Report - Scientific Evidence Refutes CCMI Claims Regarding Impact to Seven Mile Beach

In a press release dated 12th September 2019 [1], the CCMI urged stakeholders to take stock of the potential impacts of the new cruise berthing and cargo facilities project. This note provides stakeholders with clarification on several issues, some of which were misrepresented in the CCMI press release.

The CCMI's concerns

CCMI have two related concerns which are summarized as follows:

1. Dredging in George Town Harbour will remove sand and coral which reduces what they termed the "sand budget" available to replenish Seven Mile Beach. They added that "What is proposed will undoubtedly affect Cayman's most famous beach".
2. There is "limited proven success of coral relocation as a mitigation strategy" which means that in the short term the project will "disrupt an entire ecosystem" and in the long term, the reduction in coral stocks impacts sand formation which means sand on Seven Mile Beach will not be replenished.

Impact on Seven Mile Beach

CCMI's conclusion that Seven Mile Beach will be impacted is simply an assertion. There is absolutely no evidence presented to support the claim. Instead, the press release presents a single mathematical calculation. That calculation seeks to estimate the amount of material that will be removed through dredging. It then shows that volume to be the equivalent to the volume of sand if you were to remove sand to a depth of one foot over an area one hundred feet wide and one mile long on Seven Mile Beach.

What is not established by CCMI is the relevance of the calculation. There is no causal link established between the removal of material in George Town Harbour and the loss of an equivalent volume of sand on Seven Mile Beach.

In fact, all the evidence presented in the Environmental Statement (ES)[2] produced by Baird & Associates in 2015 indicates that there is no such link. The findings in the ES are based not on a single basic calculation but rather on a specifically developed, scientific model of the tides, wind, wave climate and associated sediment transportation processes that operate at the site, developed to inform the Environmental Impact Assessment (EIA) Baird and Associates carried out. Details can be found in Chapter 10 of the ES (pages 92-117).

The ES concluded that "7MB appears to be supplied by sand coming round the northwest corner of the Island, with the sand being sourced from the nearshore/fringing reefs along this shoreline." To put that in CCMI's terms, the "sand budget" for Seven Mile Beach comes from the northwest of Grand Cayman, not from George Town Harbour. It therefore follows that any loss of material from the Harbour due to dredging may impact "sand budgets" elsewhere but not on Seven Mile Beach. This leads to one of the most important conclusions in the whole of the ES which bears repetition in full:

> "There is no apparent sediment transport linkage between GTH and 7MB; therefore, **the proposed project is not expected to have any impact on 7MB**. Fluctuations in the beach width will continue but the proposed project will not cause any changes in the erosion or deposition patterns along 7MB." (ES p115)

It should be emphasized that the study concluded fluctuations in beach width anticipated in the future will be the same as normal circumstances prior to the project. There is no science on which to base any alternative view. The assertion made by CCMI in its press release is at odds with the scientific evidence and the conclusions in the ES.

Significantly, the Environmental Assessment Board (EAB) endorsed the scientific methodology followed by Baird and Associates. As a general overview the EAB stated in its report [3] that it found the data collection and results outlined in Baird's ES and Technical Appendices to be robust given the timeline for completion of the EIA.

In referencing Seven Mile Beach specifically, the EAB report states that "we note the conclusions in the ES that no large scale changes to the prevailing sediment transport patterns will arise as a result of the project. The EAB is satisfied that the results of the sediment transport modelling confirm/verify previously understood mechanisms for sediment transport regimes between George Town Harbour and Seven Mile Beach (SMB)."

As this EAB report notes, this understanding of the pattern of sediment movement was well established prior to the EIA carried out by Baird & Associates. Their findings are confirmed in a paper produced by R Seymour in 2000 for the CIG DoE and the Beach Erosion Committee, entitled 'Seven Mile Beach: A Natural History' [4]. This paper investigates the movement of sand around the island of Grand Cayman and illustrates that "*North Sound was almost certainly a contributor to the sand supply that formed Seven Mile Beach. Before development, shallow dunes, perhaps extending all the way to the Sound in some locations, would have backed the beach. When struck by severe Northwesters or a hurricane, the beach would have eroded landward, but would not have disappeared. The dunes would have provided a reserve of material to reconstitute a beach even as the storm was receding. The almost-complete development of the back beach, in some locations even of the beach itself, has eliminated this self-healing capability. Severe storms can, and do, erode the narrow beach until it disappears and the rebuilding process can take a very long time because the sand to achieve this must be moved a great distance".* Seven Mile Beach undergoes a natural process of erosion and accretion with the predominant wave action coming from the North West. This means that net drift of sand along 7MB is to the south.

