Annual SCOR Working Group Report: 2023

WG 164: CoNCENSUS

1. Brief summary with the main highlights

(200-300 words)

The CoNCENSUS Working Group (WG) was approved in November 2021 with work beginning in 2022. CoNCENSUS aims to advance our understanding of the complementarity and interoperability of data collected by different **CO**astal and **N**earshore visual **CENSUS** methods, strengthen the field of research by advancing standards and identifying priority areas for knowledge exchange and capacity development and to provide recommendations on how best to utilise data from multiple methods to address scientific questions of local and global importance.

Over the last year we have focussed on advancing ToR-3 (data management) and ToR-4 (research field mapping). We conducted an initial review of available data to address ToR-1 and decided that more existing datasets needed to be sourced, processed and incorporated into the analysis. The current community engagement processes from ToR-4 are directly contributing towards additional data acquisition.

A WG meeting was held in Hobart, January 2023 following the International Temperate Reef Symposium. The meeting was attended by four CoNCENSUS members, a guest researcher and one early career researcher. The meeting focussed on advancing the Data management system (ToR-3) and resulted in the production of a draft proposal and workflow for the system.

For ToR-4 we have completed a comprehensive (1 475 documents) bibliometric analysis of the nearshore fish visual census field research landscape, employing epistemic methods and the online platform, Cortext. The results highlight how the underwater visual census research field has grown over the last 70 years in terms of research topics, sampling methods and global participation. This analysis will form the basis of a questionnaire survey.

To strengthen the global community of practice we provided training to researchers from Namibia, South Africa, Comoros, Seychelles, Maldives and India through a combination of field expeditions and workshops.

2. Activities since previous report to SCOR

(e.g., virtual or in-person meetings, email discussions, special sessions). Limit 1000 words

2022-10 Capacity Development: In person training provided to researchers from the Maldives Marine Research Institute (6 prs) and the Centre for Marine Living Resources and Ecology (Indian Ministry of Earth Sciences; 4 prs) on the standardised use of baited remote underwater

stereo-video systems (stereo-BRUVs). Addiitonal on-line training on video analysis and data management was provided. Training enabled through the NEKTON Mission 2022.

2023-01 WG Meeting: In-person meeting to advance the objectives for ToR-3 (Attendees: Members = A Bernard, R Stuart-Smith, C Semmens, P Walsh; Guests = B Semmens (Scripps); ECRs = E Clausius (UTas)).

2023-01 Workshop: Reef Life Survey (RLS), 27 participants from 9 countries. Workshop focussed on capacity development, knowledge exchange and knowledge production.

2023-02 Capacity Development Cruise: 12 South African participants. Cruise provided training on stereo-video system methodologies and deep sea baited camera surveys. Funded through the One Ocean Hub.

2023-02 Capacity Development: In person training on stereo-BRUVs provided to researchers and students from the Namibian Nature Foundation (2 prs) and the University of Namibia (2 prs). Funded through SAIAB.

2023-05: Workshop: stereo-BRUVs research in the Seychelles, 21 Attendees. Provided support for a stereo-BRUVs training workshop hosted by the Blue Economy Research Institute at the University of the Seychelles (BERI Uni-Sey). Funded through SCOR Visiting Scholars Programme.

2023-04: Capacity Development: In person training in the Reef Life Survey methodology to researchers (2 prs) based at the BERI Uni-Sey. Funded through RLS.

2023-06: Capacity Development: In person training in the Reef Life Survey methodology to researchers based at SAIAB (1 prs) and Rhodes University (1 prs). Funded through SAIAB.

2023-08: Funding was sourced for two two-year postdocs to work on the CoNCENSUS ToR and deliverables. The positions will be advertised in November 2023 and February 2024 with the selected candidates starting in January and April 2024.

2023-08: Funding awarded from South Africa's National Research Foundation to support activities related to the CoNCENSUS WG (8 000 USD).

2023-09: Work on advancing stereo-BRUVs best practices (specifically improving the method for obtaining fish size from stereo-videos) with the Global Archive Steering Committee.

2023-09: Provided feedback to the Global Ocean Observing System (GOOS) Biology and Ecosystem (BioEco) panel on the progress of the CoNCENSUS WG and its role in advancing the development of Essential Ocean Variables (EOVs) and implementation plans.

