scotland Science. The Scottish Coastal Observatory 1997-2013. Part 2 – Description of Scotland's coastal Waters. Scottish Marine and Freshwater Science Vol 7 No 26. [Online] available at http://marinedata.scotland.gov.uk/sites/default/files/SMFS%200726%20Part%202_1.pdf (Accessed April 2017)

British Oceanographic Data Centre. (2014). *CSEMP assessment using data extracted from MERMAN on 1 September 2014*. [ONLINE] Available at www.bodc.ac.uk/projects/data_management/uk/merman/assessments_and_data_access/csemp/. (Accessed 5 May 2017)

British Trust for Ornithologists (a). *Online ringing and nest ringing report*. [Online] Available at www.bto.org/volunteer-surveys/ringing/publications/Online-ringing-reports (Accessed April 2016)

British Trust for Ornithology (b). *Wetlands Bird Survey homepage*. [Online] available at www.bto.org/volunteer-surveys/webs (Accessed May 2016)

British Trust for Ornithology (c). *Wetlands Birds Survey Report*. [Online] available at http://app.bto.org/webs-reporting/ (Accessed May 2016)

Brooks, A.J. Kenyon, N.H. Leslie, A., Long, D. & Gordon, J.E. 2013. Characterising Scotland's marine environment to define search locations for new Marine Protected Areas. Part 2: The identification of key geodiversity areas in Scottish waters. *Scottish Natural Heritage Commissioned Report No. 432*. [Online] Available at www.snh.org.uk/pdfs/publications/commissioned_reports/432.pdf (Accessed May 2016)

Buckland, F.M.A. (1871) Report on the Clyde. In: Buckland F.M.A., Young, A. (eds) Report of the Special Commissioners appointed to enquire into the effect of recent legislation on the salmon fisheries in Scotland. *Her Majesty's Stationery Office*, 115 pp.

Built Environment Forum Scotland, Small towns initiative: Helensburgh report. [Online] Available at www.befs.org.uk/wp-content/uploads/2017/04/SMALL-TOWNS-Helensburgh-Report.pdf (Accessed June 2016)

Burdon, D., Potts, T., Barbone, C., Mander, L. (2017). The matrix revisited: A bird's-eye view of marine ecosystem service provision. *Marine Policy*, 77 (2017) 78–89.

Burrows, M.T., Kamenos, N.A., Hughes, D.J., Howe, J.A., Tett, P. (2014). Assessment of carbon budgets and potential blue carbon stores in Scotland's coastal and marine environment. *Scottish Natural Heritage, Commissioned Report No. 761*.

Burton N.H.K., Maskell J. M., Armitage M.J.S., Hutchings C.J. & Rehfisch M. M. Effects of Reductions in Organic and Nutrient Loading on Bird Populations in Estuaries and Coastal Waters of England and Wales Interim Report. *BTO Research Report, No. 255*. March 2001. www.bto.org/sites/default/files/shared_documents/publications/research-reports/2001/rr255.pdf (Accessed June 2016)

Bute Community Links. Beatchwatch Bute. [Online] Available at http://butecommunitylinks.blogspot.co.uk/p/beachwatch-bute.html (Accessed October 2016)

Butler, J.R.A. (2011). The challenge of knowledge integration in the adaptive co-management of conflicting ecosystem services provided by seals and salmon. *Animal Conservation*, 14(6): 599-601.

Canmore (a). *Hms Dasher: Firth of Clyde*. [Online] Available at https://canmore.org.uk/site/102679/hms-dasher-firth-of-clyde (Accessed June 2016)

Canmore (b), *Hms/m Vandal: Inchmarnock Water, Sound Of Bute, Firth of Clyde*. [Online] Available at https://canmore.org.uk/site/119151/hmsm-vandal-inchmarnock-water-sound-of-bute-firth-of-clyde (Accessed June 2016)

Clarke, J., Bailey, D.M., and Wright, P.J. (2015). Evaluating the effectiveness of a seasonal spawning area closure. *ICES Journal of Marine Science*, doi: 10.1093/icesjms/fsv144.

Clyde Diving (2013). *Best Places to Dive in Scotland*. [Online] Available at www.clyde-diving.co.uk/the-best-places-to-dive-in-scotland.html (Accessed December 2017)

Clyde Inshore Fishery Group (2011). Fisheries Management Plan. [Online] Available at http://ifgs.org.uk/files/4414/0188/9882/SWIFG_Clyde_IFG_MP.pdf (Accessed June 2016)

Clyde Marine Planning Partnership (2017). *About the Clyde Marine Planning Partnership, Membership of the CMPP*. [Online] Available at www.clydemarineplan.scot/about-us/about-the-clyde-marine-planning-partnership/ (Accessed January 2017)

Clyde Marine Mammal Project. *Sightings list*, September 2005 to April 2016. [Online] Available at www.clydeporpoise.org/sightings/ (Accessed August 2016)

Clyde Waterfront. *Canting Basin*. [Online] Available at www.clydewaterfront.com/projects/pacific-quay--secc/commercial/canting_basin (Accessed June 2016)

Clydeplan (2015). Strategic Development Plan: Main Issues Report.

Coggan, R.A., Smith, C.J., Atkinson, R.J.A., Papadopoulou, K.-N., Stevenson, T.D.I., Moore, P.G., Tuck, I.D., (2001) Comparison of rapid methodologies for quantifying environmental impacts of otter trawls. Final Report to the European Commission, No. 98/017, 236 pp.

Collie, J.S., Hall, S.J., Kaiser, M.J., Poiner, I.R. (2000) A quantitative analysis of fishing impacts on shelf-sea benthos. *Journal of Animal Ecology*, 69, 785-798.

Commission Delegated Regulation (EU) 2015/2440 of 22 October 2015 establishing a discard plan for certain demersal fisheries in the North Sea and in Union waters of ICES Division IIa [Online] Available at https://publications.europa.eu/en/publication-detail/-/publication/7eca1515-a93d-11e5-b528-01aa75ed71a1/language-en (Accessed April 2016)

Companies House (2015). Standard industrial classification of economic activities (SIC) 2007. Crown Copyright. [Online] Available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/455263/SIC_codes_V2.pdf (Accessed May 2016)

Cook, E., Brown, S., Payne, R. and Macleod, A. (2016). Marine biosecurity: protecting indigenous marine species. *Research and Reports in Biodiversity Studies*. Volume 2016:5 Pages 1—14

Cook, E.J., Macleod, A., Payne, R.D., and Brown, S. (2014) edited by Natural England and Natural Resources Wales (2015). Marine Biosecurity Planning – Guidance for producing site and operation-based plans for preventing the introduction and spread of non-native species in England and Wales.

Coram, A., Gordon, J., Thompson, D. and Northridge, S (2014). Evaluating and assessing the relative effectiveness of non-lethal measures, including Acoustic Deterrent Devices, on marine mammals. Scottish Government.

Council Regulation (EC) No 1300/2008 of 18 December 2008 establishing a multi-annual plan for the stock of herring distributed to the west of Scotland and the fisheries exploiting that stock. [Online] Available at www.pelagic-ac.org/media/pdf/LTM%20plan%20herring%20VIa%20North.pdf (Accessed May 2016)

Council Regulation (EC) No 1342/2008 of 18 December 2008 establishing a long-term plan for cod stocks and the fisheries exploiting those stocks and repealing Regulation (EC) No 423/2004. [Online] Available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008R1342 (Accessed April 2017)

Council Regulation (EC) No. 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms. [Online] Available at http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=013262&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL (Accessed August 2016)

Council Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. [Online] Available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31998R0850 (Accessed August 2016)

Cruise Scotland. *Scottish Cruise Ports on course for another record season*. [Online] Available at www.cruisescotland.com/scottish-cruise-ports-on-course-for-another-record (Accessed June 2016)

Department for the Environment and Rural Affairs (2015). Marine Strategy Part Three: UK programme of measures. [Online] Available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/486623/marine-strategy-part3-programme-of-measures.pdf (Accessed August 2016)

Department of Transport, Marine Pollution Control Unit. (1994) Oil spill clean-up of the coastline- a technical manual. The Central Office of Information.

Discovery of sound in the sea (2016). *How does shipping affect ocean sound levels*. [Online] Available at www.dosits.org/science/soundsinthesea/shippingaffectoceansound/ (Accessed January 2016)

Dixon, T. (2014). 2013 Annual Survey of Reported Discharges Attributed to Vessels and Offshore Oil and Gas Installations Operating in the United Kingdom Pollution Control Zone. *Advisory Committee on Protection of the Sea*.

Dolman, S.J., Champion, A., Clark, J., Eisfeld-Pierantonio, S., Green, M., Gregerson, S., Hodgins, N., Ritter, F., Tetley, M. and Hoyt, E. (2013). Making space for porpoises, dolphins and whales in UK seas: Harbour Porpoise Special Areas of Conservation as part of a coherent network of marine protected areas for cetaceans. *A WDC Report*. [Online] Available at https://uk.whales.org/sites/default/files/making-space-for-uk-porpoises-dolphins-and-whales.pdf (Accessed May 2016)

Duck, C. (2007) Seals. Naturally Scottish. *Scottish Natural Heritage*. [Online] Available at: www.snh.org.uk/pdfs/publications/naturallyscottish/seals.pdf (Accessed August 2016)

Duck, C. (2010). Surveys of harbour (common) seals around Scotland August 2008. *Scottish Natural Heritage, Commissioned Report No. 361*. [Online] Available at www.snh.org.uk/pdfs/publications/commissioned_reports/361.pdf (Accessed August 2016)

Duck, C.D. & Morris, C.D. (2016). Surveys of harbour and grey seals on the south-east (border to Aberlady Bay) and south-west (Sound of Jura to Solway Firth) coasts of Scotland, in Shetland, in the Moray Firth and in the Firth of Tay in August 2015. *Scottish Natural Heritage, Commissioned Report No. 929*.

Dyson, K. (2011). Marine Litter Strategy for the Firth of Clyde Step 1: Defining the status quo. Firth of Clyde Forum. [Online] Available at http://www.clydemarineplan.scot/marine-planning/marine-planning-projects/#litter (Accessed May 2016)

Edwards, A., Baxter, M.S., Ellett, D.J., Martin, J.H.A., Meldrum, D.T., Griffiths, C.R., Clyde Sea Hydrography. In J.A. Allen et al. (eds.) The environment of the estuary and Firth of Clyde. Proceedings of the Symposium held at Glasgow, 1-2 October 1985. *Proceedings of the Royal Society of Edinburgh*, 90B: 85-96.

Eggleton J., Thomas K. V. (2004). A review of factors affecting the release and bioavailability of contaminants during sediment disturbance events. *Environment International* 30 973–980

EKOS (2012). Largs Viking Festival Economic Impact Assessment

EKOS (2014). Economic Impact Assessment of Brodick Harbour Redevelopment

Elliott, S.A.M., Ahti, P.A., Heath, M.R., Turrell, W.R. and Bailey, D.M. (2016). An assessment of juvenile Atlantic cod Gadus morhua distribution and growth using diver operated stereo-video surveys. *Journal of Fish Biology*, 89, 1190-1207. Doi:10.1111/jfb.12998.

European Commission (2016a). Env*ironment: Our Oceans, Seas and Coasts*. Legislation: the Marine Directive. [Online] Available at http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm (Accessed June 2016)

European Commission (2016b). *Environment, Urban Waste Water Directive Overview* [Online] Available at http://ec.europa.eu/environment/water/water-urbanwaste/index_en.html (Accessed October 2016)

European Commission (2016c). *Environment, MSFD Descriptor 5: eutrophication* [Online] Available at http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-5/index_en.htm (Accessed October 2016)

European Commission (2016d). *Environment, Our Oceans, Seas and Coasts* [Online] Available at http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm (Accessed October 2016)

European Commission (2016e). *Fisheries, Discarding and the landing obligation* [Online] Available at http://ec.europa.eu/fisheries/cfp/fishing_rules/discards/index_en.htm (Accessed August 2016)

European Commission (2016f). *Environment, The EU Water Framework Directive - integrated river basin management for Europe* [Online] Available at http://ec.europa.eu/environment/water/water-framework/index_en.html (Accessed August 2016)

European Commission Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). [Online] Available at http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32008L0056 (Accessed August 2016)

European Commission Directive 2009/79/409 on the Conservation of Wild Birds CITATION FOR SPECIAL PROTECTION AREA (SPA) AILSA CRAIG [Online] Available at www.snh.org.uk/about/directives/AilsaB433678.pdf (Accessed April 2016) n

European Landscape Convention, Florence, 20.X.2000. [Online] Available at https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=0900001680080621 (Accessed August 2016)

Ewart J.C. (1984) Natural history of the herring. Rep Fish Bd Scot 2:61-73

Fernandes, P.G., Coull, K., Davis, C., Clark, P., Catarino, R., Bailey, N., Fryer, R. and Pout, A. (2011). Observations of discards in the Scottish mixed demersal trawl fishery. *ICES Journal of Marine Science*, 68(8): 1734-1742.

