Aquaculture Steering Group EGs Resolutions

MA Groups approved in 2018

Working Group on Scenario Planning on Aquaculture (WGSPA)

2018/MA2/ASG01 A **Working Group on Scenario Planning on Aquaculture (WGSPA)**, chaired by Ben **Halpern**, USA, will be established and will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	8–10 November	ICES HQ, Copenhagen, Denmark	Interim report by 1 March	Seminar/ scoping meeting
Year 2019	7-8 September	Gothenburg, Sweden	Interim report by 30 November	
Year 2020	15-16 October	By correspondence	Interim report by 13 November	
Year 2021			Final report by Date	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Integrate experts in marine spacial analysis, economic impact models, environmental carring capacity and growth models, social systems, seafood/food security, business and other displines to create a prototype Atlas of Marine Aquaculture Potential for one region in the ICES area.	Governments have a need to understand the potential for sustainable marine aquaculture development in their political jursdictions. This is a new cross disciplinary area of work for ICES and requires identification and engagement of diverse experts. The Working Group will integrate discussions on current and future projections for marine aquaculture of seaweed, shellfish and finfish based on current and future technologies that include environmental, economic, and social constraints and needs and apply them to one region in the ICES area. The structure for this ToR will be provided by marine spacial analysis.	5.5, 5.7, 5.8	year 1,2 and 3 (2018, 2019 and 2020)	2019 – Brief report from working group seminar to kick off this new area of work for ICES. Abstracts and presentations available. 2019-20 – Develop a format for Atlas of Marine Aquaculture Potential using one region in the ICES area as an example, Format will take into account environmental, social and economic constraints. Publish in peer review journal or as ICES report. 2020 - Integrate with scenario planning (ToR b and c)
b	A review of the application of Scenario planning for aquaculture, Identification of knowledge gaps and recommendations for research	There is a need to determine the state of the art in scenario planning and how this has been applied in aquaculture. It can be done through an exhaustive literature revision including “grey” material and the results of previous aquaculture scenarios. In addition to reviewing the use	5.5, 6.1, 7.1	Yr 1 & 2. (2018, 2019)	To be reported on as a review and position paper.

		and application of scenario planning in other areas. The review will include the identification of knowledge needs and priorities in this new area and develop a coherent proposal for research and funding.			
c	Develop Scenario plan for one region in the ICES area (potentially the same region as choosen for the first atlas)	Encourage the development of one international project on scenario planning to complement the work under ToR a. Will require planning in yr 2 from the position paper, identification of potential resourcing and proposal development.	5.5, 6.1, 7.1	Yr 3-4 (2020-2021)	To be reported scenario planning for aquaculture.
d	Integration of Scenario planning and Atlas approaches to one product capable of communicating the environmental, economic and social options of marine aquaculture development in one region in the ICES area.	Encourage the development of one international project building on the products and techniques developed in ToR a, b and c to an example of a complete science-based analysis of the potenital and consequences of marine aquaculture development for one region in the ICES area .	5.5, 5.7 ,7.6	Yr 3-4 (2020-2021)	2020 – Submit proposal for Viewpoint to SCICOM/ACOM 2021 - Publish ICES Viewpoint for focus region.

Summary of the Work Plan

Year 1	Hold a seminar as part of the first Working Group meeting to establish this area of science and identify additional experts to join the WG.
Year 2	Develop an outline for an Atlas of marine aquaculture potential for one region in the ICES area. Provide a review and position paper on Scenario Planning in aquaculture together with knowledge gaps and recommendations for research.
Year 3	Further ToR to be developed out of the position paper. To include a scenario to be chosen in yr 2. Expand and improve Atlas to an opperational level for one example region in the ICES area .
Year 4	Integrate two approaches. International cooperation through a research project on aquaculture potential analysis. Publish Viewpoint for focal region.

Supporting information

Priority	There is a high priority for scientifically informed planning for marine aquaculture. This has been successfully applied in other areas by the use of scenario planning where potential multiple future scenarios are possible that provide uncertainty regarding the stability of policies or conditions and where adaptation is likely to be required and yet unpredictable. Information from multiple points of view (economic, environmental, social, geographical, oceanographical and so on) that is both general and specific to a place is needed for planning to be meaningful. There are now some marine spacial analysis approaches that allow potential to be analized for specific locations (see Kapetsky et al 2013, Gentry et al 2017 and Lester et al 2018) e.g. not only what could happen, but where, what inputs would be needed and what outputs could be expected. While there has been some application of scenario

	planning and spacial analysis in aquaculture this has yet to be evaluated in scientifc terms and applied in a consistant way. For example, scenario planning has been used in evaluating investment opportunities and predicting returns on investment but not in a particularly robust way. It is proposed that the working group develop the methodologies for spacial analysis and scenario planning for Aquaculture in the ICES area that enables: 1. Researchers to develop realistic options for industry development and to evaluate the impact of different policies. 2. Future Experts Groups to further develop tools to evaluate resilience to environmental change, diseases and parasites, resouce needs, implications of managemnet decisions and so on focused on a specific geography. 2. Governments and populations from a variety of jursdictions to understand the implications and options of marine aquaculture development in their areas. 4. Industry and local populations to have a discription of the production potential in a format that will allow meaningful econmic impact modelling for a specific jurisdiction. This is not about predicting the future but evaluating what different future scenarios mean, trade-offs among scenarios and for example, how scenarios interact with the different policies, changes and demands likely to happen in the future, within a realistic place-based context.
Resource requirements	There is limited current work in this area and part of the ToR are to evaluate the requirements. It is envisaged that an international project will be developed by the working group which could consider how to cooperate on currently funded research but more likely need to develop and seek resources to work on specific scenarios. Modelling and GIS capacity could be limiting and it will be important to engage other relevant ICES experts in this area and bring together the knowledge and technical expertise.
Participants	This is a new group and expected attendance is 15-20 members.
Secretariat facilities	Standard secretarial support. Meeting room at ICES HQ.
Financial	No financial implications envisaged for ICES.
Linkages to ACOM and groups under ACOM	This project sets the stage for future advice products from ICES as governments need to manage aquaculture development based upon knowledge of the economic and social benefits and risks.
Linkages to other committee or groups	There is a very close working relationship with all the groups of the Aquaculture Steering Group. We will seek to form links with the Working Group on Socio-Economic Dimensions of Aquaculture (WGSEDA) Working Group on Pathology and Diseases of Marine Organisms (WGPDMO), Working Group on Application of Genetics in Fisheries andAquaculture (WGAGFA) and proposed Working Groups on Environmental Interactions of Aquaculture (WGEIA) and Ecological Carrying Capacity in Aquaculture (WGECCA).
Linkages to other organizations	EFARO, EATiP, Industry – aquaculture businesses and producer organisations, marine mangement organisations, EAS (European Aquaculture Society), WAS, NOAA, DFO.