3. Documents published since previous report to SCOR

(e.g., peer-reviewed journal articles, reports, Web pages) and should be limited to publications that resulted directly from WG activities and which acknowledge SCOR support

(1) Draft of the bibliometric and lexical analysis to map the visual census research landscape, knowledge networks, gaps and agendas
(2) ToR-3 (Data management) planning workshop report
(3) ToR-3: Draft CoNCENSUS Infrastructure and Workflow
(4) Kick-off meeting report
(5) CoNCENSUS website. The website consists of a public and members portal and will be the central workspace for all CoNCENSUS related activities. Currently the website is operational but still underdevelopment.

4. Progress toward achieving group's terms of reference.

List each term of reference separately and describe progress on each one. Limit 1000 words

ToR-1: Methodological comparison

We conducted an initial review of available data to address ToR-1 and decided that more existing datasets needed to be sourced, processed and incorporated into the analysis. A large volume of underwater visual census (UVC), BRUVs and stereo-BRUVs data have been collected over the last five years and delaying the analyses for this ToR will allow for these data to be utilised. Where relevant, members of the WG and their research teams have been assisting in the collection and processing of these new datasets. This delay will also provide an opportunity for the available data to be curated and uploaded to suitable online data repositories. Furthermore, the current capacity building and community engagement processes from ToR-4 are directly contributing towards additional data acquisition.

ToR-2: Best practice guidelines

We have been unable to make progress on the drafting and endorsement of best practices for diver operated video (DOV), UVC and remotely operated vehicle (ROV) methodologies. These will be prioritised in the next reporting period. Importantly, the work in ToR-4 engaging with the global community of practice will lay the foundation for stakeholder participation and finalisation of appropriate and broadly applicable best practices.

We have been working on a potential solution to improve the accuracy of length frequency distribution data and quantity of length measurement from stereo-BRUVs data. Stereo-BRUVs are an ideal tool for scientific assessments of fish captured in hook and line fisheries as they attract predatory species, can be used across the full depth range of a species and are suitable for use in protected areas. However, concern has been raised by fisheries scientists about the incompleteness of length datasets from stereo-BRUVs. Here we are working with fisheries scientists from South African and Australia to develop a new approach that ensures all size-classes seen are included within the length data without double-counting or pseudo-replication.

ToR-3: Data management policy and infrastructure

The WG held a small in-person meeting in January 2023 to advance the CoNCENSUS data management infrastructure and workflows. The draft proposal is that the software architecture and workflow must meet the following criteria:

- Ease of use for researchers. CoNCENSUS aims to bring together global communities of practice collecting data on fish distribution and abundance to share and aggregate as an Essential Ocean Variable (EOV). Researchers must be able to easily understand and use the interface designed for entering metadata and uploading their data.
- Build on existing software products and tools wherever possible.
- Minimal maintenance required.

- Cloud based.
- Must comply with the Data Policy and comply with FAIR data principles for metadata and data.

Only existing data repositories accepting fish census data at global or national scale will be considered. Each portal will need to provide data in a format and using services consistent with the requirements of the OBIS IPT infrastructure to provide regular updates. The option to propose a new data portal for data collection and aggregation has not been considered as there are already numerous suitable options that provide solutions at local, national and global scales. However, for this project, data must reside in one of the currently available portals, namely:

- GlobalArchive (https://globalarchive.org/)
- RLS/IMOS NRMN (https://reeflifesurvey.com/)
- REEF (https://www.reef.org/)
- OBIS
- GBIF

Additional repositories can be included if they meet the inclusion criteria.

ToR-4: Determine priority areas for engagement, capacity development and research

The key component of ToR-4 was to perform a global assessment of the community of practice. Here, our first activity was to develop a comprehensive literature dataset and using CorTexT (https://www.cortext.net/) to undertake an epistemic analysis to map the fish visual census research landscape. CorTexT can analyse a wide range of data sources, across all techniques, to identify key research topics, influential researchers, and emerging trends. This information can help researchers identify knowledge gaps, prioritise research areas, strengthen collaboration and develop more effective monitoring strategies. We provide a summary of key findings below.

Following systematic searchers on Scopus, Web of Science, and Google Scholar a corpus of 1 475 documents spanning the time frame from 1953 to 2023 was collated. From this, 500 key terms from the abstracts were indexed using natural language processing and used in the subsequent analyses. Fifteen high level areas of research were identified and, for example, included topics related to reef ecosystems, mesophotic depths, marine reserves and oil and gas platforms. SCUBA underwater visual census (UVC) has been the predominant method since the 1990s while research utilising BRUVs has seen a rapid growth from 2005 onwards (Figure 1). Census method varied by knowledge cluster with ROVs, autonomous underwater vehicles (AUVs) and Towed Video preferred in research associated with seafloor industries while ecological research and research associated with marine protected areas was predominantly carried out with UVC, BRUVs and DOVs.