Firth of Clyde Eider News (2015). No. 13 August 2015 [Online] Available at www.arranbirding.co.uk/files/clyde_eider_news_no_13_aug_2015.pdf (Accessed August 2016)

Fisheries Research Services (2004). Case Study: *Munitions Dumping at Beaufort's Dyke*. Crown Copyright [Online] Available at www.gov.scot/uploads/documents/ae08beauforts.fh10.pdf (Accessed June 2016)

Fishing for Litter (2014). *Fishing for Litter 2011-2014 Final Report* [Online] Available at www.fishingforlitter.org.uk/project-areas/scotland (Accessed June 2015)

Fishing for Litter. *What is fishing for litter?* [Online] Available at www.fishingforlitter.org.uk/what-is-fishing-for-litter (Accessed June 2016)

Fonteyne, R. (2000). Physical impact of beam trawls on seabed sediments. In: M.J. Kaiser & S.J. de Groot (eds.), *Effects of Fishing on Non-Target Species and Habitats – Biological, Conservation and Socioeconomic Issues*. 399 pp. Oxford: Blackwell Scientific.

Food and Agriculture Organisation of the United Nations.

Management of shark fisheries in the North East Atlantic. [Online] Available at www.fao.org/docrep/003/X2097E/X2097E01.htm (Accessed July 2016)

Food Standards Scotland (2015a). *Classification report 2014-15* [Online] Available at www.foodstandards.gov.scot/downloads/shell-class-scot-1415_1.pdf (Accessed June 2016)

Food Standards Scotland (2015b). *Advice for business and industry - Shellfish*. [Online] Available at www.foodstandards.gov.scot/food-safety-standards/advice-business-and-industry/shellfish (Accessed June 2016)

Food Standards Scotland (2015c). *Classification report 2015-16* [Online] Available at www.foodstandards.gov.scot/downloads/Shellfish_Harvesting_Classification_Document_2015-16_0.pd (Accessed Sept 2015)

Forestry Commission Scotland (2010). Timberlink Environmental Benefits Review. Prepared by Transport and Travel Research Ltd. [Online] Available at http://timbertransportforum.org.uk/attachments/article/22/TTR%20Publication%202010%20TimberLINK%20Environmental%20Benefits%20Review%20Final%20Report.pdf (Accessed June 2016)

Forestry Commission Scotland (2014). Improving timber transport Case Study, Timberlink. {Online] Available at http://scotland.forestry.gov.uk/images/corporate/pdf/timber-transport-case-study-timberlink.pdf (Accessed June 2016)

Foster, S. and Marrs, S. (2012). Seabirds in Scotland, Trend Note Number 021. *Scottish Natural Heritage*. [Online] Available at www.nature.scot/sites/default/files/B1163280%20-%20Trend%20note%20-%20biodiversity%20-%20Seabirds%20in%20Scotland%20-%20October%202012%20-%20PDF%20for%20website.pdf (Accessed April 2016)

Fowler, S. (2014). The conservation status of migratory sharks UNEP/CMS Secretariat, Bonn, Germany. 30 pages. [Online] Available at www.cms.int/sites/default/files/publication/The%20Conservation%20Status%20of%20Migratory%20Sharks.pdf (Accessed December 2016)

Fox, C.J., Valcic L. and Veszelovszki A., (2015). Evidence Gathering in Support of Sustainable Scottish Inshore Fisheries: A Pilot Study to Define the Footprint and Activities of Scottish Inshore Fisheries by Identifying Target Fisheries, Habitats and Associated Fish Stocks. *Marine Alliance for Science and Technology for Scotland*. 190pp. ISBN 978-0-9934256-4-6

Fox, C. (2015). Scottish Marine and Freshwater Science Vol. 6 No 7: Collection of bycatch data for spurdog (Squalus acanthias) in the North Minch fishery: Report of Fishing Industry Science Alliance (FISA) Project 02/13. C. *Marine Scotland*. [Online] Available at www.gov.scot/Resource/0047/00479590.pdf (Accessed April 2016)

Fraser of Allander Institute for research on the Scottish Economy (2002). Input Output Multiplier Study of the UK and Scottish Fish Catching and Fish processing Sectors. *University of Strathclyde*. [Online] Available at www.seafish.org/media/Publications/io_study_economics.pdf (Accessed October 2016)

Frisk, G.V, (2012) Noiseonomics: The relationship between ambient noise levels in the sea and global economic trends. *Scientific Reports*. 2012; 2: 437.

Frost, T.M., Austin, G.E., Calbrade, N.A., Holt, C.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. & Balmer, D.E. (2016). Waterbirds in the UK 2014/15: The Wetland Bird Survey. BTO, RSPB and JNCC, in association with WWT. *British Trust for Ornithology*, Thetford. [Online] Available at www.rspb.org.uk/Images/waterbirds-in-the-uk-2014-15_tcm9-419058.pdf (Accessed June 2016)

Furness R. W., Galbraith H., Gibson I. P., and Metcalfe N. (1986). Recent changes in numbers of waders in the Clyde estuary, and their significance for conservation. The environment of the estuary and Firth of Clyde. *The Royal Society of Edinburgh*, 90B, xi.

Galgani, F., Fleet, D., Van Franeker J., Katsanevakis, S., Maes, T., Mouat, J., Oosterbaan, I., Poitou, G., Hanke, R., Thompson, R., Amato, E., Birkun, A., and Janssen, C. (2010). Marine Strategy Framework Directive Task Group 10 Report Marine Litter. *Joint Research Centre Scientific and Technical Reports*. [Online] Available at http://ec.europa.eu/environment/marine/pdf/9-Task-Group-10.pdf. (Accessed June 2016)

Galley E.A., Wright P.J., Gibb F.M. (2006). Combined methods of otolith shape analysis improve identification of spawning areas of Atlantic cod. *ICES Journal of Marine Science* 63:1710-1717

Geffen A.J., Nash R.D.M., Dickey-Collas M. (2011) Characterization of herring populations west of the British Isles: an investigation of mixing based on otolith microchemistry. ICES Journal of Marine Science 68:1447-1458

Gillham, K., and Baxter, J. (2009). Whales, Dolphins and Porpoises, Naturally Scottish. *Scottish Natural Heritage*. [Online] Available at www.snh.org.uk/pdfs/publications/naturallyscottish/whales.pdf (Accessed August 2016)

Gittenberger, A. (2007). Recent population expansions of non-native ascidians in The Netherlands. *Journal of Experimental Marine Biology and Ecology*. 342(1), pp.122-126.

Global Tourism Solutions (2015). Scottish Tourism Economic Activity Monitor for Argyll and Bute council

Gordon, J.E. (2016) Geological and geomorphological features of SSSIs contributing to the MPA network in Scotland's seas. *Scottish Natural Heritage, Commissioned Report No. 892*.

Grant, A., Anderson, C., and Lee, F. (2013). Seascape/Landscape Assessment of the Firth of Clyde. Carried out of behalf of the Firth of Clyde Forum.

Great Britain Non-native Species Secretariat (a). [Online] Available at www.nonnativespecies.org/home/index.cfm (Accessed August 2016).

Great Britain Non-Native Species Secretariat (b). *Biosecurity and Prevention*. [Online] Available at www.nonnativespecies.org/checkcleandry/ (Accessed Just 2016)

Great Britain Non-native Species Secretariat (c). *Marine Pathways Programme*. [Online] Available at www.nonnativespecies.org/index.cfm?sectionid=105 (Accessed January 2016)

Green, D., Penman, D., Migaud, H., Bron, J., Taggart, J. and McAndrew, B. (2012). The Impact of Escaped Farmed Atlantic Salmon (Salmo salar L.) on Catch Statistics in Scotland. PLoS ONE, 7(9), p.e43560.

Hall-Spencer, J.M. and Moore, P.G. (2000). Limaria hians (Mollusca:Lomacea): A neglected reef-forming keystone species. Aquatic Conservation: *Marine and Freshwater Ecosystems*. 10, 267-277.

Hansom, J., Maxwell, F., Naylor, L., Piedra, M. (2017). Impacts of sea-level rise and storm surges due to climate

change in the Firth of Clyde. *Scottish Natural Heritage Commissioned Report No. 891*.

Harding, N. (2008). Feeding Distribution of Wintering Waterfowl on the Inner Clyde SPA, Winter 2007-2008. *Scottish Natural Heritage, Commissioned Report No. 329* (ROAME No. R06LI10). [Online] Available at www.snh.org.uk/pdfs/publications/commissioned_reports/329.pdf (Accessed June 2016)

Hastings, E., Potts, T. (2013). Marine litter: Progress in developing an integrated policy approach in Scotland. *Marine Policy*. 42 49-55. [Online] Available at www.resodema.org/publications/publication21.pdf (Accessed June 2016)

Hauton, C., Hall-Spencer, J.M., Moore, P.G. (2003) An experimental study of the ecological impacts of hydraulic bivalve dredging on maerl. *Journal of Marine Science*, Volume 60, pp 381-392

Heath, M. and Speirs, D. (2011). Changes in species diversity and size composition in the Firth of Clyde demersal fish community (1927-2009). *Proceedings of the Royal Society B: Biological Sciences*, 279(1728), pp.543-552.

Hebridean Whale and Dolphin Trust. *Monthly sightings report page*. [Online] Available at www.whaledolphintrust.co.uk/sightings-monthly-sightings-reports.asp (Accessed April 2016)

Highlands and Islands Enterprise. *National Renewables Infrastructure Plan*. [Online] Available at www.hie.co.uk/growth-sectors/energy/n-rip.html (Accessed June 2016)

Hislop, J.R.G., (1986). The demersal fishery in the Clyde Sea Area. *Proceedings of the Royal Society of Edinburgh*. Section B. Biological Sciences, Volume 90, pp 423-437

Historic Environment Scotland (2016). Proposal to designate a Historic Marine Protected Areas under the Marine (Scotland) Act. [Online] Available at www.historicenvironment.scot/media/3038/iona-i-historic-mpa-proposal-document.pdf (Accessed June 2016)

HM government (2012). Marine strategy part one: UK initial assessment and good environmental status. [Online] Available at www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status (Accessed August 2016)

HM Treasury and The Rt Hon George Osbourne MP (2015). *£500 for Faslane announced by Chancellor*. [Online] Available at www.gov.uk/government/news/500-million-for-faslane-announced-by-chancellor (Accessed June 2016)

Holt, R.H.F. and Cordingley, A.P. (2011). Eradication of the non-native carpet ascidian (sea squirt) Didemnum vexillum in Holyhead Harbour: Progress, methods and results to spring 2011. Marine Monitoring Report No. 90. Countryside Council for Wales

Horton, J, (2017). Wrasse vanishing in salmon farms' sea lice 'goldrush'. *The Times*, 30 April 2017. [Online] Available at www.thetimes.co.uk/article/wrasse-vanishing-in-salmon-farms-sea-lice-goldrush-dfq8p2q33 (Accessed may 2017)

House of Commons Scottish Affairs Committee (2012). The Crown Estate in Scotland, Seventh Report of Session 2010–12. Report, together with formal minutes, oral and written evidence. Ordered by the House of Commons to be printed 7 March 2012. [Online] Available at www.publications.parliament.uk/pa/cm201012/cmselect/cmscotaf/1117/1117.pdf

House of Commons Scottish Affairs Committee (2013a). Written evidence submitted by Babcock. [Online] Available at www.publications.parliament.uk/pa/cm201213/cmselect/cmscotaf/139/139we09.htm (Accessed June 2016)

House of Commons Scottish Affairs Committee (2013b). Written evidence submitted by the Ministry of Defence. [Online] Available at www.publications.parliament.uk/pa/cm201213/cmselect/cmscotaf/139/139we08.htm (Accessed August 2016)

Howarth L., (2014). Measuring the effects of Scotland's first fully protected marine reserve. PhD thesis, University of York [Online] Available at http://etheses.whiterose.ac.uk/6795 (Accessed November 2016)

Howarth, L.M., Roberts, C.M., Thurstan, R.H., Stewart, B.D. (2014) The unintended consequences of simplifying the sea: making the case for complexity. *Fish and fisheries*, 15:690-711.

