

SHARK VIEWS

Newsletter
of the IUCN SSC Shark
Specialist Group

#09 | January 2024



IUCN SSC
Shark Specialist Group





Artwork by Keith Wiltmer

Editorial

Dear readers,

It's hard to believe that another year has gone by. I don't think I have taken stock of or reflected on everything that happened in 2023, but it certainly feels like the momentum for shark, ray, and chimaera conservation is growing. Sharks are on the agenda at every multilateral environmental agreement meeting – fisheries, trade, biodiversity conservation, protected areas, and more. It's been a busy and intense year, but exciting at the same time because we have many opportunities to make a difference. Like many of you, I used to fight to get sharks on the agenda, but now we struggle with having enough time to cover everything during a meeting. There's a sense of urgency in it, and I am proud to belong to this growing shark conservation community and encouraged by the collaborative spirit that is making this possible. 🦈 Through this issue of Shark News, we are introduced again to some innovative and wonderful initiatives that are helping to keep this momentum growing. Our feature story is about rewilding sharks – something that has been done for many terrestrial and small aquatic species and has now been attempted for the first time with Indo-Pacific Leopard Sharks. We have our usual Q&A series where Chelsea Stein introduces us to early career scientist members working in Angola and Papua New Guinea, two places we know so little about when it comes to shark fisheries. Our third series of fact sheets on human impacts on sharks and rays related to pollution. This is a threat that is less understood for many species, but that is inadvertently having an impact on some. Fisheries remain the key threat, however, and this is reflected in our stories and the work being undertaken worldwide to understand how these affect species. Fisheries surveys are being conducted in Oman, focusing primarily on rays. Oman is another key country where little data have been collected, but it plays a key role in the international trade of fins and meat. We have an overview of the historical fisheries surveys undertaken across the basin from the Mediterranean Sea. Results from these have provided much-needed life history and distribution data and allowed us to determine that this is the body of water with the highest number of threatened sharks. In parallel, we have stories from Iran on how innovative and cross-sectoral awareness of shark conservation issues is becoming and should be! The Great Eggcase Hunt has expanded and is now a global effort allowing the public to report and identify shark and skate eggs found on beaches around the world. From the Canary Islands, we gather insight into how critical habitats are being identified and how research is being integrated into policy. From Central America and the Caribbean, we learn more about how a newly described yet threatened nurse shark is being tracked to understand its ecology, how local ecological knowledge is being used to understand the behaviour of coastal communities in Panama in relation to sharks, and how dedicated efforts to educate students is making a difference in the Turks and Caicos. 🦈 The Important Shark and Ray Areas (ISRA) project has also kept us extremely busy, with 255 areas now delineated from the Central and South American Pacific, Mediterranean and Black Seas, and Western Indian Ocean regions. This project has only been possible because of the backbreaking and passionate work from the ISRA team but also mostly the over 450 contributors that have already been part of this process. We have three other regions slated for 2024, so thank you all for supporting us in ensuring we can put sharks on the map! 🦈 We leave you with a snapshot of some amazing shark discoveries for the year and what the SSG has celebrated and accomplished with your support. As always, thank you for your commitment and passion for sharks – and, of course, a massive thank you to Michael and Peter Scholl, who continue to make this newsletter a reality. With all the fantastic work ongoing worldwide, I do not doubt that the momentum will continue to grow. So, I look forward to another year of shark conservation successes and wish you and yours a wonderful 2024! → Rima



Photo by Brooke Pyke | brookepykephotography.com

Resharking leopards in Raja Ampat: a behind-the-scenes look at the StAR *(Stegostoma tigrinum)* Augmentation and Recovery) project.