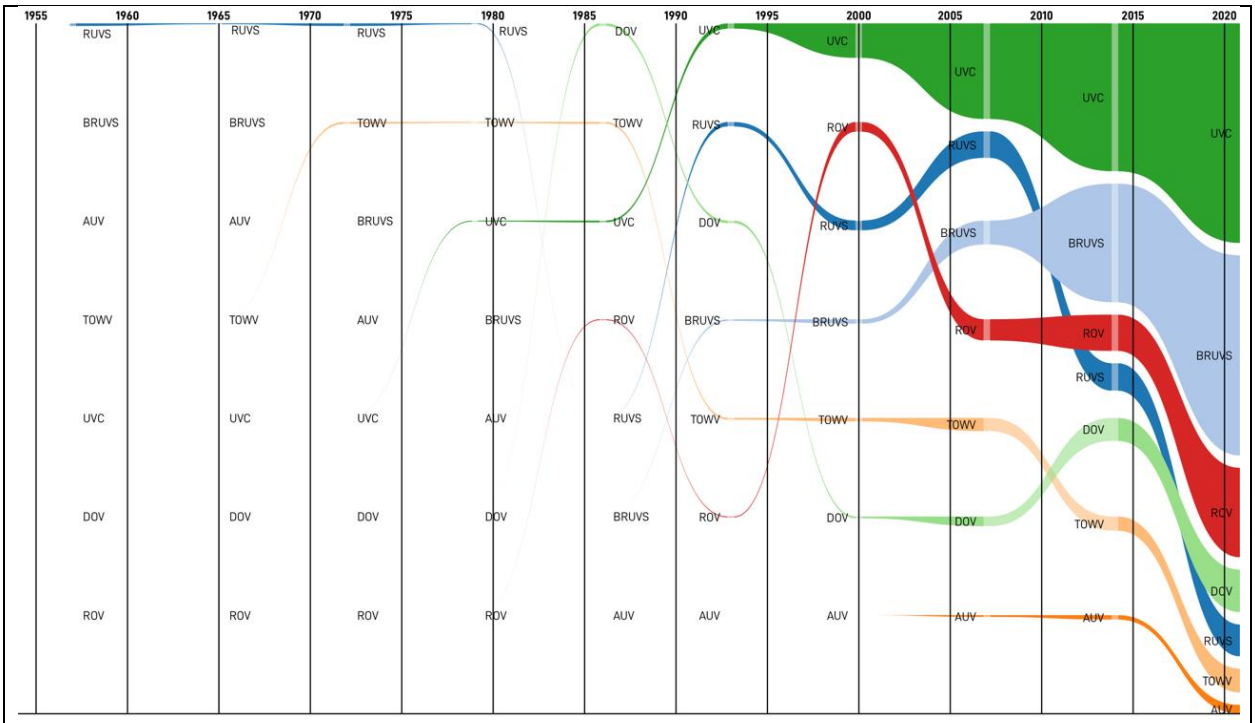

Figure 1: Proportional contribution of different sampling methodologies to the field of research through time.

The corpus included documents with authors from 86 countries (47% of nations with marine territory) and showed collaboration, although at varying degrees, between all countries (Figure 2). Over a quarter of all collaborations were linked to researchers at institutions in Australia, the United States and the United Kingdom and the strongest level of collaboration was also between these countries (Figure 2). This reflects the size of the research communities in these countries, but also access to resources and opportunities. The African continent had the lowest level of participation in the field of research with only 23 % (9) countries represented in the literature.

The next stage of the community of practice assessment will be to distribute a questionnaire to as many participants as possible, using the contact information on the publications, collaboration networks and mailing lists. This will aim to collect more detailed information on sphere of influence, current research activities, degree of standardisation within methods, extent of knowledge exchange and willingness to provide data for management and global level reporting.