Howarth, L.M., Wood, H.L., Turner, A.P., Beukers-Stewart, B.D. (2011) Complex habitat boosts scallop recruitment in a fully protected marine reserve. *Marine Biology*, Volume 158, Issue 8, pp 1767-1780

Howarth, L.M., Beukers-Stewart, B. D., (2014). The dredge fishery for scallops in the United Kingdom (UK): effects on marine ecosystems and proposals for future management. York: Report to the Sustainable Inshore Fisheries Trust. Marine Ecosystem *Management Report no. 5*, University of York,. 54 pp.

Howarth, L.M., Roberts, C.M., Hawkins, J.P., Steadman, D.J., and Beukers-Stewart, B.D., (2015). Effects of ecosystem protection on scallop populations within a community-led temperate marine reserve. *Marine Biology* 162: 823–840.

Humborstad, O.-B., Nøttestad, L., Løkkeborg, S. & Rapp, H.T. (2004). RoxAnn bottom classification system, sidescan sonar and video-sledge: spatial resolution and their use in assessing trawling impacts. *ICES Journal of Marine Science*, 61:53-63.

Hunter A., Speirs D.C., Heath M.R. (2015). Fishery-induced changes to age and length dependent maturation schedules of three demersal fish species in the Firth of Clyde. Fisheries Research. 170 (2015) 14-23.

Idier, D., Paris, F., Le Cozannet, G., Boulahya, F. and Dumas, F. (2017). Sea-level rise impacts on the tides of the European Shelf. *Continental Shelf Research*. 137 (2017) 56–71.

Intergovernmental Panel on Climate Change (2007). Climate Change 2007 Synthesis Report. An Assessment of the Intergovernmental Panel on Climate Change. [Online] Available at www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf (Accessed August 2016)

Intergovernmental Panel on Climate Change (2015). [Online] Available at www.ipcc.ch/index.htm (Accessed March 2015)

International Council for the Exploration of the Sea (2005). Ecosystems effects of fishing: impacts, metrics and management strategies. ICES Cooperative Research Report, No. 272, 177 pp.

International Council for the Exploration of the Sea (2015a). Advice on fishing opportunities, catch, and effort Celtic Seas Ecoregion Published 30 October 2015. ICES Advice 2015, Book 5 1 5.3.26 Norway lobster (Nephrops norvegicus) in Division VIa – FU 13 (West of Scotland, the Firth of Clyde, and the Sound of Jura). [Online] Available at www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/nep-13.pdf (Accessed July 2016)

International Council for the Exploration of the Sea (2015b). Report of the Working Group on Elasmobranch Fishes (WGEF), 17–23 June 2015, Lisbon, Portugal. ICES CM 2015/ACOM:19. 711 pp. [Online] Available at www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2015/WGEF/wgef_2015.pdf

International Council for the Exploration of the Sea. *Underwater noise data map* [Online] Available at http://underwaternoise.ices.dk/map.aspx. (Accessed April 2017)

International Council for the Exploration of the Sea (2016a) Advice on fishing opportunities, catch, and effort, Celtic Seas Ecoregion Published 30 June 2016, Whiting (*Merlangius merlangus*) in Division 6.a (West of Scotland). [Online] Available at http://ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/whg-scow.pdf (Accessed November 2017)

International Council for the Exploration of the Sea (2016b). Celtic Seas Ecoregion – Ecosystem overview. [Online] Available at https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Celtic_Sea_Ecoregion-Ecosystem_overview.pdf (Accessed November 2017)

International Council for the Exploration of the Sea (2017a). Advice for fishing opportunities, catch and effort, Celtic Seas Ecoregion. Cod (*Gadus morhua*) in Division 6.a (West of Scotland). [Online] Available at https://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/cod.27.6a.pdf (Accessed November 2017)

International Council for the Exploration of the Sea (2017b). Advice on fishing opportunities, catch, and effort Celtic Seas and Greater North Sea Ecoregions. Haddock (*Melanogrammus aeglefinus*) in Subarea 4, Division 6.a, and Subdivision 20 (North Sea, West of Scotland, Skagerrak). [Online] Available at www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/had.27.46a20.pdf (Accessed November 2017)

International Council for the Exploration of the Sea (2017c). Advice on fishing opportunities, catch, and effort Celtic Seas, Faroes and Oceanic Northeast Atlantic Ecoregions. Herring (*Clupea harengus*) in divisions 6.a and 7.b–c (West of Scotland, West of Ireland). [Online] Available at www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/her.27.6a7bc.pdf (Accessed November 2017)

International Council for the Exploration of the Sea (2017d). Advice on fishing opportunities, catch, and effort Ecoregions in the Northeast Atlantic and Arctic Ocean Mackerel (*Scomber scombrus*) in subareas 1–8 and 14, and in Division 9.a (the Northeast Atlantic and adjacent waters). [Online] Available at www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/mac.27.nea.pdf (Accessed November 2017)

International Council for the Exploration of the Sea (2017e). Advice on fishing opportunities, catch, and effort, Celtic Seas Ecoregion Norway lobster (*Nephrops norvegicus*) in Division 6.a, Functional Unit 13 (West of Scotland, the Firth of Clyde, and the Sound of Jura). [Online] Available at www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/mac.27.nea.pdf (Accessed November 2017)

International Maritime Organisation (2014). Guidelines for The Reduction Of Underwater Noise From Commercial Shipping To Address Adverse Impacts On Marine Life. Circular MEPC.1/Circ.833. [Online] Available at https://cetsound.noaa.gov/Assets/cetsound/documents/MEPC.1-Circ%20883%20Noise%20Guidelines%20April%202014.pdf (Accessed August 2016)

International Union for the Conservation of Nature. *Red List of threatened species* [Online] Available at www.iucnredlist.org/ (Accessed April 2016)

Inverclyde Council (2015). Inverclyde Tourism Strategy 2009-2015 Mid-Term review. [Online] Available at www.inverclyde.gov.uk/tourism-and-visitor-attractions/strategy-for-tourism-development (Accessed August 2016)

Irish Scottish Links on Energy Study. [Online] Available at www.islesproject.eu/ (Accessed June 2016)

Ivanovic, A. (2015). Modelling the physical Impact of demersal fishing gears on the seabed. A study commissioned by Fisheries Innovation Scotland (FIS) [Online] available at www.fiscot.org/media/1257/fis002.pdf (accessed April 2017)

Jardine, W.G., (1986) The geological and geomorphological setting of the Estuary and Firth of Clyde. *Proceedings of the Royal Society of Edinburgh*. 90B, 25-41.

Jobstvogt, N., Watson, V., Kenter, J. (2014) Looking below the surface: The cultural ecosystem service values of UK marine protected areas (MPAs). *Ecosystem Services*. 10, 97-110.

Johnstone, R., (2015). Trident renewal costs increase to £31bn. *Public Finance* [Online] Available at www.publicfinance.co.uk/news/2015/11/trident-renewal-costs-increase-%C2%A331bn (Accessed June 2016)

Joint Nature Conservation Committee (2001). *SPA description, Ailsa Craig*. [Online] Available at http://jncc.defra.gov.uk/default.aspx?page=1949 (Accessed April 2016)

Joint Nature Conservation Committee (2004). *Common Standards Monitoring Guidance for Birds* Version August 2004 [Online] Available at http://jncc.defra.gov.uk/page-2224 (Accessed April 2016)

Joint Nature Conservation Committee (2010a). *Guidelines for minimising the risk of injury to marine mammals from using explosives*. [Online] Available at http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Explosives%20Guidelines_August%202010.pdf (Accessed August 2016)

Joint Nature Conservation Committee (2010b). *Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise*. [Online] Available at http://jncc.defra.gov.uk/pdf/JNCC_Piling%20protocol_August_2010.pdf (Accessed August 2016)

Joint Nature Conservation Committee (2014). Population Trends and Causes of Change: 1986-2013 Report [Online] Available at http://webarchive.nationalarchives.gov.uk/20150901161645/http://jncc.defra.gov.uk/page-3201 - (Accessed April 2016)

Joint Nature Conservation Committee (2015). *Geophysical surveys.* [Online] Available at http://jncc.defra.gov.uk/page-1534 (Accessed August 2016)

Joint Nature Conservation Committee (2016a). *Marine Activities and Pressures evidence*. [Online] Available at http://jncc.defra.gov.uk/page-7136 (Accessed June 2016)

Joint Nature Conservation Committee (2016b). *The Seabird Monitoring Programme (SMP)* [Online] Available at http://jncc.defra.gov.uk/page-1550 (accessed October 2016)

Joint Nature Conservation Committee (2016c). *UK Marine Noise Registry*. [Online] Available at http://jncc.defra.gov.uk/page-7070 (Accessed April 2017)

Joint Nature Conservation Committee (a), *Seabird colony site counts* [Online] Available at http://jncc.defra.gov.uk/smp/sitesBrowser.aspx (Accessed April 2016)

Jones, P., Cathcart, A., Speirs, D.C. (2015). Early evidence of the impact of preindustrial fishing on fish stocks from the mid-west and southeast coastal fisheries of Scotland in the 19th century. ICES *Journal of Marine Science*, doi:10.1093/icesjms/fsv189.

Kaiser, M.J., Ramsay, K., Richardson, C.A., Spence, F.E., Brand, A.R. (2000), Chronic fishing disturbance has changed shelf sea benthic community structure. *Journal of Animal Ecology*. 69, 494-503.

Kunzelik P.A. (1988). The Basking Shark. Pamphlet, Number 14. *Scottish Fisheries Information*

Lancaster, J. (Ed.), McCallum, S., Lowe A.C., Taylor, E., Chapman A. & Pomfret, J. (2014). Development of detailed ecological guidance to support the application of the Scottish MPA selection guidelines in Scotland's seas. *Scottish Natural Heritage*, Commissioned Report No.491. Eelgrass Beds – supplementary document.

Lancaster, J. (Ed.), McCallum, S., Lowe A.C., Taylor, E., Chapman A. & Pomfret, J. (2014). Development of detailed ecological guidance to support the application of the Scottish MPA selection guidelines in Scotland's seas. *Scottish Natural Heritage, Commissioned Report No.491*. Basking shark – supplementary document.

Land Use Consultants (1999). Glasgow and the Clyde Valley landscape assessment. Review No 116. *Scottish Natural Heritage* [Online] Available at www.snh.org.uk/pdfs/publications/review/116.pdf (Accessed August 2016)

Learning and teaching Scotland (2010) Curriculum for excellence through outdoor learning. [Online] Available at https://education.gov.scot/Documents/cfe-through-outdoor-learning.pdf (Accessed June 2016)

Lengyel, N., Collie, J.S. and Valentine, P.C. (2009). The invasive colonial ascidian Didemnum vexillum on Georges Bank — Ecological effects and genetic identification. *Aquatic Invasions*. 4(1), pp.143-152.

Little, A., Bailey, N., Cook, R., Curtis, H., Fox, C., Heath, H., Marshall, T., Mouat, B., Fernandes, P. (2015). A Review of Scotland's Marine Fisheries: Stock Status, Knowledge Gaps, Research Requirements and Stakeholder Engagement. A study commissioned by Fisheries Innovation Scotland (FIS) [Online] Available at www.fiscot.org/media/1283/fis001-2.pdf (Accessed April 2017)

LUC (2016). Scottish Marine Recreation and Tourism Survey. Prepared for Marine Scotland. [Online] Available at www.gov.scot/Resource/0049/00497904.pdf

Mackay, D.W., and Doughty, R. C., (1986). Migratory salmonids of the Estuary and Firth of Clyde. *Proceedings of the Royal Society of Edinburgh. Section B. Biological Sciences*. 90, pp 479-490. doi: 10.1017/S0269727000005170.