Written by

Christine L Dudgeon
University of the Sunshine Coast,
University of Queensland, Qld Australia

Nesha Ichida
Thrive Conservation, Indonesia

Charlie D Heatubun
West Papua Provincial Government and
the Research and Innovation Agency of
Indonesia

Catherine A Hadfield
Seattle Aquarium, Seattle WA USA

Lisa A Hoopes
Georgia Aquarium, Georgia, USA

Erin Meyer
Seattle Aquarium, WA USA

Leah Neal
Georgia Aquarium, Georgia, USA

Mark V Erdmann
Conservation International



Adult Zebra Shark (*Stegostoma tigrinum*), Julian Rocks Nguthungulli Nature Reserve, New South Wales, Australia

With growing conservation concern for sharks and rays, the majority of interventions have consisted of species protection advocacy at the local and national levels, fisheries regulations at the national and regional levels, international treaties (e.g., Convention on the International Trade in Endangered Species of Flora and Fauna [CITES], Convention on the Conservation of Migratory Species of Wild Animals [CMS]), and spatial protections (e.g., Marine Protected Areas [MPA], dedicated "Shark Sanctuaries", etc.). In stark contrast, one intervention strategy that has received almost no attention for threatened elasmobranchs is ex-situ breeding for wild release and other translocation efforts. This might seem surprising given the success of this approach for recovering other threatened species such as the California Condor (*Gymnogyps californianus*), Scimitar-horned Oryx (*Oryx dammah*), and Black-footed Ferret (*Mustela nigripes*); we suspect that this is mainly explained by differences in our understanding of the diverse reproductive strategies of sharks and rays relative to mammals and birds, combined with the dominant perception of elasmobranchs as commodities or a menace to human safety rather than as ecologically important and charismatic species deserving of concerted protection efforts. There is, however, no *a priori* reason why translocations should not form an essential part of integrated conservation strategies for sharks and rays. Enter ReShark (www.reshark.org), an international collective focused on linking in-situ and ex-situ conservation solutions for threatened shark and ray species through captive breeding and/or other translocations. The first project within the ReShark collective, the **Stegostoma tigrinum Augmentation and Recovery (StAR) project**, serves as a successful model for ex-situ conservation management of shark and ray species following IUCN's *One Plan Approach* and the IUCN SSC *Guidelines on the use of ex-situ management for species conservation*. Here, we provide an overview of the StAR project, from conceptualization to implementation, as an example of how the ReShark approach can be successfully applied to threatened elasmobranch conservation efforts.

IUCN One-Plan Approach

This initiative of the IUCN Species Survival Commission (SSC) Conservation Planning Specialist Group (CPSG) aims to develop one comprehensive conservation plan for individual species that bridges the gap between field-based initiatives to conserve threatened species and long-term ex-situ breeding programs for maintaining sustainable wildlife populations in human care. Under this initiative, there are guidelines to assist with the use of ex-situ breeding populations for wildlife management that have helped to formulate the ReShark approach.

Star Project

Early Ideas of ReSharking

The origins of the ReShark approach date to 2015. During the reassessment of the Indo-Pacific Leopard Shark (also known as Zebra Shark; *Stegostoma tigrinum*) for the IUCN Red List of Threatened Species™, a striking conservation asymmetry was revealed: the species was highly threatened throughout much of its range in the wild but was thriving in aquarium facilities around the world. Given the implementation of ex-situ breeding programs to conserve other species, this raised the question of the feasibility for threatened sharks and rays. At that time, Dr Mark Erdmann of Conservation International was working in Raja Ampat, Eastern Indonesia, in collaboration with the SEAA Aquarium (Singapore). In contrast to the SEAA Aquarium, which had an over-abundance of Indo-Pacific Leopard Shark pups in their facility, this species was nearly extirpated from the Raja Ampat MPA network (established in 2007, comprising

nine MPAs totaling just under 2 million hectare of high diversity coral reefs and associated ecosystems). Though a decade of conservation efforts, including the designation of the entire area as a strict shark and ray sanctuary in 2012, produced an impressive recovery of the local populations of reef shark species and Reef Manta Rays (*Mobula alfredi*), there was no noticeable recovery of Indo-Pacific Leopard Sharks.