Working Group on Environmental Interactions of Aquaculture (WGEIA)

2018/MA2/ASG02 A **Working Group on Environmental Interactions of Aquaculture (WGEIA)**, chaired by Terje Svåsand, Norway, will be established and will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	10–14 December	ICES HQ, Copenhagen, Denmark	Interim report by 1 March	
Year 2019	3–5 September	Stirling, Scotland	Interim report by 30 November	
Year 2020	5-7 May	By correspondence	Final report by 16 June	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Review of laws and regulatory standards for monitoring and managing environmental impacts of marine aquaculture, and the corresponding thresholds values established by contributing ICES countries with the aim of improving current management options.	Understanding environmental impacts of aquaculture and how they meet, or do not meet legal environmental mandates is limiting further sustainable growth. First, an understanding of the legal environmental drivers which impact marine aquaculture and how they differ among ICES countries is needed. Consistent and transparent science-based management tools to ensure compliance with environmental laws and to build public confidence in the aquaculture industry are needed. Tools based on models, indicators, threshold values and/or monitoring programmes are needed for impacts requiring management in the majority of ICES countries. Examples may include: • Spread of pathogens, incl. pest management • Escapes and genetic interactions • Nutrients and organic loads • Habitat and biodiversity interactions • Animal welfare What use do ICES countries currently make of these management tools and where is improvement possible?	5.6, 7.4	years 1 & 2	Outputs of benchmarking review presented in 2018 & 2019 interim reports.
b	Recommendations for prioritized research to elucidate knowledge gaps in aquaculture-environment interactions needed for effective industry regulation.	There is a need to move beyond the letter of environmental laws to address the spirit of environmental responsibility. The number of studies and reviews in the fields of aquaculture and environment interactions have been increasing during the last 10-20 years, but still there are many knowledge gaps. In addition, there is need	2.1, 5.6	1&2 year	A prioritized list of current paradigms related to aquaculture/environment interactions for all types of marine aquaculture and research to elucidate knowledge gaps. The

		to synthesize what is known in some areas into working paradigms and list key environmental interactions in a matrix of species type by production system. To develop the field further, we need continued focus on international cooperation, within the priority thematic areas.			report will include suggestions for project proposals and/or ToR for new EGs. Outputs will form part of the interim report in 2019 and final report in 2020
c	Recommendations for risk and benefit assessment methods and models to assess trade-offs associated with aquaculture scenarios	Methods for risk and benefit assessments are not very well developed for marine ecosystems and aquaculture. Building on results from ToR b, WGEIA aims to review and recommend methods and models for assessments including environmental impacts of aquaculture production.	2.1, 5.6, 5.8	year 2&3	Final report in 2020 and an ICES viewpoint and/ or publication covering ToR a, b and c with highlighted examples.
d	International cooperation	WGEIA aims to encourage development of at least one international project according to the prioritized research areas in ToR b or c	NA	year 3	Report status at ASC 2020/final report 2020

Summary of the Work Plan

Year 1	Two of reference a (Benchmarking legal standards and monitoring) and b (prioritized terms research) will be initiated in the starting year
Year 2	Terms of reference a) and b) will be further developed and reported. and reference c (Assessment methods and models) will be initiated.
Year 3	Terms of reference c and d (International cooperation) will be reported. Synthesis publication will be produced.

Supporting information

Priority	The current activities of this Group will continue to lead ICES into issues related to aquaculture including elucidating the legal structure under which the environmental interactions of aquaculture are managed in different ICES countries. Scientific work on ecosystem interactions will lay the scientific foundation for further sustainable aquaculture growth to meet or surpass legal requirements. Consequently, these activities are considered to have a high priority.
Resource requirements	Hosting of the first meeting in Copenhagen.
Participants	The Group will be established of 15-25 experts of aquaculture - environment interactions, regulators, legal experts and others
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	This project sets the stage for future advice products from ICES as governments need to manage aquaculture development based upon the requirements of various environmental laws and regulations. Viewpoint documents will provide an example of the types of advice products ICES can produce for aquaculture.
Linkages to other committees or groups	There is a very close working relationship with all the groups of the Aquaculture Steering Group. We will seek to form links with the Working Group on Socio-Economic Dimensions of Aquaculture (WGSEDA) Working Group on Pathology and Diseases of Marine Organisms (WGPDMO), Working Group on Application of Genetics in Fisheries and Mariculture (WGAGFM), Working Group on Scenario Planning on Aquaculture (WGSPAQ), and Working Group on Ecological Carrying Capacity in Aquaculture (WGECCA). It is also very relevant to the Working Groups, WGHABD, WGITMO, WG Benthic Ecology

Linkages to other organizations	OSPAR, NASCO, EAFP, EFARO, EATiP, FAO, EU (EUMAP regulation), NOAA, DFO.