Marine Accident Investigation Branch (a). [Online] Available at www.gov.uk/government/organisations/marine-accident-investigation-branch/about (Accessed May 2016)

Marine Accident Investigation Branch (b). *Marine Accident Investigation Branch Reports*. [Online] Available at www.gov.uk/maib-reports (Accessed May 2016)

Marine Climate Change Impacts Partnership (2015a). *Annual Report Card 2010-11*, [Online] Available at www.mccip.org.uk/impacts-report-cards/full-report-cards/2010-2011/ (Accessed September 2016)

Marine Climate Change Impacts Partnership (2015b). Marine Clim*ate Change Impacts Report Card 2013*. [Online] Available at www.mccip.org.uk/impacts-report-cards/full-report-cards/2013/ (Accessed August 2016)

Marine Climate Change Impacts Partnership (2016). Implications for the implementation of marine biodiversity legislation 2015 [Online] Available at www.mccip.org.uk/impacts-report-cards/special-topic-report-cards/marine-biodiversity-legislation-2015/ (Accessed October 2016)

Marine Conservation Society (2014). The Great British Beach Clean 2014 Report. [Online] Available at www.mcsuk.org/downloads/pollution/beachwatch/latest2015/MCS_GBBC_2014_Report.pdf (Accessed June 2016)

Marine Management Organisation. *Evidence supporting the use of environmental remediation to improve water quality in the South Marine Plan Areas*. [Online] Available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/500278/Evidence_Supporting_the_Use_of_Environmental_Remediation_to_Improve_Water_Quality_in_the_South_Marine_Plan_Areas_summary__1105_.pdf (Accessed June 2016)

Marine Scotland (2009a). A fresh start, the renewed Strategic Framework for Scottish Aquaculture. [Online] Available at www.gov.scot/resource/doc/272866/0081461.pdf (Accessed November 2016)

Marine Scotland (2009b). Technical Report: Economic Impact of Recreational Sea Angling in Scotland. undertaken by Alan Radford at Glasgow Caledonian University, Geoff Riddington of Grid Economics and Professor Hervey Gibson at CogentSI Research International Ltd. [Online] Available at www.gov.scot/resource/doc/280648/0084568.pdf (Accessed September 2016)

Marine Scotland (2013). Dredging and Sea Disposal Sites: Guidance on Creating a New Sea Disposal Site. [Online] Available at www.gov.scot/Resource/0044/00443833.pdf (Accessed June 2016)

Marine Scotland (2013b) Planning Scotland's Seas: 2013 - Possible Nature Conservation Marine Protected Areas Consultation Overview - Strategic Environmental Assessment Report. [Online] Available at www.gov.scot/Publications/2013/08/2591 (Accessed November 2017)

Marine Scotland (2014a). The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters. Prepared in partnership with Scottish Natural Heritage. [Online] Available at www.gov.scot/resource/0044/00446679.pdf (Accessed August 2016)

Marine Scotland (2014b). An Assessment of the benefits to Scotland of aquaculture. Prepared by Imani Development and SAMS Research Services Limited. [Online] Available at www.gov.scot/Resource/0045/00450798.pdf (Accessed October 2016)

Marine Scotland (2015). Marine Analytical Unit Monthly Marine Briefing. [Online] Available at www.gov.scot/Resource/0048/00484289.pdf (Accessed June 2016)

Marine Scotland (2016a). *National Marine Plan interactive*. [Online] Available at https://marinescotland.atkinsgeospatial.com/nmpi/ (Accessed May 2016)

Marine Scotland (2016b). *Seal Licensing*. [Online] Available at www.gov.scot/Topics/marine/Licensing/SealLicensing (Accessed April 2016)

Marine Scotland (2016c). *Historic MPAs*. [Online] Available at www.gov.scot/Topics/marine/marine-environment/mpanetwork/historicmpas (Accessed November 2016)

Marine Scotland Science (2014). Management of the Scottish Inshore Fisheries; Assessing the Options for Change, Technical Report. Prepared by Marine Scotland by: Geoff Riddington and Alan Radford (Grid Economics) and Hervey Gibson (CogentSI). [Online] Available at www.gov.scot/Resource/0046/00467217.pdf

Marine Scotland Science (2016). Locational Guidelines for the Authorisation of Marine fish Farms in Scottish Waters. Crown Copyright. [Online] Available at www.gov.scot/Resource/0050/00507228.pdf

Marine Traffic. *Arrivals and departures on the Port of Finnart*. [Online] Available at www.marinetraffic.com/en/ais/index/port_moves/all/port:229/portname:FINNART (Accessed August 2016)

Mason, J. and Fraser, D.I. (1986). Shellfish fisheries in the Clyde Sea Area. *Proceedings of the Royal Society of Edinburgh*. 90B, 439-450.

Masselink, G., Castelle, B., Suanez, S., Jackson, D. & Floc'h, F. 2016. Extreme wave activity during 2013/2014 winter and morphological impacts along the Atlantic coast of Europe. Geophysical Research Letters. 43(5): 2135-2143.

Mazik, K., Strong, J., Little, S., Bhatia, N., Mander, L., Barnard, S. & Elliott, M. 2015. A review of the recovery potential and influencing factors of relevance to the management of habitats and species within Marine Protected Areas around Scotland. *Scottish Natural Heritage Commissioned Report No. 771*.

Mesquita, C., Dobby, H., and McLay, A. 2016. Crab and lobster fisheries in Scotland: Results of stock assessments 2009-2012. Scottish Marine and Freshwater Science, 7: 73pp.

Mesquita, C., Miethe, T., Dobby, H., and McLay, A. (2017). Crab and Lobster Fisheries in Scotland: Results of Stock Assessments 2013-2015. Scottish Marine and Freshwater Science Vol 8 No 14. [Online] Available at: http://data.marine.gov.scot/sites/default/files//SMFS%200814_0.pdf (Accessed November 2017)

McDonald, M.A., Hildebrand, J.A., Wiggins, S.M. and Ross, D. A 50 Year comparison of ambient ocean noise near San Clemente Island: A bathymetrically complex coastal region off Southern California. 2008. *Journal of the Acoustic Society of America*. 124 (4) 1985-92.

McIntyre, F., Fernandes, P.G. and Turrell, W. R. (2012). Clyde Ecosystem Review. Scottish Marine and Freshwater Science Report Volume 3 Number 3. *Marine Scotland Science*. [Online] Available at www.gov.scot/Publications/2012/06/7562 (Accessed August 2016)

McLusky, D.S., Elliott, M., (2004) *The Estuarine Ecosystem – Ecology, Threats, and Management*. 3rd edition. Oxford: Oxford University Press.

Merchant, N.A., Blondel, P., Dakin, D.T., and Dorocicz, J., (2012). Averaging underwater noise levels for environmental assessment of shipping. *Journal of the Acoustical Society of America.* 132 (4), EL343-EL349.

Merchant, D.N., Brookes, K. A., Faulkner, R. C., Bicknell, A. W. J., Godley, B. J., and Witt, M. J. (2016). Underwater noise levels in UK waters. Scientific Reports 6, 36942 (2016) doi:10.1038/srep36942. [Online] Available at www.nature.com/articles/srep36942 (accessed April 2017)

Met Office (2015). *Storm surge*. [Online] Available at www.metoffice.gov.uk/learning/learn-about-the-weather/weather-phenomena/storm-surge (Accessed Feb 2015)

Miller, B.S., Pirie, D.J. and Redshaw, C.J. 2000, An assessment of the contamination and toxicity of marine sediments in the Holy Loch, Scotland, *Marine Pollution Bulletin*. 40, 22–35.

Milligan, R.J., Neil, D.M., and Albalat, A. (2013) Scottish *Nephrops* Survey Phase III: Evaluation of Measures for Reducing Bycatch and Discards in a *Nephrops* Fishery. Project Report. University of Glasgow, Glasgow, UK. [Online] Available at http://eprints.gla.ac.uk/81235/ (Accessed April 2016)

Mills, F., (2012a) Coastal litter management guidelines for duty bodies. *Firth of Clyde Forum*. [Online] Available at www.clydemarineplan.scot/wp-content/uploads/2016/06/Firth-of-Clyde-Forum-Coastal-Litter-Management-Guidelines-for-Duty-Bodies.pdf (Accessed August 2016)

Mills, F., (2012b) Firth of Clyde Biosecurity Plan 2012 – 2016. *Firth of Clyde Forum*. [Online] Available at www.clydemarineplan.scot/wp-content/uploads/2016/05/Guidance-Biosecurity-Planning.pdf (Accessed August 2016)

Minchin, D., Cook, E. and Clark, P. (2013). Alien species in British brackish and marine waters. *Aquatic Invasions*. 8(1), pp.3-19.

Minchin, D., Duggan, C.B. and King, W., (1987). Possible effects of organotins on scallop recruitment. *Marine Pollution Bulletin*, 18: 604-608.

Ministry of Defence (2014 & 2016). Location of all UK regular service and civilian personnel quarterly statistics: index. [Online] Available at www.gov.uk/government/collections/location-of-all-uk-regular-service-and-civilian-personnel-quarterly-statistics-index (Accessed June 2016)

Ministry of Defence and Defence Safety Authority (2010 & 2016). Management of environmental protection in defence (JSP 418) [Online] Available at www.gov.uk/government/publications/jsp-418-mod-corporate-environmental-protection-manual (Accessed June 2016)

Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (2004). *Seabird Populations of Britain and Ireland: results of the Seabird 200 census*. London: Poyser.

Monaghan P., and Zonfrillo B., (1986). Population dynamics of seabirds in the Firth of Clyde. *Proceedings of the Royal Society of Edinburgh*, 90B, 363-375.

Munro, L.A., and Wallace, I.S., (2015). Scottish Fish Farm Production Survey 2014. *Marine Scotland Science*. Crown Copyright. [Online] Available at www.gov.scot/Publications/2015/09/6580 (Accessed June 2016)

Murray, F. and Cowie, P. (2011). Plastic contamination in the decapod crustacean *Nephrops norvegicus* (Linnaeus, 1758). *Marine Pollution Bulletin*, 62(6), pp.1207-1217.

Murray, S., Harris, M.P., Wanless, S. (2015). The status of the gannet in Scotland in 2013-14. *Scottish Birds*, 35 (1). 3-18. [Online] Available at http://nora.nerc.ac.uk/510050/ (Accessed October 2016)

National Biodiversity Network Atlas. *Limaria hians (Gmelin, 1791) Flame Shell*. [Online] Available at https://species.nbnatlas.org/species/NBNSYS0000176146. (Accessed November 2016)

Natural Scotland (2006). The Scottish Government. A Sustainable Framework for Scottish Sea Fisheries 2006. [Online] Available at www.gov.scot/Resource/Doc/113915/0027742.pdf (Accessed June 2016)

Natural Scotland (2013). Managing Invasive Species in Scotland Water Environment: A Supplementary Plan to the River Basin Management Plans. Compiled by SEPA for Natural Scotland, Scottish Government. December 2013. [Online] Available at www.sepa.org.uk/media/37362/managing-invasive-non-native-species_plan.pdf (Accessed August 2016)

Natural Scotland (2015). The river basin management plan for the Scotland river basin district 2015 – 2027. [Online] Available at www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf (Accessed August 2016)

Nature Conservation (Scotland) Act, 2004 [Online] Available at www.legislation.gov.uk/asp/2004/6/contents (Accessed August 2016)

NERC Special Committee on Seals (2016). Scientific Advice on Matters Related to the Management of Seal Populations. [Online] Available at www.smru.st-andrews.ac.uk/files/2017/04/SCOS-2016.pdf (Accessed April 2017)

Normandeau, Exponent, T. Tricas, and A. Gill. (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA.

OCS Study BOEMRE 2011-09. [Online] Available at www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/2011-09-EMF-Effects.aspx (Accessed December 2016)

North Ayrshire Council. Rural Affairs, Climate Change and Environment Committee Framework 3. [Online] Available at www.scottish.parliament.uk/S4_RuralAffairsClimateChangeandEnvironmentCommittee/General%20Documents/North_Ayrshire_Council(2).pdf (Accessed June 2016)

Office for National Statistics. Annual Survey of Hours and Earnings: 2015 Provisional Results. [Online] Available at www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2015provisionalresults (Accessed September 2016)

Oil spill clean-up of the coastline – a technical manual, 2nd edition 1994. Prepared on behalf of the Marine Pollution Control Unit of the Department of Transport. Produced by the Central Office of Information. Crown Copyright.

OSPAR Commission (2009a). Background Document for Basking shark *Cetorhinus maximus*. [Online] Available at www.ospar.org/documents?v=7189 (Accessed April 2016)

OSPAR Commission (2009b). *Evaluation of the OSPAR system of Ecological Quality Objectives for the North Sea (update 2010).* [Online] Available at http://qsr2010.ospar.org/media/assessments/EcoQO/EcoQO_P01-16_complete.pdf (Accessed June 2016)

OSPAR Commission (2015). Background Document on Basking shark, *Cetorhinus maximus* – 2015 Update. [Online] Available at www.ospar.org/documents?v=7377 (Accessed May 2016)

OSPAR Commission (a). *List of threatened and/or Declining Species and habitats*. [Online] Available at www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats (Accessed April 2016)

Parrish, B.B., Saville, A., Craig, R.E., Baxter, I.G., Priestley, R. (1959) Observations on herring spawning and larval distribution in the Firth of Clyde in 1958. *Journal of the Marine Biological Association UK* . 38:445-453.