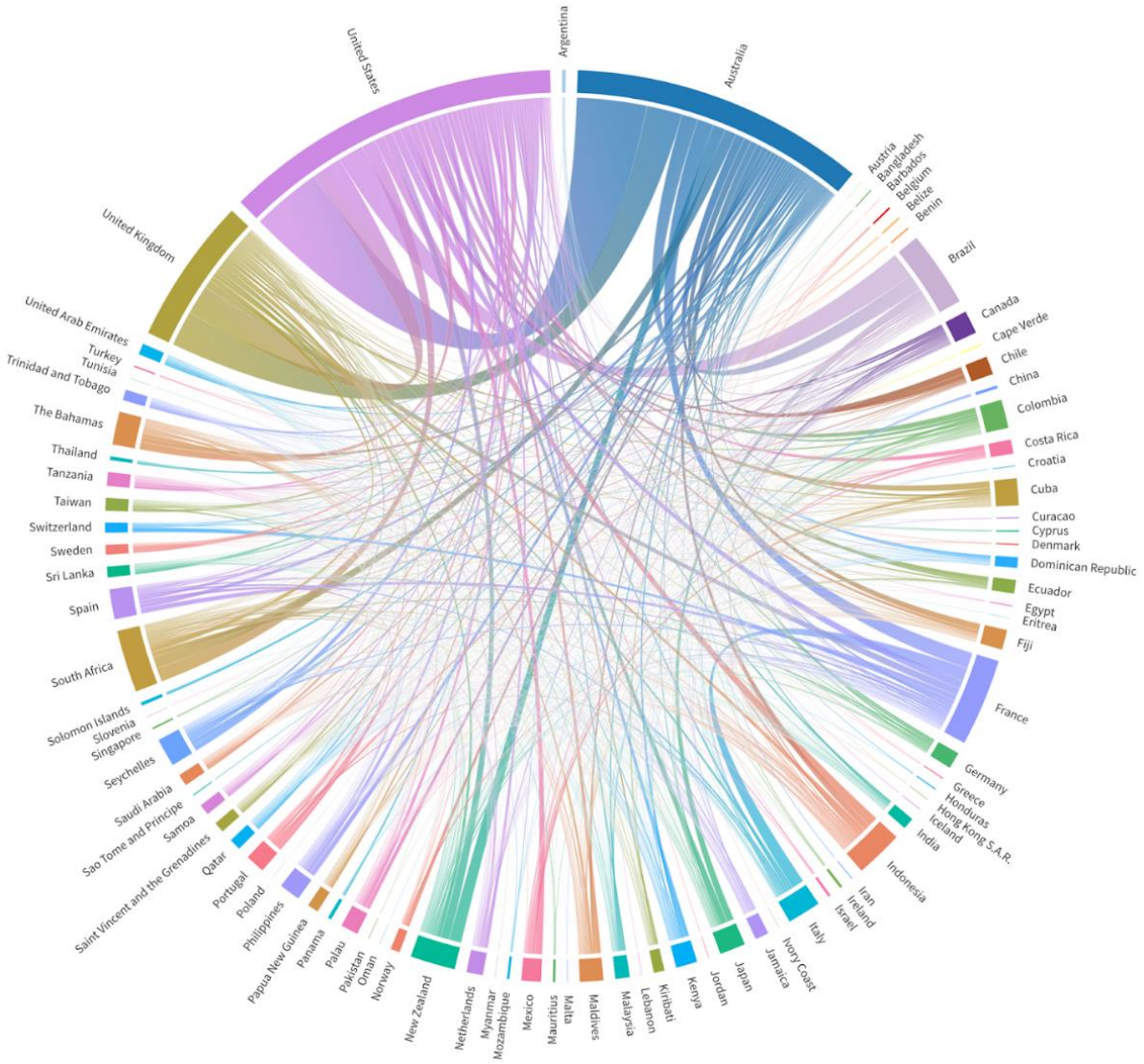

Figure 2: Chord diagram of the international collaboration network at the country level. When multiple institutions of the same country were present in the same reference, the country contribution was only counted once. The arc length is scaled to represent the total number of collaborations (an indicative measure of the countries' investment in fish visual census research) while chord thickness displays the collaboration frequency between countries.

We have continued to make progress on establishing and supporting research programmes in key areas in the Western Indian Ocean (Seychelles) and South-Eastern Atlantic (Namibia). Memorandums of understanding are in place between SAIAB and the Namibian Nature Foundation and the Blue Economy Research Institute at the University of the Seychelles and both organisations have been undertaking research and monitoring using best practices in the field.

ToR-5: Establish a global community of practice

It was originally envisaged that a global community of practice will emerge from the community engagement processes and the development of support tools carried out in ToRs 1-4. As such, we have been progressing slowly towards ToR-5. We expect that momentum will increase during the next reporting period when direct engagement with the community begins.