Working Group on Pathology and Diseases of Marine Organisms (WGPDMO)

2018/MA2/ASG03 The **Working Group on Pathology and Diseases of Marine Organisms** (WGPDMO), chaired by Ryan Carnegie, USA, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	5–9 February	Copenhagen, Denmark	Interim report by 1 April	
Year 2020	4-7 February	Reykjavik, Iceland	Interim report by 17 February	
Year 2021	TBD February	Tenerife, Spain	Final report by 1 April to ACOM and SCICOM	Election of new chair

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Summarize new and emerging disease trends in wild and cultured fish, molluscs and crustaceans based on national reports	New disease conditions and trends in diseases of wild and cultured marine organisms will be reviewed. This is an annual, ongoing ToR for WGPDMO and will provide information for ToRs b-i	5.6	3 years	Summary in annual reports
b	Deliver leaflets on pathology and diseases of marine organisms	A number of ICES publications currently in preparation will be reviewed by WGPDMO. This is an ongoing, annual ToR	5.6	3 Years	Publication in ICES Identification Leaflets for Diseases and Parasites of Fish and Shellfish
c	Synthesize information on the spread and impact of *Bonamia ostreae* in flat oysters in the ICES area	*Bonamia ostreae* is a major pathogen of European flat oysters that has expanded its range in recent years. The present distribution, recent trends in parasite prevalence and infection intensity, and the effectiveness of contemporary management strategies will be summarized, with perspective on the related species *Bonamia exitiosa*, recently documented in oysters from some ICES member countries. This is a continuing ToR from the previous cycle	2.1, 5.6	2 Years	Publication in the peer-reviewed literature

d	Summarise the role of *Vibrio* pathogens contributing to mortalities in shellfish aquaculture and to seafood-associated disease risks in humans	*Vibrio* bacteria have long been associated with larval production problems in shellfish hatcheries, but the potential impacts of vibriosis in sub-market and market-sized Pacific oysters in European production areas has become an important emerging concern. Likewise, concerm about *Vibrio* risks to human consumers has also grown. This ToR will synthesize the current knowledge on *Vibrio* highlight critical gaps in our understanding of these species. This is a continuing ToR from the previous cycle	2.1, 5.6, 5.8	3 Years	Peer-reviewed journal article
e	Synthesize perspective on complex gill disease (CGD) in salmon and identify strategies for mitigation	Complex gill disease (CGD) is an emergent, economically important health issue that limits productivity in salmon aquaculture. CGD is believed to results from a complex interaction of environmental, host and infectious factors. The performance and survival of affected fish is influenced by the severity of the gill lesions. Environmental factors associated with CGD include exposure to harmful algae, jellyfish, low dissolved oxygen and elevated water temperatures. Relevant infectious agents include Atlantic salmon paramyxovirus, salmonid gill poxvirus, *Candidatus Piscichlamydia salmonis* and the microsporidian *Desmozoon lepeophtherii*. This ToR will describe the causes and consequences of CGD in salmon aquaculture in ICES member countries and identify mitigation strategies in the context of climate change	5.6, 6.1	3 Years	Peer-reviewed journal article
f	Integrate perspective on emerging health issues affecting wild salmon populations of Baltic member countries	National reporting in recent years has revealed an array of disease concerns in Baltic salmon populations, with elevated mortality being widely reported. Determining similarities and differences in patterns of disease and mortality and gaining insight into potential aetiological factors is urgent for effective management of salmon health in the region. This ToR will involve coordination among representatives of member countries around the Baltic to	5.6, 6.1	3 Years	Peer-reviewed journal article

		consolidate information concerning Baltic salmon health problems and identify strategies for better understanding and mitigating them			
g	Identify strategies to prevent further spread of ostreid herpesvirus OsHV-1 within the ICES region and mitigate impacts where it occurs	The emergence of 'microvar' variants of the ostreid herpesvirus OsHV-1, which have caused significant Pacific oyster mortality from Europe to Australia and New Zealand, is the most significant mollusc disease development in decades. Preventing further spread of these pathogens and mitigating damage in affected areas are twin challenges of OsHV-1 management today. This ToR will aim to identify strategies to prevent OsHV-1 microvariant dispersal to North American member countries, presently free of the microvars, and to maintain commercial production should an epizootic emerge. It will also more broadly consider the OsHV-1 microvar emergence as a case study in response to emerging viral and bacterial pathogens, to identify general strategies for future responses and potential pitfalls with regard to their application	5.6, 6.1	3 Years	ICES Journal of Marine Science article
h	Complete assessment and refine application of the Fish Disease Index (FDI)	Results of assessment of the FDI will be reviewed, and data harmonisation and quality assurance will be addressed as refined guidelines are produced for FDI application	5.6	3 Years	Publication in final WGPDMO report
i	Provide expert knowledge and management advice on fish and shellfish diseases, if requested, and related data to the ICES Data Centre	This is an annual ToR in compliance with a requests from the ICES Data Centre	5.6, 6.1	3 Years	Ad hoc reports

Summary of the Work Plan

Year 1	Three terms of reference (a, b and i) are annual tasks and form a core part of WGPDMO activities. New fish and shellfish disease leaflets will also be prepared under ToR b in each of the three years. A working draft concerning Bonamia ostreae in flat oysters (ToR c) will be developed, and work will commence on synthesis related to Vibrio pathogens in shellfish, complex gill disease in salmon, Baltic salmon health, and OsHV-1 in oysters (ToRs d-g). Results of the Fish Disease Index assessment will be reviewed (ToR h).
Year 2	A final draft manuscript on B. ostreae (ToR c) will be produced and discussed. A Workshop on Emerging Mollusc Pathogens (WKEMOP) including OsHV-1 (ToR g) will be conducted with a

	draft report produced for discussion. Terms of reference d-f will be developed as working draft manuscripts.
Year 3	Final draft reports on B. ostreae (ToR c), Vibrio pathogens (ToR d), complex gill disease (ToR e), Baltic salmon health (ToR f), OsHV-1 and emerging mollusc pathogens (ToR g), and the Fish Disease Index (ToR h) will be produced and discussed.