Parsons, E.C.M., Warburton, C.A., Woods-Ballard, A., Hughes, A., Johnston, P. (2003). The value of conserving whales: the impacts of cetacean-related tourism on the economy of rural West Scotland. Aquatic Conservation. *Marine and Freshwater Ecosystems*. 13: 397-415.

Parsons, M., Mitchell, I., Butler, A., Ratcliffe, N., Frederiksen, M., Foster, S., and Reid, J. B. 2008. Seabirds as indicators of the marine environment. *ICES Journal of Marine Science*. 65: 1520–1526.

Payne R.D., Cook E.J., Macleod A., Brown S.F., (2014). Marine Biosecurity Planning – Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species. Report by SRSL Ltd. in conjunction with Robin Payne to the Firth of Clyde Forum and Scottish Natural Heritage. [Online] Available at www.clydemarineplan.scot/wp-content/uploads/2016/05/Guidance-Biosecurity-Planning.pdf (Accessed October 2016)

Peel Ports Clydeport (2015). Clyde Leisure Navigation Plan. [Online] Available at www.peelports.com/media/1370/8-clyde-leisure-navigation-guide-5th-edition.pdf (Accessed June 2016)

Peel Ports Clydeport (2016). Notice To Mariners No 51/16 River Clyde – Peel Ports Clydeport 2016 Dredging Campaign.

Peel Ports Group. Clydeport Port Regulations, Port Waste Management Procedure. [Online] Available at www.peelports.com/media/1368/6-gpf6-port-regulations-waste-manageme-emergency-procedures.pdf (Accessed June 2016)

Perruadin, F., (2015). Osbourne announces £500m for Faslane and says Corbyn threatens UK security. *The Guardian*. [Online] Available at www.theguardian.com/uk-news/2015/aug/31/faslane-naval-base-clyde-500m-jobs-george-osborne (Accessed June 2016)

Pierce S. (2005). The role of rays in the ecosystem. [Online] Available at www.mesa.edu.au/seaweek2005/pdf_senior/is03.pdf (Accessed May 2016)

Potts, T., Hastings, E. (2011). Marine Litter Issues, Impacts and Actions. *Marine Scotland*. [Online] Available at www.gov.scot/Resource/0040/00402421.pdf (Accessed June 2016) *Report No. 891*.

Robinson, S.P., Lepper, P. A. and Hazelwood, R.A. (2014). Good Practice Guide for Underwater Noise Measurement. National Physical Laboratory. Good Practice Guide No. 133. ISSN: 1368-6550.

Roman, J., Estes, J.A., Morissette, L., Smith, C., Costa, D., McCarthy, J., Nation, J.B., Nicol, S., Pershing, A., Smetacek, V. (2014). Whales as marine ecosystem engineers. *Frontiers in Ecology and the Environment*. 12: 377-385.

Ross, D., Thompson, K. R., and Donnelly, J.E. (2009). The State of the Clyde: Environment Baseline Report. SSMEI Clyde Pilot Project. [Online] Available at www.gov.scot/seag/seagDocs/SEA-00236/8087.pdf (Accessed June 2016)

Royal Navy. *Her Majesty's Naval Base Clyde*. [Online] Available at www.royalnavy.mod.uk/our-organisation/where-we-are/naval-base/clyde (Accessed June 2016)

Royal Society for the Protection of Birds. *About Ailsa Craig*. [Online] Available at www.rspb.org.uk/discoverandenjoynature/seenature/reserves/guide/a/ailsacraig/about.aspx (Accessed June 2016)

Royal Society for the Protection of Birds. *Horse Island Reserve*. [Online] Available at www.rspb.org.uk/discoverandenjoynature/seenature/reserves/guide/h/horseisland/index.aspx (Accessed April 2016)

Ryan, M. R. & Bailey, D. M. (2012) Trawling and Dredging in the Clyde Sea Area: History, Impacts and Prospects for Recovery. A report to the Sustainable Inshore Fisheries Trust. [Online] Available at www.sift-uk.org/media/file/RRyan%20&%20Bailey%20(2012),%20Trawling%20and%20Dredging%20in%20the%20Clyde%20Sea%20Area,pdf.pdf

Sabatino, A.D., O'Hara Murray, R.B., Hills, A., Speirs, D.C. and Heath M.R. (2016). Modelling sea level surges in the Firth of Clyde, a fjordic embayment in south-west Scotland. Natural Hazards. Natural Hazards doi:10.1007/s11069-016-2506-7

Sail Scotland (2015). *Scotland is World's Best to Sail*. [Online] Available at www.sailscotland.co.uk/news/posts/2015/scotland-is-world%E2%80%99s-best-to-sail/ (Accessed June 2016)

Scotland's Environment (2014). *Coastal waters information*. [Online] Available at www.environment.gov.scot/media/1174/water-coastal-waters.pdf (Accessed July 2015)

Scotland's Environment (b). *Bathing Waters Classification Application*. [Online] Available at www.environment.gov.scot/data-analysis-applications/bathing-waters/ (Accessed July 2015)

Scottish and Southern Energy (2016). Project Boosting electricity network from Kintyre to Huntserston completes on time and on budget. [Online] Available at http://sse.com/newsandviews/allarticles/2016/03/kintyre-to-hunterston-project-completes-on-time-and-on-budget/ (Accessed November 2016)

Scottish and Southern Energy Power Distribution. *Submarine Electricity Cables*. [Online] Available at http://news.ssepd.co.uk/submarinecables/information/ (Accessed June 2016)

Scottish Aquaculture Innovation Centre (2015a), SAIC Case Study: *Lumpfish Projects*. [Online] Available at http://scottishaquaculture.com/wp-content/uploads/2015/11/SAIC-lumpfish-projects-Nov-2015.pdf (Accessed June 2016)

Scottish Aquaculture Innovation Centre (2015b), *Wrasse project offers production boost to Scottish salmon industry*. [Online] Available at http://scottishaquaculture.com/wp-content/uploads/2015/05/SAIC-wrasse-project-May-2015.pdf. (Accessed April 2017)

Scottish Aquaculture Innovation Centre (2015c), *Salmon feed innovations set to boost Scotland's biggest food export market*. [Online] Available a http://scottishaquaculture.com/salmon-feed-innovations-set-to-boost-scotlands-biggest-food-export-market/. (Accessed Aptil 2017)

Scottish Canals (2015). Scottish Canals Environment Strategy 2015-2025. [Online] Available at www.scottishcanals.co.uk/corporate/wp-content/uploads/sites/2/2015/12/0-Introduction-and-Summary.pdf (Accessed August 2016)

Scottish Civic Trust (2016). Doors open Day [Online] Available at www.doorsopendays.org.uk/ (Accessed June 2016)

Scottish Development International (2011). Scottish Offshore Renewables Development Sites: West Coast Cluster.

Scottish Development International (2015) *West Coast Energy Ports*. [Online] Available at www.sdi.co.uk/knowledge-hub/articles/insight/scottish-energy-ports/west-coast-energy-ports (Accessed June 2016)

Scottish Energy News. *Scot-Govt sets up new River Clyde and West Coast oil and gas exploration group*. [Online] Available at www.scottishenergynews.com/scot-govt-sets-up-new-river-clyde-and-west-coast-oil-and-gas-exploration-group/ (Accessed June 2016)

Scottish Enterprise (2010). Sailing Tourism in Scotland. Final report prepared by Tourism Resource Company; EKOS and British Marine Federation [Online] Available at www.evaluationsOnline.org.uk/evaluations/Browse.do?ui=browse&action=show&id=369&taxonomy=TOU (Accessed August 2016)

Scottish Environment Protection Agency (2009). Clyde area management plan 2010-2015, Clyde Area Advisory Group. [Online] Available at www.sepa.org.uk/media/37206/clyde_area-management-plan.pdf (Accessed June 2016)

Scottish Environment Protection Agency (2013a). Disproportionate Cost Assessment for the Inner Clyde Estuary – draft report.

Scottish Environment Protection Agency (2013b). Managing Invasive Species in Scotland Water Environment. [Online] Available at www.sepa.org.uk/media/37362/managing-invasive-non-native-species_plan.pdf (Accessed August 2016)

Scottish Environment Protection Agency (2015a). *Bathing water profile Etterick Bay*. [Online] Available at www.sepa.org.uk/media/39489/ettrick-bay-bathing-water-profile.pdf (Accessed July 2015)

Scottish Environment Protection Agency (2015b). River Basin Management Plan for Scotland [Online] Available at www.sepa.org.uk/environment/water/river-basin-management-planning/publications/ (Accessed August 2016)

Scottish Environment Protection Agency (a). *Area Advisory Groups*. [Online] Available at www.sepa.org.uk/environment/water/river-basin-management-planning/who-is-involved-with-rbmp/area-advisory-groups/ (Accessed July 2015)

Scottish Environment Protection Agency (b). *Aquaculture*. [Online] Available at www.sepa.org.uk/regulations/water/aquaculture/ (Accessed June 2016)

Scottish Environment Protection Agency (c). *Bathing waters profiles* [Online] Available at http://apps.sepa.org.uk/bathingwaters/Profiles.aspx (Accessed July 2015)

Scottish Environment Protection Agency (d). *Responsible Authorities*. [Online] Available at www.sepa.org.uk/environment/water/river-basin-management-planning/who-is-involved-with-rbmp/responsible- authorities/ (Accessed June 2016)

Scottish Environment Protection Agency (e). *Scottish Pollutants Release Inventory*. [Online] Available at http://apps.sepa.org.uk/SPRIPA/Search/ByPollutant/Options.aspx (Accessed November 2015)

Scottish Environment Protection Agency (F), Water Classification Hub. [Online] Available at www.sepa.org.uk/data-visualisation/water-classification-hub/ (Accessed December 2017)

Scottish Environment Protection Agency (g). *Water Environment Hub*. [Online] Available at www.sepa.org.uk/data-visualisation/water-environment-hub/ (Accessed May 2016)

Scottish Environment Protection Agency (h). *Waterbody information data sheets*. [Online] Available at http://apps.sepa.org.uk/waterbodydatasheets/ (Accessed November 2015)

Scottish Environment Protection Agency (j). *What water regulations apply in Scotland*. [Online] Available at www.sepa.org.uk/regulations/water/ (Accessed June 2016)

Scottish Marine Animals Stranding Scheme. [Online] Available at www.strandings.org/ (Accessed April 2016)

Scottish Marine Wildlife Watching Code (2017) [Online] Available at: www.marinecode.org (Accessed April 2017)

Scottish Natural Heritage (2011). Sanda Island site management statement. [Online] Available at http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=1402 (Accessed July 2016)

Scottish Natural Heritage (2014a). Scottish Marine Protected Area Project, Data Confidence Assessment. Clyde Sea Sill Nature Conservation Marine Protected Area. [Online] Available at www.nature.scot/sites/default/files/2017-11/Marine%20Protected%20Area%20-%20Data%20confidence%20assessment%20-%20Clyde%20Sea%20Sill%20MPA.pdf (Accessed May 2016)

Scottish Natural Heritage (2014b). Site Condition Monitoring Management Note Inner Clyde, Redshank.

Scottish Natural Heritage (2014c). Site Condition Monitoring Management Note Inner Clyde.

Scottish Natural Heritage (2016a). *Sanda Island Site of Special Scientific Interest*. [Online] Available at http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=1402 (Accessed April 2016)

Scottish Natural Heritage (2016b). *Water Framework Directive*. [Online] Available at www.snh.gov.uk/protecting-scotlands-nature/protecting-nature/water-framework-directive/ (Accessed September 2016)

Scottish Natural Heritage (2016c). *Inner Clyde Site of Special Scientific Interest, site management statement* [Online] Available at http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=1701 (Accessed August 2016)

Scottish Natural Heritage (2016d). *Ailsa Craig Site of Special Scientific Interest*. [Online] Available at http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=22 (Accessed April 2016)

Scottish Natural Heritage (2016e). *Ailsa Craig Special Protection Area*. [Online] Available at http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8463 (Accessed April 2016)

Scottish Natural Heritage (2016f). *Inner Clyde Site of Special Scientific Interest*. [Online] Available at https://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=1701 (Accessed May 2016)

Scottish Natural Heritage (2016g). *Inner Clyde Special Protection Area*. [Online] Available at https://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8514 (Accessed May 2016)

Scottish Natural Heritage (a). *Clyde Sea Sill Marine Protected Area Summary*. [Online] Available at www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/marine-protected-areas/nature-conservation-31 (Accessed June 2015)

Scottish Natural Heritage (b). Confirmation of Southannan sands SSSI and Portencross woods SSSI: Economic concerns raised by Clydeport.