Seymour's report also concludes that "*At the south end, there is no transport into the system because it is the end of the line. As a result, the beach begins to disappear, beginning from the south and working northward. In the center of the system and northward from there, roughly the same amount of sand moves into a region of beach as moves out, so that losses are small and difficult to see. Uncharacteristically, during the period encompassing the last three hurricane approaches, there was only one sizeable northwester. These storms, which normally are experienced in larger numbers during*

the winter season, move sand to the south and restore the beaches that disappear during those storms delivering waves out of the south." The paper therefore provides further evidence to support the finding that the proposed cruise port will not therefore affect the sediment transport system towards Seven Mile Beach.

It is also important to note that the piers have been designed as open structures and, as such would not interfere with sediment transport in any direction, as would occur when solid structures are built within the coastal zone.

Effectiveness of Coral Relocation

CCMI have a great deal of experience in coral conservation and education and are contributing to the growing understanding of the challenges the marine environment faces, particularly those challenges associated with climate change.

The CCMI press release states that "positive results from coral regeneration and relocation practice also continue to be challenging". They point to relocated corals "typically suffering 80% mortality within two years of relocation". This is consistent with CCMI's own reported results. Their 2019 Healthy Reefs report [5] states "despite enormous success growing, diversifying and building resilient populations of at several nursery sites, coral mortality is high (up to 80%) when re-planted to wild reef substrates." [*NB the syntax error is carried from the original document.*]

The views expressed by CCMI on the challenges of coral relocation therefore deserve careful consideration.

The Government has always recognized the challenges inherent in the plans for coral relocation in George Town Harbour. The 2015 EIA made this clear. The non-technical summary of the ES [6] states "a coral relocation program will not achieve "no net loss", and success is not guaranteed." In relation to the question of no net loss, the aim of the Coral Relocation Plan is to achieve no net loss of biodiversity which follows the overall goal stated in the Cayman Islands National Biodiversity Action Plan, 2009 [7].