Initial discussions between Erdmann and Indo-Pacific Leopard Shark researcher Dr Christine Dudgeon around the potential of an ex-situ conservation initiative were generally favorable but raised questions about potential genetic pollution from the release of animals bred in captivity (see Genetics inset box), the feasibility of the project and ethical considerations. Interest in the project was reignited in 2017 from work being conducted at the Aquarium des Lagons in New Caledonia, which had been collecting Indo-Pacific Leopard Shark eggs from the wild, hatching and rearing the pups as part of a display for the public, and then releasing them back to Noumea's reefs. Further, the Aquarium had successfully shipped Indo-Pacific Leopard Shark eggs across the Pacific to Chicago's Shedd Aquarium, providing proof-of-concept for long-distance egg shipments and rearing and releasing pups into the wild.

Genetics

Two primary considerations for genetics in ex-situ breeding programs are outbreeding and inbreeding. Outbreeding concerns genetic pollution and ensures that released animals originate from the appropriate genetic stock. For *Stegostoma*, population genetics had shown the global distribution to be split into two major sub-populations divided within Indonesia by the Indonesian Throughflow Current, which coincides with the biogeographic feature of the Wallace Line. Raja Ampat falls on the eastern side of this divide. All animals in human care are screened using maternally inherited mitochondrial DNA (ND4) and bi-parentally inherited microsatellite markers (16 marker panel). If both marker types support an eastern population provenance, the animal is deemed an appropriate breeder. All genetic samples are screened at the same facility (Feldheim Laboratory, The Field Museum, Chicago USA) to ensure calibration across samples. Inbreeding is concerned with genetic fitness, where mating of closely related animals results in reduced genetic diversity. Using microsatellite markers, we select potential breeding pairs that demonstrate low genetic relatedness – that is, they do not fall into the categories of parent-offspring, full-sibling, or half-sibling relationships. An extreme form of inbreeding is parthenogenesis. This translates to 'virgin birth' and has been recorded from over ten shark and ray species, including the Indo-Pacific Leopard Shark. Although the mechanism is not determined, the genetic signal of parthenogenesis is clear. The DNA in the haploid egg cell is duplicated. Hence, the diploid parthenote offspring have identical gene copies at each genetic marker, rather than the genetic diversity observed when different gene copies are passed on from each parent. Parthenotes have a very high level of mortality, as any harmful gene will be expressed. The first batch of viable eggs from each potential ex-situ breeding pair are screened for parthenotes. Only breeding pairs that are producing heterozygous offspring, indicating sexual reproduction, are approved for the program.

Georgia Aquarium workshop, Setting up the structure, SC and the COVID years

The StAR Project is born

The next momentum pulse came from discussions between Erdmann and Dr. Al Dove from the Georgia Aquarium, which eventually led to a seminal December 2019 workshop on *Stegostoma* conservation. The workshop, which was hosted by the Georgia Aquarium and included 21 representatives from Association of Zoos and Aquariums (AZA)-accredited aquariums, academia, conservation organizations and the IUCN SSC CPSG, comprised three days of examining the feasibility and appropriateness of a conservation translocation program for Leopard Sharks. There was resulting unanimous support to proceed with the idea, with Raja Ampat deemed an appropriate demonstration site given its healthy and well-managed reefs and strongly supportive stakeholders. Further conversations demonstrated support from multiple levels of the Indonesian government (see below). Moreover, two local NGOs based at Raja Ampat dive resorts, the Raja Ampat Research and Conservation Centre (RARCC), and Misool Foundation (MF), indicated strong interest in building and managing the nurseries envisioned for the project.

By February 2020, as the COVID pandemic swept the globe, a small team began holding biweekly video conferences to discuss how to turn this bold idea into reality. A Steering Committee (SC) was formed, with Dr. Erin Meyer from Seattle Aquarium appointed chair, and within two months, an overall workplan was agreed upon and a Charter drafted. The project, named the *Stegostoma tigrinum* Augmentation and Recovery (StAR) project, now had a clear objective: to re-establish a healthy, self-sustaining population of Indo-Pacific Leopard Sharks beginning with the Raja Ampat archipelago through the world's first conservation translocation of captive-bred threatened sharks and rays.