Scottish Natural Heritage (c). *South Arran Marine Protected Area Summary.* [Online] Available at www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/marine-protected-areas/nature-conservation-20 (Accessed June 2015)

Scottish Natural Heritage (d). *Upper Loch Fyne and Loch Goil Marine Protected Area Summary*. [Online] Available at www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/protected-areas/national-designations/marine-protected-areas/nature-conservation-22 (Accessed June 2015)

Scottish Sea Angling Conservation Network. *Scottish Shark Tagging Programme*. [Online] Available at www.ssacn.org/sstp (Accessed April 2016)

Scottish Statutory Instrument 2014 No 206, South Arran Marine Conservation Order 2014

Seafish (2014). June and October 2014 ICES advice – Commentary on discards (taken verbatim from ICES text). Covers: North Sea, Celtic Sea and West of Scotland, Baltic Sea. [Online] Available at www.seafish.org/media/Publications/SeafishSummary_2014ICESAdvice_Discards.pdf

Seasearch (2006). *Sanda Island, 05/06 July 2006 Summary Report* [Online] Available at www.seasearch.org.uk/downloads/Sanda.pdf (Accessed June 2015)

Secreteriat of the Stockholm Convention (2008). *Homepage* [Online] Available at http://chm.pops.int/default.aspx (Accessed May 2017)

Smith, C.J., Papadopoulou, K.N. & Diliberto, S. (2000). Impact of otter trawling on an eastern Mediterranean commercial trawl fishing ground. *ICES Journal of Marine Science*, 57: 1340-1351.

Speedie, C.D., Johnson, L. A., Witt, M.J. (2009). Basking Shark Hotspots on the West Coast of Scotland: Key sites, threats and implications for conservation of the species. *Scottish Natural Heritage Commissioned Report No.339*. [Online] Available at www.snh.org.uk/pdfs/publications/commissioned_reports/339.pdf (Accessed April 2016)

Stratoudakis, Y., Fryer, R. J., Cook R. M., Pierce G. J., Coull K. A. (2001). Fish bycatch and discarding in Nephrops trawlers in the Firth of Clyde (west of Scotland). *Aquatic Living Resources*. Volume 14, Issue 5, Pages 283-291.

Swann, R. (2013). Marine Protected Area and Marine Renewable - related black guillemot surveys. *Scottish Natural Heritage, Commissioned Report No. 612* [Online] Available at www.snh.org.uk/pdfs/publications/commissioned_reports/612.pdf (Accessed April 2016)

Tett, P., Gowan, R., Grantham, B., and jones, K. (1986). The phytoplankton ecology of the Firth of Clyde sea-lochs Striven and Fyne. *Proceedings of the Royal Society of Edinburgh* 90B, 223-238, 1986.

Tett, P., Kennaway, G. M., Boon, D., Mills, D.K., O'Connor, G.T., Walne, A.W., and Wilton, R. (2001) Optical monitoring of phytoplankton blooms in loch Striven, en eutrophic fjord. *International Journal of Remote Sensing*, 22, 339-358 , 2001.

The Chartered Institute of Logistics and Transport (2011). *The Tall Ship Races*. [Online] Available at www.ciltscotland.com/arcmr140911.php (Accessed June 2016)

The Clyde Yacht Clubs' Association. *Cruising and Moorings*. [Online] Available at www.cyca-Online.org.uk/cruising.asp (Accessed June 2016)

The Environmental Liability (Scotland) Regulations, 2009 [Online] Available at www.gov.scot/Topics/Environment/waste-and-pollution/Pollution-1/ELD/ELDRegs (Accessed August 2016)

The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2004. SSI 2004/276. [Online] Available at www.legislation.gov.uk/ssi/2004/276/contents/made (Accessed August 2016)

The Inshore Fishing (Prohibition on Fishing) (Lamlash Bay) (Scotland) Order 2008. [Online] Available at www.legislation.gov.uk/ssi/2008/317/contents/made (Accessed August 2016)

The Marine Life Information Network (2007). *Maerl*. [Online] Available at www.marlin.ac.uk/species/detail/1210 (Accessed April 2017)

The Marine Life Information Network (2016). *Zostera marina/angustifolia beds on lower shore or infralittoral clean or muddy sand*. [Online] Available at www.marlin.ac.uk/habitats/detail/257 (Accessed April 2017)

The Salmon Carcass Tagging (Scotland) Regulations 2016. [Online] Available at www.legislation.gov.uk/ssi/2016/116/contents/made (Accessed June 2016)

The Scotland River Basin District (Quality of Shellfish Water Protected Areas) (Scotland) Directions 2015 [Online] Available at www.gov.scot/Publications/2015/03/8135/0 (Accessed June2016)

The Scottish Government (2010). *Regional Location Guidance: Mull of Kintyre* [Online] Available at www.gov.scot/Publications/2010/09/17095123/8 (Accessed June 2016)

The Scottish Government (2010b). The economic impact

of wildlife tourism in Scotland. Prepared by International Centre for Tourism and Hospitality Research, Bournemouth University *Scottish Government Social research*. [Online] Available at www.gov.scot/Resource/Doc/311951/0098489.pdf (Accessed May 2016)

The Scottish Government (2012a). *Code of Practice on Non-Native Species* [Online] Available at www.gov.scot/Publications/2012/08/7367 (Accessed August 2016)

The Scottish Government (2012b). *Designated Bathing waters in Scotland*. [Online] Available at www.gov.scot/Topics/Environment/Water/15561/bathingwaters/designatedbathingwaters (Accessed July 2015)

The Scottish Government (2012c). Learning for sustainability. [Online] Available at www.gov.scot/Topics/Education/Schools/curriculum/ACE/OnePlanetSchools/LearningforSustainabilitreport (Accessed June 2016)

The Scottish Government (2012d). *Marine and Fisheries: Environmental Impacts*. [Online] Available at www.scotland.gov.uk/Topics/marine/Fish-Shellfish/18716/environmentalimpact (Accessed June 2016)

The Scottish Government (2014a). Implementing the Water Environment and Water Services (Scotland) Act 2003: Assessing Scotland's water environment – use of environmental standards, condition limits and classification schemes. [Online] Available at www.gov.scot/Resource/0045/00458328.pdf (Accessed July 2015)

The Scottish Government (2014b). Our place in time, The Historic environment strategy for Scotland. [Online] Available at www.gov.scot/Resource/0044/00445046.pdf (Accessed June 2016)

The Scottish Government (2014c). Scottish Draft Budget 2015-16. [Online] Available at www.gov.scot/Publications/2014/10/2706/14 (Accessed June 2016)

The Scottish Government (2015). *Marine Strategy Forum*. [Online] Available at www.gov.scot/Topics/marine/seamanagement/forum (Accessed June 2016)

The Scottish Government (2016a). Marine and Fisheries: *Marine Licensing in Scotland*. [Online] Available at www.gov.scot/Topics/marine/Licensing/marine (Accessed June 2016)

The Scottish Government (2016b). *Marine Scotland: Conservation measure to control the killing of wild salmon*. [Online] Available at www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence (Accessed June 2016)

The Scottish Government (2016c). *Sensitive areas under the Urban Waste Water Treatment Directive*. [Online] Available at www.gov.scot/Topics/Environment/Water/15561/UWWTDSensitiveAreas (Accessed October 2016)

The Scottish Government (2016d). *Shellfish Waters*. [Online] Available at www.gov.scot/Topics/Environment/Water/15561/ShellfishWaters (Accessed October 2016)

The Scottish Government (2016e). *Location maps for the Scotland River Basin District Shellfish Water Protected Areas* [Online] Available at www.gov.scot/Topics/Environment/Water/15561/ShellfishWaters/LocationMaps (Accessed October 2016)

The Scottish Salmon Producers Organisation. *Rural economies boosted by salmon farming industry* [Online] Available at http://scottishsalmon.co.uk/rural-economies-boosted-by-salmon-farming-industry (Accessed June 2016)

The Sea Fish (Prohibited Methods of Fishing) (Firth of Clyde) Order 2012 [Online] Available at www.legislation.gov.uk/ssi/2012/4/pdfs/ssi_20120004_en.pdf (Accessed August 2016)

The Urban Waste Water Treatment (Scotland) Amendment Regulations 2003 [Online] Available at www.legislation.gov.uk/ssi/2003/273/contents/made (Accessed October 2015)

Thurstan RH, Roberts CM (2010) Ecological meltdown in the Firth of Clyde, Scotland: Two centuries of change in a coastal marine ecosystem. Plos One 5:e11767

Tivy, J., (1986) The geography of the Estuary and Firth of Clyde. *Proceedings of the Royal Society of Edinburgh. Section B. Biological Sciences*. Volume 90.pp 7-23

Torrissen, O., Jones, S., Asche, F., Guttormsen, A., Skilbrei, O., Nilsen, F., Horsberg, T. and Jackson, D. (2013). Salmon lice - impact on wild salmonids and salmon aquaculture. J Fish Dis, 36(3), pp.171-194.

Townson, J.M., and Collar, R.H.F. Water movement and the simulation of storm surges in the Firth of Clyde. In: J.A. Allen *et al*., (eds.) The environment of the estuary and Firth of Clyde. Proceedings of the Symposium held at Glasgow, 1-2 October 1985. Proceedings of the Royal Society of Edinburgh, 90B: 85-96.

Transport Scotland (2012). Scottish Ferry Services: Ferries Plan 2013-2022. [Online] Available at www.transport.gov.scot/scottish-ferries-plan (Accessed June 2016)

Trendall, J.R., Bedford, G., Lawton, P., Davison, D.M., Fortune, F. and Saunders, G. (2010). Assessment of the spread of the non-native species Sargassum muticum: Solway Firth to the Ardnamurchan Peninsula. *Scottish Natural Heritage, Commissioned Report No. 347* (ROAME No. R07AC707).

Tuck, I.D., Hall, S.J., Robertson, M.R., Armstrong, E., Basford, D.J. (1998). Effects of physical trawling disturbance in a previously unfished sheltered Scottish sea loch. *Marine Ecology Progress Series*, 162, 227-242.

Turrell, W.R., Gibson, P., McAllister, G. and Bailey. N. (2016). Investigation of Reports of Semi-Pelagic White Fish in the Clyde, *Marine Scotland Science* Report 01/16. [Online] Available at www.gov.scot/Resource/0049/00497713.pdf (Accessed August 2016)

Tyack, P., Frisk, G., Boyd, I., Urban, E. and Seeyave S. (2015). International Quiet Ocean Experiment Plan. [Online] Available at www.scor-int.org/IQOE/IQOE_Science_Plan-Final.pdf (Accessed May 2016)

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. and Crawford-Avis, O.T. (2016). Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406.

UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report. UNEP-WCMC, Cambridge. [Online] Available at http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx (Accessed June 2016)

United Nations Environment Programme (2005). Marine Litter An analytical overview. [Online] Available at https://www.unenvironment.org/resources/report/marine-litter-analytical-overview (Accessed June 2016)

United Nations Environment Programme (2015). *Plastics in cosmetics factsheet*. [Online] Available at www.unenvironment.org/resources/report/plastics-cosmetics-are-we-polluting-environment-through-our-personal-care (Accessed August 2015)

University of Plymouth. *Plastics in the marine environment*. [Online] Available at www1.plymouth.ac.uk/research/mberc/Research/Marine%20pollution/Pages/Plastics.aspx (Accessed July 2016)

Urban Realm (2012). *Ben Arthur consultation launched*. [Online] Available at www.urbanrealm.com/news/3464/ben_arthur_resort_consultation_launched.html (Accessed August 2016)

Visit Scotland (2012). Ayrshire and Arran Regional Factsheet. [Online] Available at www.visitscotland.org/pdf/Ayrshire%20and%20Arran%20Regional%20Factsheet%20-Visitor%20Survey%202012%20final_pptx%20%5bRead-Only%5d.pdf (Accessed June 2016)

Waltho C., What has happened to our eider, *Clyde Breakers*. Summer 2011, Issue 12 [Online] Available at www.clydemarineplan.scot/wp-content/uploads/2016/06/Issue-11-Summer-2010.pdf (Accessed August 2016)

Wanless, S., Murray, S., Harris, M.P. & Evans, S. 2015. The Scottish gannet survey 2004. *Scottish Natural Heritage, Commissioned Report No. 628*. [Online] Available at www.snh.org.uk/pdfs/publications/commissioned_reports/628.pdf (Accessed August 2016)

Water Environment and Water Services (Scotland) Act 2003 [Online] Available at www.legislation.gov.uk/asp/2003/3/contents (Accessed June 2016)

Webster, L., Phillips, L.A., Russell, M., Dalgarno, E.J. (2005). Organic contaminants in the Firth of Clyde following the cessation of sewage sludge dumping. *Journal of Environmental monitoring*. 7, 1378-1387

Webster, L., Russell, M., Walsham, P., Robinson, C., Phillips, L.A., Hussy, I., Packer, G., Rose, M., Dalgarno, E.J., Devalla, S., Avery D., and Moffat, C. (2010). *Scottish Marine and Freshwater Science* Vol. 01 No 17, Regional Assessment of Hazardous Substances in Coastal and Offshore Marine Environments: 1999-2009. Available at www.gov.scot/resource/doc/295194/0104805.pdf (Accessed June 2016)

Weilgart, L. S., 2007, A Brief Review of Known Effects of Noise on Marine Mammals https://escholarship.org/uc/item/11m5g19h#page-1 (Accessed April 2017)

Welden, N. A. C. (2015), Microplastic pollution in the Clyde sea area: a study using the indicator species *Nephrops norvegicus*. PhD thesis, University of Glasgow.

Welden, N.A.C., and Cowie, P. R. (2016), Environment and gut morphology influence microplastic retention in langoustine, Nephrops norvegicus. *Environmental Pollution* 214 (2016) 859-865.

Western Link Project. [Online] Available at www.westernhvdclink.co.uk/ (Accessed June 2016)

Whitnich, C., and Belanger M., (2014). Climate change and human impacts on our oceans and seas – It's a sad time to be a marine species. *Journal of Marine Animals and Their Ecology*. Vol. 7, No 2. [Online] Available at www.oers.ca/journal/volume7/issue2/editorial.pdf (Accessed December 2016)

Wildlife and Natural Environment (Scotland) Act, 2011 [Online] Available at www.legislation.gov.uk/asp/2011/6/contents/enacted

Williams C. and Carpenter G. (2016). The Scottish Nephrops Fishery: Applying Social, Economic and Environmental Criteria. *New Economics Foundation working paper*. [Online] Available at http://b.3cdn.net/nefoundation/21d024b2ce367cac07_ybm6bd667.pdf (Accessed September 2016)

Williams, F., Eschen, R., Harris, A., Djeddour, D., Pratt, C., Shaw, R.S., Varia, S., Lamontagne-Godwin, J., Thomas, S. E., Murphy, S.T., The Economic Cost of Invasive Non-Native Species on Great Britain. *Centre for Agriculture and Biosciences International*. November 2010

Wood, H. (1960). The herring of the Clyde estuary. *Scottish Fisheries Bulletin* 13, 23

Zonfrillo, B. (2001). Ailsa Craig before and after the eradication of rats in 1991. *Ayrshire Bird Report*. [Online] Available at www.ayrshire-birding.org.uk/2001/01/ailsa_craig_before_and_after_the_eradication_of_rats_in_1991/ (Accessed April 2016)

9. Appendices

Appendix I
Coastal and marine ecosystem services

What are ecosystem services?

An ecosystem is a biological community of interacting living organisms and their physical environment. These are linked through nutrient cycling and energy flows such as food webs. Ecosystem services fit into the broader concept of the Ecosystem Based Approach (EBA) to environmental management. The EBA is about integrating conservation of natural resources with social and economic needs and objectives of society in a way that sustains the health of an ecosystem/s on which we depend. It is often described as a holistic approach which considers the needs of all users and attempts to balance these with sustainable development and exploitation of the ecosystem, including its goods and services.

Ecosystem services provide benefits to people from the ecological functions of healthy ecosystems. The UK NEA assessment defines them as *'the benefits provided by ecosystems that contribute to making human life both possible and worth living.'* The concept of Ecosystem Services is a way to discuss the dependence of humans on nature and what that means to us socially and economically.

These benefits can be categorised as tangible or intangible, and are further defined into the following descriptors: Provisioning services (raw materials- sometimes known as ecosystem goods), Regulating services, Cultural services and Supporting services.

Ecosystems do not necessarily provide all of these services at the same time. This publication from Natural England looks in detail at the ecosystem services provided by each kind of marine or coastal habitat: publications.naturalengland.org.uk/publication/301112.

The Marine Strategy Framework Directive requires member states to apply an ecosystem based approach to marine management in working towards attaining Good Environmental Status. The Marine Scotland Act and National Marine Plan are also aligned with the ecosystem approach, ensuring that the health of the marine environment in a central consideration in marine planning.

Why are ecosystem services important to Marine Planning?

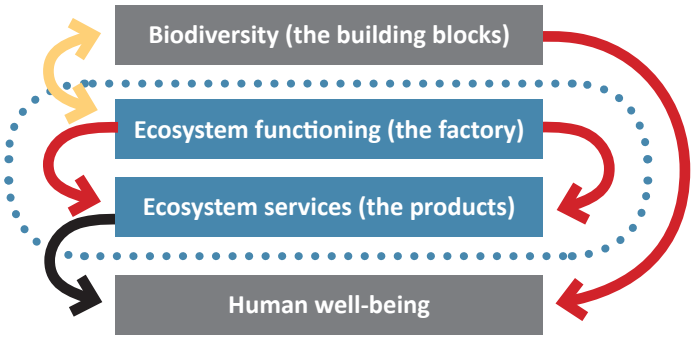
- **Indicator of ecosystem health** – Effective marine planning consists of monitoring pressures on the marine and coastal environment and regulating the human activities causing these pressures. There is a clear link between how well an ecosystem functions (or the health of the ecosystem) and the level of biodiversity associated with it. Degradation of systems undermines ecosystem resilience, which in turn reduces the ability of the ecosystem to provide ecosystem services, which ultimately affects human wellbeing.

This chart shows the goods and benefits that humans derive from coastal and marine natural processes

GOODS/BENEFITS DERIVED FROM COASTAL/MARINE NATURAL PROCESSES				
MARINE ECOSYSTEMS	**INTERMEDIATE SERVICES**	**FINAL ECOSYSTEM SERVICES**		**GOODS/BENEFITS**
Components e.g. • Habitats and species • Sea space • Sea water • Substratum Processes e.g. • Production • Decomposition • Food web dynamics • Ecological interactions • (inter- and intra-specific) • Hydrological processes • Geological processes • Evolutionary processes	• Primary production • Larval and gamete supply • Nutrient cycling • Water cycling • Formation of – species habitat – physical barriers – seascape • Biological control • Natural hazard regulation • Waste breakdown and detoxification • Carbon sequestration	• Fish and shellfish • Algae and seaweed • Ornamental materials • Genetic resources • Water supply • Climate regulation • Natural hazard protection • Clean water and sediments • Places and seascapes	Built human and social capital	• Food (wild, farmed) • Fresh feed (wild, farmed, bait) • Fertiliser and biofuels • Ornaments and aquaria • Medicines and blue biotechnology • Healthy climate • Prevention of coastal erosion • Sea defence • Waste burial/removal/ neutralisation • Tourism and nature watching • Spiritual and cultural well-being • Aesthetic benefits • Education, research • Health benefits

Source: UK National Ecosystem Assessment website http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx, accessed May 2015.

KEY: Supporting Regulating Provisioning Cultural



- **Managing change to a system** – Understanding ecosystem services can help us to understand or predict the implications of changes in ecosystems, and allow us to consider this in terms of their impact on humans. Ecosystem services therefore provide a method to monitor the impacts of ecosystem change and can also be used to identify triggers for intervention in management.
- **Considering the value of ecosystem services (natural capital)** – Degradation of an ecosystem service represents a loss of natural capital. Availability of natural capital is crucial to the functioning of an economy. In the past degradation of natural capital i.e. logging a forest, fisheries, extracting oil, has only been reflected in growth of national GDP. Economics is now starting to give a value to ecosystems goods and services. These values come from their role in supporting our lives, their cheapness, and our limited ability to replace them with human-engineered alternatives. Ecosystem services 'valuation' (in economic terms) allows there to be a reflection in markets of the benefits nature provides for people. However it should also be remembered that there are other ways of valuing ecosystem services.
- **Supports an Ecosystem Based Approach to management** – The ecosystem approach is a central principal of marine planning, and integrates the management of human activities with knowledge of ecosystem dynamics to achieve sustainable use of ecosystem good and services, while maintaining the health and resilience of an ecosystem.
- **Supports better management and planning choices** – Considering the value of ecosystem services is relevant to governance and planning purposes, as it allows more informed management choices, and allows for the influence of human behaviour. It also assists in setting planning priorities. It can be utilised in policy, project and programme appraisal and can help determine liability and compensation in environmental litigation. For example, the associated ecosystem services provided by Marine Protected areas and Priority Marine Features (such as improved system quality and local-scale provisioning) played an important role in guiding their implementation.

MARINE ECOSYSTEM SERVICES ACCORDING TO THE MILLENIUM ASSESSMENT CATEGORIES		
PROVISIONING SERVICES **Products obtained from ecosystems**	**REGULATING SERVICES** **Benefits obtained from the regulation of ecosystem processes**	**CULTURAL SERVICES** **Non-material benefits obtained from ecosystems**
• Food provision (fisheries and aquaculture) • Water storage and provision • Biotic materials • Fiber, timbres, and fuel	• Water purification • Air quality regulation • Flood/storm protection • Erosion control • Climate regulation • Weather regulation • Ocean nourishment • Life cycle maintenance • Biological regulation • Human disease control	• Spiritual and religious • Recreation and ecotourism • Aesthetic • Inspirational • Educational • Sense of place • Cultural heritage
SUPPORTING SERVICES		
• Photosynthesis • Primary production • Nutrient cycling • Resilience and resistance • Biologically mediated habitat		

Useful links

1. *The State of Europe's Seas* report covers an assessment of our seas at an EU wide scale, discusses the use of ecosystem based management, whether we are meeting the targets set under the MSFD and our use of the seas natural capital www.eea.europa.eu/publications/state-of-europes-seas
2. This Natural England report looks in detail at the ecosystem services provided by each kind of marine and coastal habitat, e.g. intertidal zones, maerl beds, salt marshes and estuarine habitats http://publications.naturalengland.org.uk/publication/301112
3. The UK National Ecosystem Assessment is the first analysis of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity http://uknea.unep-wcmc.org/
4. These two short videos provide further explanations of ecosystem services www.youtube.com/watch?v=wMIUglBligI and www.youtube.com/watch?v=oU9G2E_RYJo

Appendix II Nature conservation designations and Site Condition around the Clyde Marine Region

Marine and coastal species and habitats

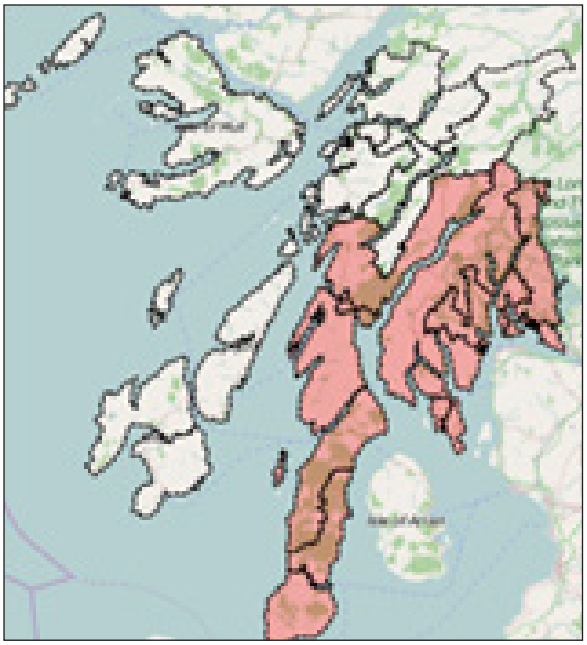
(includes any species directly reliant on a marine or coastal habitat)