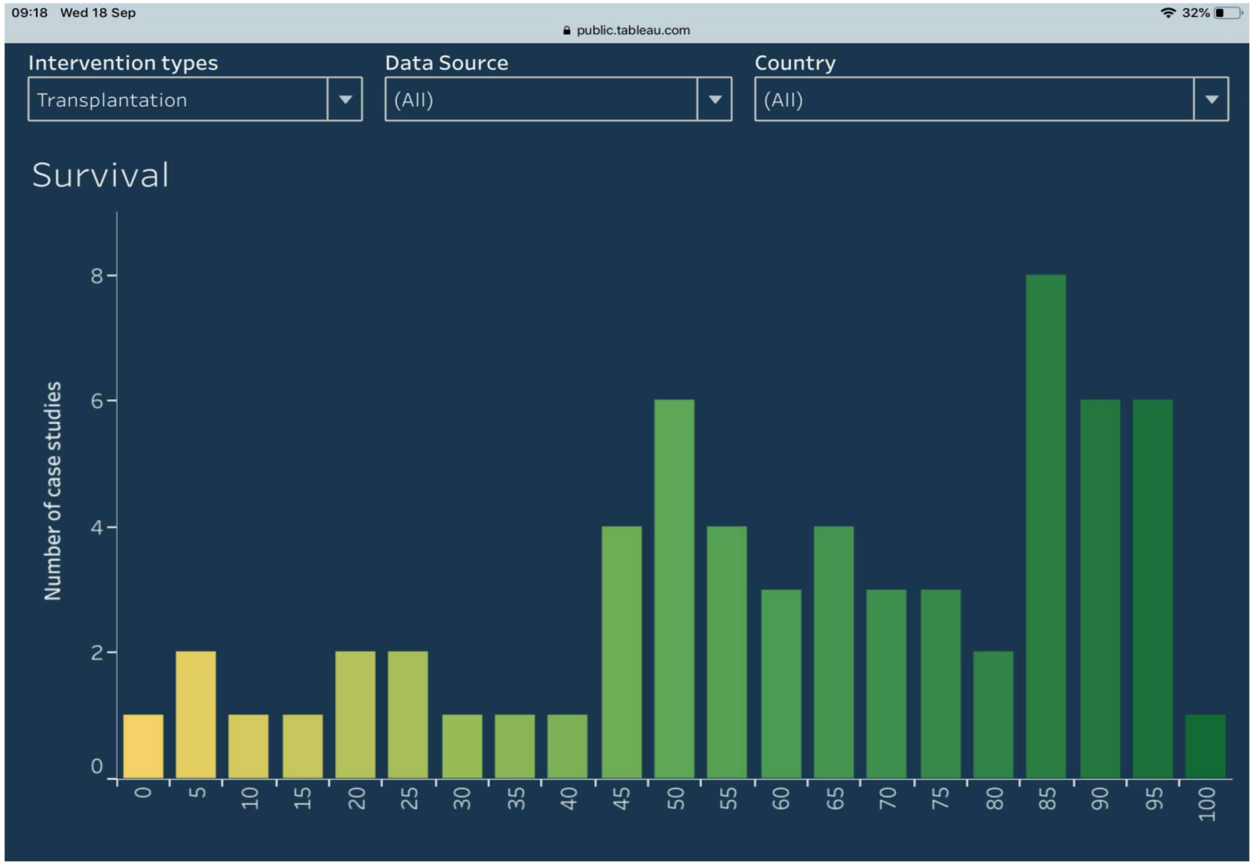
In relation to the success of coral relocation programmes, the approach adopted will learn from international experience and draw upon international best practice. In 2018 a global meta-study was produced by a team of scientists led by Lisa Bostrom-Einarsson for the Tropical Water Hub, part of the National Environmental Science Programme based in Australia.

That report is called *"Coral restoration in a changing world – A global synthesis of methods and techniques"* [8]. It covers 329 case studies, 94 (21%) of which are direct transportation projects of the kind most likely in George Town Harbour. Across all those studies Bostrom-Einarsson et al found that "on average, survival in restored corals is relatively high."

As well as their report, the researchers created an online interactive database that can be interrogated and individual case studies can be followed up as appropriate.

One of the problems in the study is that there are few long term monitoring projects on which to draw. The vast majority cover less than 30 months but there are studies stretching much longer. Interestingly, Bostrom-Einarsson et al state "we would expect a negative relationship between monitoring length and average survival, however there was no such evidence in the data".

The research found "overall, direct transportation studies reported an average survival of 64%, with 20% reporting >90% survival of transported corals." It must be acknowledged that the success rates reported by projects are variable. Using the interactive database, the figure below shows the success rates for all of the direct transportation studies considered as part of the Bostrom-Einarsson et al study.



Bostrom-Einarsson et al go on to state that the results demonstrate that "coral colonies relocated from dredging or construction areas may thrive in a suitable location". This conclusion is borne out in individual studies such as:

- Mohammed Kotb's 2016 report on a project at Aqaba in the Red Sea [9] studied survival and growth rates of transplanted coral over a two year period and compared them to growth rates at a control site. "The overall survival rate for the transplanted colonies was estimated to exceed 87% and the linear growth rates of the 16 species studied showed very similar values to colonies of the same species at the control site." This leads Kotb to conclude, "the results of this work support the premise that endangered coral colonies can be translocated to other reef areas".