In May 2020, the SC obtained the endorsement of the StAR concept from the joint chairs of the IUCN SSC Shark Specialist Group at the time, Dr Nick Dulvy and Dr Colin Simpfendorfer, following discussions and reassurance that this approach complements and does not replace other elasmobranch conservation measures, including fisheries management approaches and MPA designations. Dulvy and Simpfendorfer further recommended modelling the approach to demonstrate the need for conservation translocation to recover the Raja Ampat population and clearly define what success would look like for the project (see PVA inset box).

An initial "anchor grant" for StAR was successfully secured from Fondation Segré to fund implementation activities in Indonesia (ranging from governmental meetings to nursery construction and operations and staffing). Over 30 institutional and private donors have joined the coalition to support the StAR project, including a number participating in the "Adopt-A-Leopard-Shark" program by contributing \$10,000 to adopt and name one of the pups to be released.

As momentum for the StAR project continued to build, Nesha Ichida (from the Indonesian NGO Thrive Conservation) was hired as the Indonesian Program Manager, and the SC developed topical working groups which meet regularly to further flesh out important details for project implementation and to develop Standard Operating Procedures (SOPs).

Indonesian Implementation Working Group (WG)

The Indonesian Implementation WG is tasked with engaging and coordinating the range of stakeholders within Indonesia for the successful implementation of the StAR project. Its immediate focus upon formation was to ensure strong local ownership, while also building national-level support from relevant ministries that needed to endorse the project and issue the various permits to import eggs, release pups into the wild, and conduct research. The Indonesian Implementation WG has representation from relevant government agencies and local NGOs Konservasi Indonesia and Thrive Conservation.

Multiple levels of government support

The Raja Ampat MPA Management Authority was the first agency to be engaged to ensure local ownership; immediately after that, the Regional Research and Innovation Agency of West Papua Province was brought on as the lead project agency under the direction of Prof Charlie Heatubun. In March 2021, a high-level meeting in Jakarta to gain national-level government support was chaired by Prof Heatubun along with the Governor of West Papua. This brought together local and regional agencies, including the special staff to the President of the Republic of Indonesia; representatives of multiple departments of the Ministry of Marine Affairs and Fisheries; numerous local NGOs; and StAR Project international representation. Collaborators from the National Research and Innovation Agency provided critical support. Though participants largely supported the approach, two significant concerns raised included whether the project is needed for the species' recovery (see PVA inset box) and genetic pollution (see Genetics inset box). These concerns were duly addressed, and representatives from the four Ministries attending signed a high-level commitment to support the project. In November 2022, once the first shipment of eggs had been received and the first release of pups was imminent, the West Papua government hosted a gala launching ceremony for the StAR project that included a tour of the nursery facilities for government officials.

PVA

Population Viability Analysis (PVA) is a quantitative assessment of species extinction risk under current or predicted conditions. Dr. Kathy Traylor-Holzer from the IUCN CPSG was engaged to run through the PVA for the Indo-Pacific Leopard Shark in Raja Ampat with the StAR committee. One of the very first critical steps was defining success. What is the project's major goal, and how do we know when we have reached it? The definition of success for StAR is: 'to re-establish a healthy, genetically diverse and self-sustaining population of Leopard Sharks in the Raja Ampat archipelago'. The PVA was then implemented through multiple computer simulation scenarios with this definition of success as the target. The scenarios included 'business as usual' – that is, no contribution from ex-situ breeding programs – as well as multiple scenarios with different numbers of animal releases over varying time frames. The outputs showed that under a "business as usual" scenario, the Raja Ampat population would need more than 60 years to recover to a base population (100–200 individuals) with a 23% chance of extinction. The optimal release scenario supported a much more robust recovery through animal releases from ex-situ breeding over a 10-year time frame and a highly reduced chance of extinction. The PVA was instrumental in formulating an animal release design (numbers of animals and frequency of releases) and being an essential tool for demonstrating the conservation utility of the ex-situ breeding program for stakeholders. www.cpsg.org/content/zebra-shark-pva