Supporting information

Priority	The current activities of this Group will provide key perspective on disease impacts on fisheries and aquaculture, and on potential avenues for mitigation to promote sustainable industries. It will lead ICES into new areas of consideration with regard to aquaculture-environment interactions. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 10–15 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	ACOM/ SCICOM group
Linkages to other committees or groups	There are clear linkages to the groups of ASG, WGSEDA and WGAGFA, that we will seek to develop.
Linkages to other organizations	OSPAR, HELCOM, EAFP, OIE

Stakeholder Workshop on the Value of Genetic and Genomic Tools for identifying species in mixed landings, fish products and by-products (WKGenoTools)

2018/2/ASG05 A **Stakeholder Workshop on the Value of Genetic and Genomic Tools for identifying species in mixed landings, fish products and by-products (WKGenoTools)**, chaired by Claudia Junge*, Norway, and Jann Martinsohn*, Italy, will meet in Brussels, Belgium, 5-6 February 2020 to:

a) Review and consider recent technology developments in genetics and genomics that can support the identification of species in mixed landings, fish products and by-products in the context of fisheries management and policy needs such as mixed-stock fisheries management, stock identification, or the EU Landing Obligation;

b) Review and consider end-user needs and discuss genetic and genomic approaches in the light of feasibility, added value and cost-efficiency.

WKGenoTools will report by 1 of April 2020 (via Aquaculture SG) for the attention of ACOM and SCICOM.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem effects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority.

Scientific justification	Fisheries management, but also the implementation of rules along the supply chain, rely to a great extent on the identificatiuon on fish species and also the geographical origin, including on processed products. Examples include the management of mixed fisheries, the identification of stocks and stock boundaries and the reduction of discards. It is generally acknowledged that discarding is a wasteful practice, impacting the endeavour of moving towards sustainable fisheries. This is why a number of countries and the European Union attempt to tackle the issue of discarding through dedicated fisheries management measures. To this end, the European Union is currently implementing the Landing Obligation. However, the complexity inherent to the present fishing practices confronts both the industry and authorities that are mandated with monitoring and controlling with unprecedented challenges. To support the advancement of mixed fisheries managment, the stock identification and the reduction of discards, opportunities offered through the recent progress in genetic and genomic technological and analytical applications should be tapped into. However, it is necessary to ensure a mutual understanding between scientists and end-users to identify end-user needs and the most critical issues to be addressed, and to clarify which issues relevant for the Landing Obligation can be tackled by genetic approaches and also to render limits of such approaches evident. Based on an initial assessment, carried out by the WGAGFA and first documented feedback by stakeholders, this workshop will help to clarify to what extent genetic and genomic approaches can support the aforementioned key components of fisheries management, and which are the necessary steps to enable a successful technology and knowledge transfer.
Resource requirements	Resources supporting this WK will be identified. Additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	This WK will be attended by some 20–25 participants.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	Support and advice from SCICOM and ACOM would be appreciated.
Linkages to other committee or groups	Not applicable
Linkages to other organizations	ICES WGAGFA members, European Commission DG MARE, The Norwegian Directora of Fisheries, Representatives of Regional Advisory Councils (Commission Delegated Regulation (EU) 2017/1575), FAO.

Working Group on Open Ocean Aquaculture (WGOOA)

2018/MA2/ASG06 A **Working Group on Open Ocean Aquaculture (WGOOA)**, chaired by Bela H. Buck, Germany, will be established and will work on ToRs and generate deliverables as listed in the table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	20 - 22 March	Copenhagen	Interim report by 1 July	Constitutive/scoping meeting
Year 2020	26-27 May	By correspondence	Interim report by 7 June	
Year 2021	TBD May	Portland, Maine, USA	Final report by Date	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Identify and develop descriptions and guidelines for various types of open ocean aquaculture systems and their characteristics needed to develop an ecosystem approach for sustainable management of open ocean aquaculture including methods for assessing potential interactions and synergies between open ocean aquaculture operations and the wider socio-ecological-system (SES).	The aim of this ToR is to support authorities and/or the work of extension agents who work at the interface between decision-making, research and business, helping investors and agencies understand, structure and articulate types of open ocean aquaculture and develop objective management tools. A description of various types of offshore aquaculture including where these types of aquaculture interact with legal or cultural values associated with the environment is needed to understand where and what types of offshore aquaculture are appropriate in various ICES regions.	5.7 – 5.8	Yr 1 & 2. 2019, 2020	To be reported on as a review paper.
b	Identify risk and mitigation measures for potential interactions between open ocean aquaculture operations and structures and protected species, such as marine mammals and turtles.	The aim of this ToR is to calculate risks of entanglement of whales, seals and turtles by offshore aquaculture structures and identify structural (engineering) and management methods to reduce potential negative impacts. Mitigation can be of technical (e.g. system design), ecosystem, environment and/or management nature.	5.7 – 5.8	Yr 1 & 2. 2019, 2020	Organise and conduct a workshop to develop as an ICES Viewpoint.
c	Collate existing information relevant for open ocean aquaculture on a regional sea-basin system level to identify site-specific opportunities for different types of open ocean aquaculture in the ICES area.	Using information from ToR a and b, this ToR will help to identify space in the ICES region that will support various types and combinations of offshore aquaculture from an oceanographic and environmental point of view. This ToR will	5.7 – 5.8	Yr 2-3. 2020-2021	To be reported on as a position paper.

		develop a framework to evaluate potential which can be used in different basins. This evaluation will also articulate knowledge gaps, and be designed to provide data that can be inputs to economic impact and optimization models.			
d	Collect and summarize data on large scale open ocean aquaculture.	New systems for large scale offshore aquaculture are now coming on line in Norway and Asia. How these perform environmentally, structurally and economically needs to be documented and evaluated to identify and articulate the potential of these new large systems to significantly increase seafood production globally.	5.7 – 5.8	Yr 1-3. 2020-2021	Annual reports with a position paper in year 3.

Summary of the Work Plan

Year 1	Focus on ToR a and d. Develop descriptions of different types of offshore aquaculture including new large-scale fish systems. Organize workshop for ToR b.
Year 2	Publish review paper from ToR a and turn over Viewpoint from ToR b for external review. Develop framework to analyze basins and apply to a test case. Draft paper.
Year 3	Publish papers on framework for basin development and analysis of large-scale systems.