5. WG activities planned for the coming year.

Limit 500 words

ToR 1: Methodological comparison

We plan to have a large WG meeting in October 2024. At this meeting we aim to make significant progress towards meeting ToR-1 by completing key data analyses and drafting research reports and publications. Leading up to this meeting we will ensure that:

- All suitable data are accessed, curated and incorporated within the CoNCENSUS data infrastructure framework.
- Rationale, questions and frameworks for two priority manuscripts are drafted and will form the foundation for the data analyses in the workshop.
- Suitable metrics and indicators and pressure and/or environmental gradient datasets are prepared to answer the priority questions.

ToR 2: Best practice guidelines

Following the completion of the online questionnaire survey, we will engage with researchers currently using DOV, ROV and BRUVs to receive feedback on available best-practices and how to improve them to be more inclusive, if necessary. We expect that this will commence in the second half of 2024. We will use the outcomes of this exercise to update the best-practices and then initiate the process of getting these best practices endorsed by GOOS.

Data gathered from the online questionnaire will provide essential information on the variety of UVC approaches being used around the word. We will use this information to draft a best-practice guideline based on the suitability of different approaches to collect data that meets data requirements for different indicators and metrics suitable for measuring fish EOVs. This work will be initiated during the October 2024 workshop and continue into 2025.

During the October 2024 WG meeting we will also work on a paper that provides a methodological decision making framework to support the design and implementation of visual census research projects.

ToR 3: Data management policy and infrastructure

Within the first quarter of 2024 we will have completed the CoNCENSUS Infrastructure and Workflow plan. Following this, we will begin implementing the plan to ensure that available data are

incorporated, curated and accessible in the relevant repositories to feed into the work carried out for ToR-1 during the October 2024 meeting.

We will continue to support the development and growth of relevant data management repositories (e.g. Global Archive, RLS, ODIS).

ToR 4: Determine priority areas for engagement, capacity development and research

We expect that the bibliometric analysis of the visual census research field will be published by February 2024. The community of practice questionnaire assessment will be distributed by March 2024 with the data collection process completed by June 2024. The data curation, analysis and reporting will likely continue into 2025.

ToR 5: Establish a global community of practice

Out main direct efforts in this space will be engagement with the community of practice through the questionnaire survey and follow up conversations.

Additional engagement with different components of the research community will included workshops on data management, establishment of national and regional researcher networks and science to policy engagement. We will continue to participate in the Ocean Practices Workshops by hosing and contributing towards different sessions, and we will continue to engage with the broader community through targeted capacity building initiatives (e.g. Ocean Data Bootcamp, Brazil).

Meetings

- We are planning to have an in-person meeting from 21 – 25 October 2024. This will be held in the vicinity of Cape Town and coincided with the 7th International Marine Conservation Congress (13-18 Oct 2024).
- Prior to this meeting, all of the ToR sub-groups will have at least one on-line meeting to advance their ToR and prepare document and materials for the workshop.

Capacity development

- Science to Policy meetings in South Africa, Namibia, Mozambique and Seychelles. These will focus on developing a framework to maximise the contribution of visual census data to policy and management.
- Support capacity development for the NEKTON Mission research cruise in India

6. Is the group having difficulties expected in achieving terms of reference or meeting original time schedule? If so, why, and what is being done to address the difficulties

Limit 200 words

In general, the members have all been struggling to make time available to efficiently advance the ToR for this WG. This was highlighted as a concern in the first report but we have not yet been able to adequately overcome the challenge. This is a result of a combination of changing personal circumstances of key members and increased pressure from employers to catch up academic and

administrative workloads or changes in KPIs. While we were provisionally allocated funds for a post-doc, we were also unable to find a suitable candidate and the funding was withdrawn. This has meant that we have been unable to work effectivity across most ToRs.

In the areas where we have made progress it is because of post-graduate student and paid assistants who are addressing specific aspects of different ToRs.

Additional funding has been sourced through the South African National Research Foundation (NRF). This includes funds for two post-doctoral fellowships (2-year period each), paid assistants (40 days) and running costs to support travel and a local WG meeting ($8 000). We have identified one suitable South African post-doc who will start in April 2024 and we will advertise to recruit the second one to start in January 2024. The second post-doc will be opened to international candidates which will increase the pool of potential applicants.

7. Any special comments or requests to SCOR.

Limit 100 words.

We request an extension of the support period from 3 to 4 years.

Additional information can be submitted and will be included in the background book for the SCOR meeting at the discretion of the SCOR Executive Committee Reporter for the WG and the SCOR Secretariat.