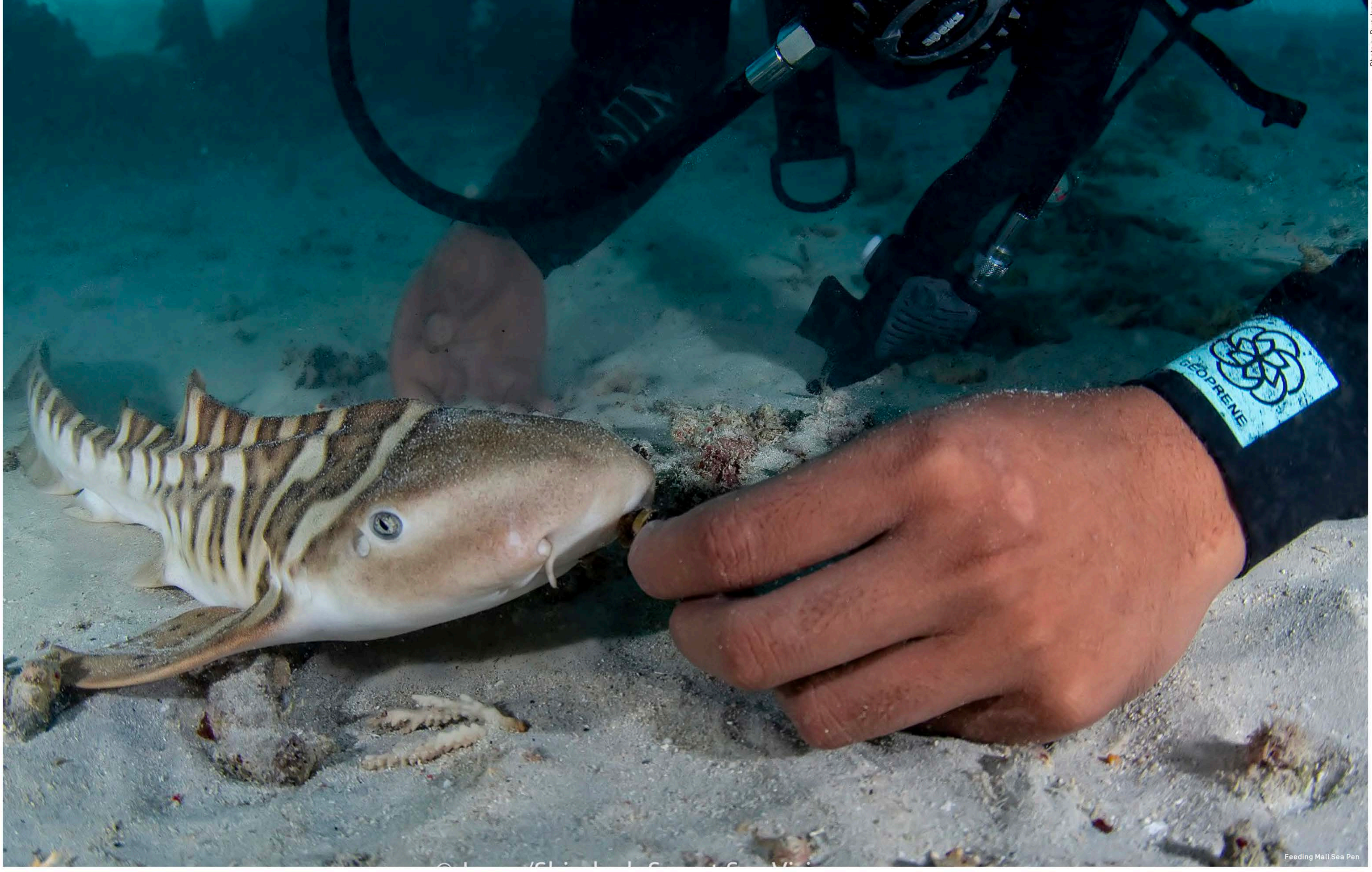


Photo by Burt Jones



Wayag release site



Audrey prior to release

Photos by Mark V Erdmann



Photo by Mark V Erdmann

Kathlyn 10 weeks







Blessing newly arrived eggs



Zebra Shark fishery,
Raja Ampat, Southwest
Papua, Indonesia