Supporting information

Priority	Offshore aquaculture has the potential to be highly appropriate to the ICES region and become a significant producer of sustainable seafood. As a new sector, the time for development in accordance with the ICES vision is now. In addition, this is a time of great change and evolution in this field to large scale systems which could fundamentally alter where our seafood comes from and create increased demand for advice.
Resource requirements	There is limited current work in this area in ICES and parts of the ToR are to evaluate the requirements. It is envisaged that an international project will be developed by the working group which could consider how to cooperate on currently funded national research but may need to develop and seek resources to work on specific case study scenarios.
Participants	Scientists and engineers will be key to this working group, with contributions from oceanographers, economists, GIS specialists and marine mammal/turtle experts.

Secretariat facilities	None.
Financial	No financial implications envisaged for ICES.
Linkages to ACOM and groups under ACOM	This project sets the stage for future advice products from ICES as governments need to manage open ocean aquaculture development. The whale and turtle issue are already a management need.
Linkages to other committee or groups	There is a close working relationship with all the groups of the Aquaculture Steering Group. We will seek to form links with the Working Group on Socio-Economic Dimensions of Aquaculture (WGSEDA) Working Group on Pathology and Diseases of Marine Organisms (WGPDMO), Working Group on Application of Genetics in Fisheries and Mariculture (WGAGFM), Working Group on Environmental Interactions of Aquaculture (WGEIA), Working Group on Scenario Planning in Aquaculture (WGSPA) and Working Group on Ecological Carrying Capacity in Aquaculture (WGECCA). There are also likely linkages to other groups not listed.
Linkages to other organizations	EFARO, EATiP, DGMARE, AORA, EAS (European Aquaculture Society), WAS, NOAA, DFO. Industry – aquaculture businesses and producer groups, marine management organizations.

Working Group on Ecological Carrying Capacity in Aquaculture (WGECCA)

2018/MA2/ASG07 A **Working Group on Ecological Carrying Capacity in Aquaculture (WGECCA)**, chaired by Jeff Fisher, Ireland, and Carrie Byron*, United States, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	9-11 April	ICES HQ, Copenhagen, Denmark	Interim report by 1 August	
Year 2020	27-29 May	By correspondence	Interim report by 26 June	**Additional Chair in 2020**: Carrie Byron, United States
Year 2021	TBD	TBD	Final report by XXXX	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Review existing and developing methodologies for predicting and assessing the carrying capacity of the ecosystems at different geographic scales and strategies for environmental sustainability of aquaculture.	Building on work carried out by WGAQUA on benthic impacts on soft bottoms, it was appreciated that a review on drivers of ecological impacts, habitat sensitivity and current assessment methodologies is required. It will also be important to define the different carrying capacities approached (i.e., carrying capacities for what? Single species, multiple species, ecosystem based?), as well as to define which indicators can be used to assess these. Models may need to be created, or existing models applied, to balance different loads in any given system, and the working group will attempt to resolve and rationalize how such loads should be balanced.	5.5, 5.6	year 1	Review paper
b	Recommendations for prioritized research to elucidate knowledge gaps in use of IMTA at the scale of the farm and the basin, and the opportunites to maximize ecosystem services from diverse production systems.	Integrated Mult-Trophic Aquaculture (IMTA), both as an aquaculture production method and as a means to consider the use of different trophic componants in an ecosystem as mitigation, or to provide enhanced ecosystem services (nutrient/carbon management, habitat value, etc.) is high on the agenda in several aquaculture producing countries. Analysis of the effect on carring capacity from Basin Scale Integrated Multi-Tropic Aquaculture (BSIMTA), where trophic level interactions of	5.5, 5.6, 5.8	Year 1	Prioritized list of research to elucidate knowledge gaps as part of WGECCA's annual reports in 2019

		different single species trophic level industries produce different trophic level products yet occupy the same marine area is needed. WG ECCA, through international cooperation and the shared experiences of its members, will focus on prioritizing thematic areas that would be highly beneficial to address in future research.			
c	Develop international guidelines on loads and combinations of loads (indicators) from aquaculture and its possible remediation.	The concept of carrying capacity is a measure to describe how a high biological load of single or multiple species may affect production of the cultured species and/or other species using the same habitat. It must be calculated within a specific spatial area—either locally or regionally, and uncertainty of measurement can be greatly affected by the spatial area to which the calculations are applied. WGECCA will need to define the different types of loads that could/should be considered, and how—recognizing that the answers to these scenarios will vary by the spatial scale of analysis, and in different geographic areas. In any given area at any given time, there will be a balance between different loads present, but often one being dominating.	5.5, 5.6, 2.1	Year 2	Deliver final report in 2020 as part of annual WGECCA report.
d	Analyse and describe current monitoring practises related to environmental concerns. Review mass balance and other modelling of nutrient flow between multi trophic levels (farmed and wild) and in circular systems to consider how such modeling can be applied to carrying capacity estimations in a multi-trophic landscape.	An analysis of current monitoring practices used by ICES member states would help to reveal geographic trends in environmental concerns related to local aquaculture activities. This analysis would indicate if monitoring objectives are consistent and would help to identify any commonality in the setting of regulatory thresholds for managing environmental status and impacts. Similarly, models, where applied for consideration of environmental concern, energy transfer, etc., should be analyzed for their accuracy and their value as decision support tools.	5.5, 5.6, 3.2	Year 2 & 3	Deliver progress report in 2020 and final report in 2021 as part of the WGECCA annual report
e	Review status and potential for low-trophic aquaculture.	A substantial increase in sustainable marine aquaculture production may be enhanced by further development of low trophic	5.5, 5.8	Years 2&3	Deliver progress report in 2020 and final report in 2021 as part of the WGECCA annual report

	level aquaculture. WGECA aims to evaluate this potential in the shared waters of ICES member states including sea urchins, bivalve shellfish, macro algae, polychaetes. Opportunities and constraints by regional sea will be the focus of the analyses.