- Hofstede et al [10] studied a project designed to protect marine life from the impact of dredging works to create a new port access channel in Coral Harbour, New Providence, Bahamas. This is "one of the larger conservational mitigation projects in the region" and their headline findings were that 14 months after transplantation, "the assessment showed…..a survival rate of 91%" and that "of the traced relocated coral colonies, 82% were in a healthy condition without observable affliction." They conclude that "the Coral Harbour Coral Transportation Project has reduced the ecological impact of the Coral Harbour's dredging project by preserving many viable corals and associated invertebrates through relocation." Therefore, "the applied strategy for transportation of small and large coral colonies may be recommended for future application to preserve corals that are threatened by permanent destruction".
- There are two large coral re-attachment cases in the recent past in West Bay and Eden Rock, Grand Cayman. Shipping incidents dislodged and fractured large sections of the limestone reef and damaged thousands of corals at both sites. The proposed Verdant Isle Coral Relocation Partner restored both of these sites in 2016 and 2017. Coral fragments broken and disturbed by vessel anchors and ship hulls should arguably have lower survival than those removed more carefully, yet monitoring studies have reported 89% survival of tagged specimens in the West Bay site two years following the restoration compared to 93% of unaffected coral colonies (Precht et al. 2018) [11]. Coral colonies that survive for a year or more in good condition following reattachment are likely to mimic natural survival patterns of unaffected corals in future years. The same coral species in the same vicinity relocated by the same teams may provide the best evidence of likelihood of success for this project.

This is not to underestimate the challenges involved in carrying out a coral relocation project at the scale envisaged in George Town Harbour. However, the experiences both locally and elsewhere can help us as we define the project, drawing on the experience of what has worked, and what has failed, elsewhere. The Government intends that the project here will not only reflect the learning from elsewhere but that it should be a best practice example that advances the ability of relocation to contribute to the meeting future challenges to coral reefs.

One of the key limits to learning noted by the Bostrom-Einarsson et al global study was the need to improve monitoring of outcomes – both what is monitored and how we monitor it. The Cayman Islands could help fill that gap if we work with the scientific community to build in a comprehensive and holistic monitoring programme at the outset.

It is clear that the proposed coral relocation will never completely mitigate the ecological impacts of the port improvements but the aim of the coral relocation plan is to work towards no net loss of biodiversity. If we are positive in drawing on international experience and learning, it will be possible to replicate the best results achieved in similar projects elsewhere. Bostrom-Einarsson et al recommend "setting 70% survival in outplanted corals as a benchmark target of success". We should be willing to adopt such a target for the George Town Harbour project. We hope that CCMI will come and participate and help make the project a success.

References

[1] CCMI Urges Close Look at Downstream and Long-Lasting Impacts to the Island by Proposed George Town Dock Whilst There is Still Time (2019) News release and Statement Justification

[2] Baird & Associates (2015) Proposed Cruise Berthing Facility, Grand Cayman Environmental and Engineering Consultancy Services Environmental Statement

[3] George Town – Proposed Cruise Berthing Facility. EAB Review of Consultation Draft Environmental Statement, Technical Appendices and Non- Technical Summary

[4] Richard J. Seymour, Ph.D., P.E. (2000) Seven Mile Beach: A Natural History: Prepared for Cayman Islands Government Department of Environment and the Beach Erosion Committee

[5] Central Caribbean Marine Institute (2019) Healthy Reefs 2019

[6] Baird & Associates (2015) Proposed Cruise Berthing Facility, Grand Cayman Environmental and Engineering Consultancy Services Environmental Statement Non-Technical Summary

[7] Department of Environment (2009) Cayman Islands National Biodiversity Action Plan

[8] Bostrom-Einarsson et al (2018) Coral restoration in a changing world – A global synthesis of methods and techniques

[9] Kotb M (2016) Coral Translocation and Farming as Mitigation and Conservation Measures for Coastal Development in the Red Sea: Aqaba Case Study

[10] Hofstede R ter et al (2016) Monitoring and Evaluation of Coral Transplantation to Mitigate the Impact of Derending Works. Proceedings of the 13th International Coral Reef Symposium Honolulu

[11] Precht, W. Challenger G., Warrender T., Rogers K., Hudson H., McCoy, C., Chin P. and T. Austin. 2018 Cooperative Natural Resource Damage Assessment Leads to Successful Restoration of Injured Coral Resources. 71st annual conference of the Gulf and Caribbean Fisheries Institute, San Andres, Colombia | 5–9 November 2018