NAME	DESIGNATION	MARINE/COASTAL FEATURE/S	SITE CONDITION	COMMENT
Clyde Sea Sill	Nature Conservation mpa	Marine Geomorphology – sand ribbon fields, sand banks and sand wave fields Fronts Black Guillemot Circalittoral and offshore sand and coarse sediment communities	N/A	Conservation Objective 'Conserve' for all features.
Ballantrae Shingle Beach	SSSI	Shingle	Unfavourable Declining	Unfavourable condition linked to nutrient enrichment through stock feeding, and both natural and anthropogenic influences affecting shingle dynamics. Management review in progress. Stock feeding has ceased.
Girvan to Ballantrae Coast Section	SSSI	Llondovery (stratigraphy)	Favourable Maintained	Ordovician Igneous feature previously considered in unfavourable condition due to illegal tipping and coastal defence works, however these have more recently been judged not to be affecting important exposures sufficiently to affect feature condition.
		Arenig-Llanvirn (stratigraphy)	Favourable Maintained	
		Ordovician Igneous (petrology)	Unfavourable No change	
		Caradoc – Ashgill (stratigraphy)	Favourable Maintained	
Sgavoch	SSSI	Ordovician Igneous (petrology)	Favourable Maintained	
Ailsa Craig	SPA	Seabird assemblage, breeding	Favourable Maintained	Declines in the three gull species at least partly reflect national declines and may result in part from reductions in food availability.
		Guillemot, breeding	Favourable Maintained	
		Kittiwake, breeding	Unfavourable Declining	
		Gannet, breeding	Favourable Maintained	
		Lesser black-backed gull, breeding	Unfavourable Declining	
		Herring gull, breeding	Unfavourable Declining	
	SSSI	Tertiary Igneous (petrology)	Favourable Maintained	
		Gannet, breeding	Favourable Maintained	
		Seabird colony, breeding	Favourable Maintained	
		Beetles	Favourable Maintained	
		Flies	Favourable Maintained	
Turnberry Lighthouse to Port Murray	SSSI	Old Red Sandstone Igneous (petrology	Favourable Maintained	
Turnberry Dunes	SSSI	Beetle assemblage	Favourable Maintained	
Maidens to Doonfoot		Carboniferous – Permian Igneous (petrology)	Favourable Maintained	
		Old Red Sandstone Igneous (petrology)	Favourable Maintained	
		Lower Carboniferous (stratigraphy)	Favourable Maintained	
		Maritime cliff	Favourable Maintained	
		Shingle	Favourable Maintained	
		Invertebrate assemblage	Favourable Maintained	

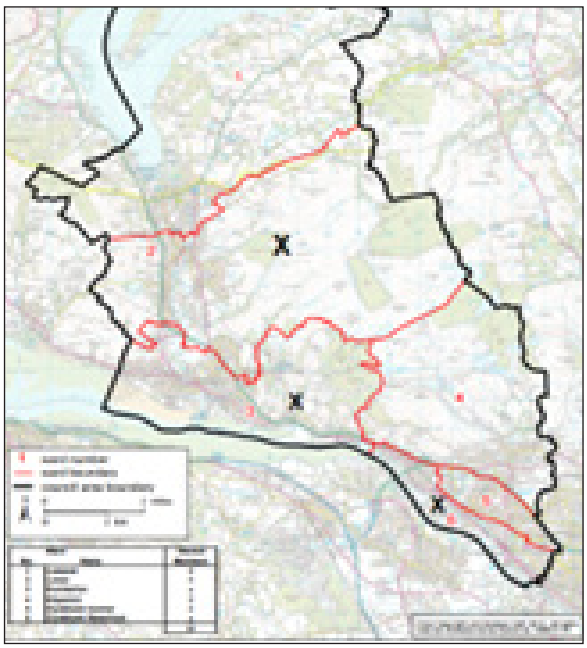
NAME	DESIGNATION	MARINE/COASTAL FEATURE/S	SITE CONDITION	COMMENT
Troon Golf Links and Foreshore	SSSI	Sand dunes	Unfavourable No change	Long-term lack of grazing has resulted in some loss of habitat diversity and encroachment by native and non-native scrub. Scrub management by the golf course has restored some dune grassland and further measures are under discussion.
Ballantrae Shingle Beach	SSSI	Shingle	Unfavourable Declining	Unfavourable condition linked to nutrient enrichment through stock feeding, and both natural and anthropogenic influences affecting shingle dynamics. Management review in progress. Stock feeding has ceased.
Western Gailes	SSSI	Invertebrate assemblage	Unfavourable No change	Long-term lack of grazing has resulted in some loss of habitat diversity in the sand dune habitats, and encroachment by non-native scrub. This has reduced the availability of habitat for sand dune insects. Strandline vegetation and insects that live on strandline vegetation and detritus have suffered losses due to unauthorised mechanical beach cleaning. Mechanical beach cleaning has now ceased.
		Sand dunes	Unfavourable No change	
Bogside Flats	SSSI	Saltmarsh	Favourable Maintained	Mudflat feature under review.
		Mudflats	Not yet monitored	
Ardrossan to Saltcoats Coast	SSSI	Carboniferous – Permian Igneous (petrology)	Favourable Maintained	
South Arran	Nature Conservation MPA	Burrowed mud	N/A	Conservation Objective 'Conserve' for all features except maerl beds which have the conservation objective 'enhance'.
		Maerl beds		
		Kelp and seaweed communities on sublittoral sediment		
		Ocean quahog aggregations		
		Seagrass beds		
		Maerl or coarse shell gravel with burrowing sea cucumbers		
		Shallow tide-swept coarse sands with burrowing bivalves		
South Coast of Arran	SSSI	Maritime cliff	Favourable Declining	Some decline in habitat condition has been attributed to localised under grazing and bracken encroachment. Management measures have recently been agreed in some areas to control bracken and promote grazing. The shingle vegetation has suffered minor damage from small-scale shingle extraction and vehicle use.
		Shingle	Unfavourable No change	
		Tertiary Igneous (petrology)	Favourable Maintained	
Dippin Head, Arran	SSSI	Tertiary Igneous (petrology)	Favourable Maintained	
Clauchlands Point – Corrygills, Arran	SSSI	Tertiary Igneous (petrology)	Favourable Declining	
		Saltmarsh	Favourable Maintained	
		Maritime cliff	Favourable Maintained	
Corrie Foreshore and Limestone Mines, Arran	SSSI	Upper Carboniferous (stratigraphy)	Favourable Maintained	
		Lower Carboniferous (stratigraphy)	Favourable Maintained	
		Permian – Triassic (stratigraphy	Favourable Maintained	
Laggan, Arran	SSSI	Palaeozoic Palaeobotany	Favourable Maintained	
North Newton Shore, Arran	SSSI	Non-marine Devonian (stratigraphy)	Favourable Maintained	
Drumadoon to Tormore, Arran	SSSI	Permian – Triassic (stratigraphy)	Favourable Maintained	
		Tertiary Igneous (petrology)	Favourable Maintained	
Southannan Sands	SSSI	Sandflats	No site condition New site (previously part of Portencross Coast SSSI)	Within area zoned for industrial development around Hunterston.
Kames Bay, Cumbrae	SSSI	Sandflats	No site condition	Feature status under review
Ballochmartin Bay, Cumbrae	SSSI	Sandflats	No site condition	Feature status under review

NAME	DESIGNATION	MARINE/COASTAL FEATURE/S	SITE CONDITION	COMMENT
Largs Coast Section	SSSI	Non-marine Devonian (stratigraphy)	Favourable Maintained	
Inner Clyde	SPA	Redshank, non-breeding	Favourable Maintained	
	SSSI	Saltmarsh	Favourable Maintained	
		Cormorant, non-breeding	Unfavourable Declining	
		Oystercatcher, non-breeding	Favourable Recovered	
		Red-breasted merganser, non-breeding	Favourable Maintained	
		Redshank, non-breeding	Favourable Maintained	
		Goldeneye, non-breeding	Favourable Maintained	
		Eider, non-breeding	Favourable Maintained	
		Red-throated diver, non-breeding	Favourable Maintained	
	Ramsar	Redshank, non-breeding	Favourable Maintained	
Rhu Point	SSSI	Quaternary of Scotland	Favourable Maintained	
Ruel Estuary	SSSI	Saltmarsh (and other non-marine)	Favourable Maintained	
North End of Bute	SSSI	Breeding bird assemblage including red-throated diver	Favourable Maintained	
Upper Loch Fyne & Loch Goil	Nature Conservation MPA	Ocean quahog aggregations	N/A	Conservation Objective 'Conserve' for all features except flame shell beds where the conservation objective is 'enhance'.
		Burrowed mud		
		Flame shell beds		
		Horse mussel beds		
		Sublittoral mud and specific mixed sediment communities		
Strone Point, North Loch Fyne	SSSI	Dalradian, structural and metamorphic geology	Favourable Declining	
Sanda Islands	SSSI	Maritime cliff	Favourable Declining	For birds - 25% or more population decline not due to local issues but part of UK issue.
		Black guillemot, breeding	Favourable Maintained	
		Puffin, breeding	Unfavourable Declining	
		Shag, breeding	Unfavourable Declining	
		Great black-backed gull, breeding	Favourable Recovered	
		Fulmar, breeding	Favourable Maintained	
		Storm petrel, breeding	Favourable Maintained	
		Cormorant, breeding	Favourable Maintained	
		Kittiwake, breeding	Favourable Maintained	
		Guillemot, breeding	Favourable Maintained	
		Razorbill, breeding	Favourable Maintained	
		Manx shearwater, breeding	Favourable Maintained	

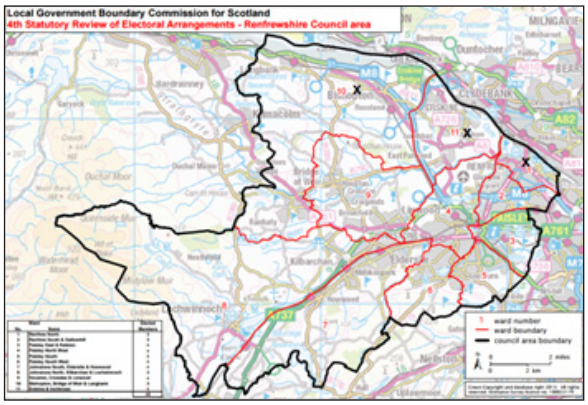
Appendix III
Coastal Wards used for Productive Section – Clyde Marine Region



Argyll and Bute includes CAS wards: 04C23 Ardenslate; 04C34 Arrochar, Luss, Arden and Ardenconnel; 04C25 Auchamore and Innellan; 04C19 Bute Central; 04C18 Bute North; 04C20 Bute South; 04C02 Campbeltown Central; 04C36 Cardross; 04C07 Craignish – Glenaray; 04C28 East Central Helensburgh; 04C03 East Central Kintyre; 04C21 East Lochfyne; 04C33 Garelochhead and Cove; 04C29 Helensburgh Central; 04C27 Helensburgh East; 04C30 Helensburgh North; 04C31 Helensburgh West; 04C26 Holy Loch; 04C22 Kirn and Hunter's Quay; 04C05 Knapdale; 04C06 Lochgilphead; 04C24 Milton; 04C04 North and West Kintyre; 04C35 Roseneath, Clynder and Kilcreggan; 04C01 South Kintyre; 04C32 West Helensburgh and Rhu.



West Dunbartonshire includes the Multimember wards of 2 Leven; 3 Dumbarton; 6 Clyde Waterfront.



Glasgow includes the Multimember wards 13 Garscadden/Scotstounhill; 12 Partick West; 10 Anderston/City; 9 Calton; 8 Southside Central; 5 Govan.

South Lanarkshire includes the Multimember Ward 12 Rutherglen Central and North.



Renfrewshire includes the Multimember Wards of 1 Renfrew north; 10 Bishopton, Bridge of Weir and Langbank; 11 Erskine and Inchinnan.

All wards from Inverclyde, North Ayrshire and South Ayrshire were included.



Common seals in the Clyde © SARAH BROWN

Clyde Marine Planning Partnership

Clyde Marine Planning Partnership
Caspian House
2 Mariner Ct, 8 South Ave
Clydebank Business Park
Clydebank G81 2NR

www.clydemarineplan.scot
email: info@clydemarineplan.scot
twitter: @clydemarineplan
tel: 0131 314 6782