Summary of the Work Plan

Year 1	One term of reference a) review existing and developing methods for assessing carrying capacity and will be finalised and b) Recommendations for prioritized research to elucidate knowledge gaps in use of IMTA and other mitigating practises will be initialised.
Year 2	Term of reference b) and c)Development of international guidelines on loads and combinations of loads (indicators) will be finalised and terms of reference d) monitoring practises and e) low trophic aquaculture will be initalised.
Year 3	Term of reference d) and e) will be finalised and the final report will be submitted. The opportunity to produce a Viewpoints document pulling together multiple ToR's will be evaluated.

Supporting information

Priority	The activities of this Group will continue to lead ICES into the key scientific issues related to aquaculture – ecological carrying capacity including lower trophic aquaculture, use of aquaculture to enhance ecosystem services and so on, with a main focus to lay the scientific foundations for further sustainable aquaculture growth. The subject of ecological carrying capacity, and how to address it appropriately, has become fundamental to permitting decisions. Permitting decisions affect the potential for aquaculture to realize its potential in member states waters where ICES operates. ICES, and the expert working group framework it has developed, is particularly well poised to develop the international best practices for considering ecological carrying capacity in aquaculture permitting and its relationship to spatial planning. Such guidelines are needed if the sustainable aquaculture goals identified by respective ICES Member States are to be realized. Consequently, the activities of WGECCA are considered to have a high priority.
Resource requirements	Meeting logistics
Participants	The Group is normally attended by approximately 10 -20 members and guests.
Secretariat facilities	Meeting rooms at the Secretariat will be required
Financial	No financial implications envisaged for ICES.
Linkages to ACOM and groups under ACOM	Viewpoint document will establish an example of the types of advice countries will need to manage aquaculture to maximize ecosystem services and growth targets sustainably. Outputs may also have direct implications for governments working on nutrient and/or carbon trading systems. Habitat creation and nutrient management will have positive implications for wild capture fisheries.
Linkages to other committees or groups	There is a very close working relationship with all the groups of the Aquaculture Steering Group. We will seek to form links with the Working Group on Socio-Economic Dimensions of Aquaculture (WGSEDA) Working Group on Pathology and Diseases of Marine Organisms (WGPDMO), Working Group on Application of Genetics in Fisheries and Mariculture (WGAGFM), Working Group on Environmental Interactions of Aquaculture (WGEIA), and the Working Group on Scenario Planning on Aquaculture (WGSPAQ). It is also very relevant to the Working Groups, WGHABD, WGITMO, and WG Benthic Ecology.
Linkages to other organizations	OSPAR, NASCO, EAFP, EFARO, EATiP, FAO, EU (EUMAP regulation), NOAA, DFO

MA Groups approved in 2017

Working Group on Application of Genetics in Fisheries and Aquaculture (WGAGFA)

2017/MA2/ASG01 The **Working Group on the Application of Genetics in Fisheries and Mariculture (WGAGFM)** will be renamed the **Working Group on the Application of Genetics in Fisheries and Aquaculture (WGAGFA)**, chaired by Jann Martinsohn, Italy/ European Commission, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	15–17 May	Brest, France	Interim report by 30 June	
Year 2019	13–17 May	Ispra, Italy	Interim report by 30 June	
Year 2020	11-15 May	By correspondence	Final report by 12 June to ACOM and SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Review and report on genetic and genomic approaches for quantifying indirect genetics of salmon aquaculture on wild salmon populations	There is substantial existing evidence that interbreeding between wild Atlantic salmon and escaped domestic individuals occurs, and alters the nature and reduces the viability of wild populations. However, indirect genetic interactions may also occur. Caged or escaped farm fish can change the environment, so as to alter selective pressures and long-term fitness in wild populations even in the absence of direct interbreeding. This can lead to changes in the life history traits of wild populations, decreased survival, and reductions in population size. The production of all-female sterile triploids is seen as an approach to reduce the likelihood of effects on wild fish populations. In North America a large expansion has been approved involving the production of 7 million triploid Norwegian salmon annually. The use of triploid all female salmon is expected to reduce direct genetic interactions though the actual magnitude of direct and indirect genetic interactions remains unknown). This ToR will review the literature and explore the potential for genetic and genomic tools to quantify indirect interactions with wild salmon populations. This will involve the assessment of genomic tools to allow quantification of changes in wild populations due to changes in the selective landscape (i.e. disease, parasite, competition); as well as the estimation of effective population size of wild populations to allow declines in wild population size due to indirect effects to be quantified.	2.7, 5.6, 6.1	3 years	Review paper and metrics for measures of indurect genetic impacts
b	Review and report on principles of and prospects for genomic selection applied to aquaculture species	Genomic selection is a genome-wide marker-assisted selection method that caused a revolution in terrestrial animal and plant breeding in the last decade. Expected gains, such as acceleration of breeding cycle, increase of accuracy of prediction of multi-trait performance, are particularly high for long-lived species. The development of high-throughput SNP arrays for an increasing number of species now allows the potential implementation of genomic selection in aquaculture. However, biological characteristics	4.1, 4.5, 5.5	2-3 years*	(a) Review Paper (b) seafood production brief (c) Publication

		of most aquaculture species request specific optimization of genomic selection studied prior to their application for these species, as clearly demonstrated by simulation studies. Results are promising as recent genome-wide association studies in different salmonid species have concluded that genomic selection could efficiently contribute to improve disease resistance. The present ToR will introduce basic principles of genomic selection and the key steps of its implementation in breeding programs. It will focus on current progresses and prospects for aquaculture species and propose recommendations to facilitate its future developments in these species.			
c	Assess and report on the value of genetic and genomic tools for identifying species in mixed landings, fish products and by-products.	Mixed-species landings and the use of a mix of species in fish products continues to pose a formidable challenge to fisheries control and enforcement as well as traceability along the supply chain. In light of the difficulties in monitoring mixed species landings and identifying species in fish products and by-products we aim to elaborate whether genetic and genomic tools can provide robust and cost-efficient support to determine species composition, also quantitatively, and directly supporting fisheries management and policy needs. A timely and relevant example is the global attempt to develop and implement rules that lead to the reduction of discards. Discarding is the rather common practice of returning unwanted catches to the sea, either dead or alive, because they are undersized, due to market demand, the fisherman has no quota or because catch composition rules impose this. In Europe, the reform of the Common Fisheries Policy (CFP) of 2013 aims at gradually eliminating this wasteful practice and seeks to phase in the implementation of the landing obligation ("the discard ban") from 2015 through to 2019 for all commercial fisheries (species under TACs, or under minimum sizes) in European waters and for European vessels fishing in the high seas. The landing obligation requires all catches of regulated commercial species on-board to be landed and counted against quota. These are species under TAC (Total Allowance Catch, and so-called quotas) or, in the Mediterranean, species which have a minimum landing size (MLS – under the Landing Obligation: minimum conservation reference sizes (MCRS)). Undersized fish cannot be marketed for direct human consumption purposes whilst prohibited species cannot be retained on board and must be returned to the sea. The discarding of prohibited species should be recorded in the logbook and forms an important part of the science base for the monitoring of these species. (https://ec.europa.eu/fisheries/cfp/fishing_rules). It is generally acknowledged that the implementation of the landing obligation is a highly challenging and complex endeavour. For example, how can it be assured that no prohibited species have been landed and that undersized fish are in fact from the officially reported species, given that in both cases the landed biomass tends to be immediately processed for products that are not for direct human	1.6, 2.7, 6.3	3 years	a) Review Paper; b) ICES Viewpoint.

		consumption? These potentially mixed species samples are very difficult to identify once they have been processed, especially when considering products like fish oil and gelatine. Genetic and genomic methods might help with the challenge of ensuring that these "by-products" only contain the undersized catches (or potentially non- commercial bycatch species) but no other, illegal-to-land, species which might have been processed as "undersized, animal-by-products". If undersized commercial species need to be processed separated from bycatch species, genetics tools might further help to test if this is in fact the case in a given situation or if for example commercial species are being processed as "bycatch" to avoid overstepping a quota. If both do not need to be processed separately, the relative proportion of them within a product should be roughly according to their reported catch proportions. Focussing on, but not dealing with exclusively, we will elaborate whether genetic methods might efficently support the implementation of rules designed to reduce discards and related control, monitoring and enforcement measures.			
d	eDNA in Fisheries Management and Ecosystem Monitoring	Developments in the field of genetics have transformed our understanding of the natural world. In a fisheries context among other things it has helped us identify species, define population structures, begin to understand the genetic basis of adaptive traits and monitor adaptive population changes. Typically such insights have been gained from analysis of DNA obtained from tissue samples collected directly from individuals across a study area. Additionally, the analysis of DNA through metabarcoding from a bulk sample composed of a mixture of individuals of different zooplankton and/or macroinvertebrate species has enabled more cost-effective biodiversity assessments. Recently however, a new source of DNA has begun to be used for analysis of macro species, so-called "environmental DNA" (eDNA), which relies on collection of DNA sloughed off from tissue (e.g. skin, blood, faeces, mucous, eggs) into the natural environment. This eDNA promises to revolutionise the examination of biodiversity in the wild by allowing the detection larger organisms without needing to sample them and may be of particular usefulness in the marine environment where traditional sampling is difficult to carry out. A number of approaches using eDNA have been utilised already and/or are under development. These include species identification (especially useful for rare/cryptic/small individuals), community composition, ecosystem monitoring, relative species abundance and even attempts at absolute species abundance. In the aquatic environment such techniques have often been developed in freshwater ecosystems but are now beginning to be utilised in the marine environment. As such there is a growing recognition that the use of eDNA in the marine sphere may in the near future bring powerful new tools to the arsenal of the fishery manager and also allow new approaches to ecosystem monitoring. However, there are also numerous caveats	1.6, 4.1, 4.4	3 years	(a) Review paper (b) Non-technical review topic sheet.

	associated with eDNA approaches linked to sampling strategies, DNA stability in different environments, analytical approaches etc. that require expert attention to enable proper interpretation of study data. This ToR will summarise the research to date, identify areas where tools are already available for use and examine future developments whilst crucially seeking to also identify areas where the use of the new approaches should be undertaken with care if at all. The ToR will also try to produce a non-technical summary of the state of the field for direct dissemination to fishery managers with little or no genetic background.

Summary of the Work Plan

Year 1	**ToR a)** Review the literature on indirect genetic interactions among aquaculture salmon and wild populations. **ToR b)** Review of the basic principles of genomic selection and the key steps of its implementation in breeding programs, focus on current progresses and prospects for aquaculture species and propose recommeAndations to facilitate its future developments in these species. **ToR c)** Review the legal framework and supporting information, such as reports on the Landing Obligation by the Scientific, Technical and Economic Committee for Fisheries (STECF); identify the stakeholders; develop a work flow chart to work up mixed species samples, with decision points; develop theoretical scenarios/cases where genetic testing would be helpful and how the implications would be for a given outcome. **ToR d)** Review of the literature on the use of eDNA in the aquatic environment. Together with an overview of the field, particular focus will be to identify where eDNA techniques have/are being used at present in the marine environment and on other techniques used in freshwater that may be utilised in the marine sphere. Produce a glossary or commonly used terms in the field.
Year 2	**ToR a)** Identify approaches to quantify indirect genetic impacts and explore their sensitivity and power. **ToR b)** Develop cases where genomic selection would be helpful and how its implementation would benefit selective breeding programs. **ToR c)** Real-life scenario test based on developed work flow chart (from year 1) using real product samples; report results and discuss; report on feasibility and cost issues; recommendations to adjust methods/work flow developed in year 1 if needed. **ToR d)** Continuation of the literature review and identification of key studies describing the use of eDNA in the marine environment where the techniques used have significant potential for novel species and/or situations. Produce a flowchart of the critical steps needed from sampling to biodiversity assessment. Start to formulate review paper manuscript.
Year 3	**ToR a)** Complete review paper, and develop recommendations. **ToR b)** Develop a knowledge transfer plan; industry briefs; publication; implications, advice and final recommendations. **ToR c)** Develop a knowledge transfer plan; topic summaries; publication; implications and recommendations. **ToR d)** Finalise and update review: detail key studies, identify areas where novel techniques show particular promise, and identify problematic areas requiring future research. Finish review paper and non-technical review topic sheet.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the sustainable management of fisheries and aquaculture practices, monitoring of marine biodiversity and ecosystem function, and assessing the species composition of fish products and by-products. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 15-20 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Joint SCICOM/ACOM group.
Linkages to other committees or groups	There is a very close working relationship with EPDSG, EOSG and EPISG. Additionally, several EGs, including WGITMO, WGBIODIV, WGBOSV.
Linkages to other organizations	European Commission, IFREMER, NOAA, DFO

Working Group on Socio-Economic Dimensions of Aquaculture (WGSEDA)

2017/MA2/ASG02 The **Working Group on Social and Economic Dimensions of Aquaculture** (WGSEDA), chaired by Gesche Krause, Germany, and Cornelia Kreiss*, Germany, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	28 May–1 June	Oban, Scotland, UK	Interim report by 10 July	
Year 2019	13-17 May	Halifax, Canada	Interim report by 1 July	**Additional Chair in 2019**: Cornelia Kreiss, Germany
Year 2020	11-15 May	By correspondence	Final report by 26 June to ACOM and SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Identify and develop methods to determine the socio-economic effects of aquaculture	Aquaculture can offer employment and income earning opportunities to local, often rural and marginal, communities. However, questions pertaining to i.e. social site-selection criteria, community impacts, right of access, ownership, taxation, liabilities of the negative repercussions from the environmental effects on society, ethical issues, to name but a few, have remained largely untackled in a comprehensive, integrated manner. Practitioners note that sustainable	5.8, 7.1	3 years	Review Paper

		aquaculture must not only maximize benefits, but also minimize accumulation of detriments, as well as other types of negative impacts on natural and social environment. However, the systematic assessment of the socio-economic effects of aquaculture is still in its infancy. The question how and by which methods to capture the social repercussions of aquaculture are central here.			
b	Assess and identify trajectories of socio-economic concerns of aquaculture development	The social transformations caused by new technological innovations that competes, and threatens to replace, a capture fishery imbued with history and mythology about traditional practices is a major challenge that science if facing today. If aquaculture is to play a vital role in the well-being of coastal communities, it must be better integrated into social life. So far, aquaculture productions can be outright failures due to a lack of stakeholder participation, acceptance and/or understanding of social influences on ecosystems and of ecosystems on humans and society. Most interpretations of the social and economic dimension of aquaculture production are also highly context-specific, each following different trajectories and outcomes. This makes the issue of a general strategy for sustainable aquaculture that endorses the relevant context-based social issues so difficult. Whilst addressing the interactions and feedbacks between issues (e.g. economic, social and environmental consequences of aquaculture) in a spatial planning context, it becomes evident that many of these play out over time (i.e. in past, present and future contexts) and space (i.e. at local, regional and ecosystem/global scale)—these are referred to as 'cross-scale' or 'multi-scale' processes. Processes commonly unfold at different geographical scales and over different time scales: the more aggregated the geographical scale (e.g. the regional ecosystem scale), the slower a system's dynamics unfold. Conversely, at a less aggregated geographical scale (e.g. the local scale) the social-ecological dynamics are more responsive. To capture this increased complexity in the context of sustainable aquaculture and its interrelation with socio-economics, this ToR aims to identify central socio-economic trajectories of aquaculture development.	7.1, 7.3	3 years	Review Paper/Policy brief
c	Identify knowledge transfer processes that are available and employed for socio-economics of aquaculture	For WGSEDA to be able to address present and emerging issues and provide the most relevant science advice to promote the sustainable use of living marine resources, it must become familiar with respect to how knowledge is transferred in a bi-directional manner, focusing on socio-economic aspects.	7.5	3 years	Review Paper

d	Identify new emerging issues of socio-economic aspects of aquaculture.	This activity will identify and rank issues identified by the group as a whole that may require future attention by the WGSEDA or other related ICES Expert Groups, either alone or through collaborative work. The task is to highlight new and important issues that may require additional attention by the WGSEDA and/or another Expert Group as opposed to providing a comprehensive analysis. Proposals for Theme Sessions for the Annual Science Conference may evolve from this activity.	5.8, 7.1	1-3	Report

Summary of the Work Plan

WGSEDA envisions for the next 3-year term to work especially on the realm of reviewing and advancing method development for integrative assessments of aquaculture. In addition, special attention will be placed on trajectories of socio-economic concerns and the identification of related emerging issues within the ICES member states. Furthermore, knowledge transfer processes that are accessed and used for socio-economics of aquaculture shall be subject to analysis to gain a better understanding on science-stakeholder interaction processes that are of particular relevance for the social and economic dimensions of aquaculture development. The outputs of these activities shall be created by a report, policy brief and review paper(s).

Year 1	Review Paper
Year 2	Report
Year 3	Policy brief and review paper

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem effects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 8-15 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	ACOM
Linkages to other committees or groups	There is a very close working relationship with all the groups of ASG and EPISG. It is also very relevant to the Working Group for Marine Planning and Coastal Zone Management (WGMPCZM) and the Working Group on the History of Fish and Fisheries (WGHIST).
Linkages to other organizations	EU COST Action OPP and EU COST Action OceanGov

ASG Expert Groups dissolved in 2019

2018/2/IEASG01	**WKEMOP** - Workshop on Emerging Mollusc Pathogens	Janet Whaley, USA, and Ryan B. Carnegie, USA