UNIVERSITY OF CANBERRA

INSTITUTE FOR APPLIED ECOLOGY

REPORT ON ACTIVITES 2013 - 2016

THE PIKU PROJECT: COMMUNITY-LED CONSERVATION

The Pig-nosed Turtle *Carettochelys insculpta*

Extracts from a report to the PNG LNG Project, a project managed by ExxonMobil PNG Limited

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BREAK THROUGH

REPORT ON ACTIVITIES

THE PIKU PROJECT: COMMUNITY LED CONSERVATION

The Pig-nosed Turtle *Carettochelys insculpta*

2013 - 2016

1. Executive Summary

The Kikori communities are undergoing unprecedented change owing to the substantial benefits derived from the extractive industries (petroleum and forestry) and improvements in transport infrastructure and access to the region. The resultant opportunities for income and trade are fostering a shift from a subsistence to a cash economy which, together with increasing human population densities, has potential to put additional pressures on the natural environment.

Change is unavoidable, but the potential impacts of that change, both positive and negative, require active management based on the best available information. This project works closely with local communities in the Kikori catchment to build awareness of the challenges facing conservation of the region's unique biodiversity and the benefits of environmental sustainability. It will build capacity to respond to these challenges.

We have chosen the pig-nosed turtle (*Carettochelys insculpta*) as the best avenue by which we can interact with the Kikori communities to bring about positive outcomes for biodiversity conservation and sustainability.

The species has a high profile internationally, being the last member of its family, and restricted in distribution to the southern rivers of Papua New Guinea and scattered localities in northern Australia.

The species has a high profile locally as a favoured traditional food and important source of protein for local villagers. Both the international community and the local community have an interest in the sustainable management of this species.

Recently, the species received national and international attention from the media, owing to the confirmed population decline and conservation activities in Kikori (Eisemberg, 2011). In 2013, the Piku Team operating out of the University of Canberra began a new phase of the community-led conservation project in Kikori under renewed funding from PNG LNG Project managed by ExxonMobil PNG Ltd. The contract extended from July 2013 to December 2016.

Although the project has the pig-nosed turtle as its focus, the benefits extend much more broadly. The project builds constituency behind conservation and sustainability, builds capacity in the local community to deal with challenges as they arise, and supports community-led initiatives such as the establishment of protected areas

considered to be of particularly high value, and managing environmental impacts more generally.

The aim of the project was to capitalize on the unparalleled opportunity presented by the pig-nosed turtle and the social and cultural context of the Kikori lowlands to engage with the local communities to achieve positive outcomes for sustainability and conservation of the natural resources of the region – to build community awareness and capacity building, and to achieve biodiversity conservation and sustainability that extend beyond the needs of the flagship species.

Outcomes

We now have an excellent level of engagement with 23 villages across the Kikori lowlands for two-way dialog on conservation and sustainability, and have built a high level of trust. This is becoming increasingly important with peak NGOs like WWF progressively withdrawing from the region for complex reasons. This allowed the Piku Team to deliver on a number of fronts.

The environmental education component of the project delivered through engagement with schools in the development and delivery of their curricula around environmental management and sustainability, experiential learning (learning by doing), working with PNG universities to provide work experience for their graduates, supporting postgraduate research training, and outreach.

The team ran teacher workshops in Kikori and Moro using materials created by the team and circulated to schools with a copy for each student – *The Adventures of Piggy on the Kikori*, *Monty and the Lake Kutubu Invasion*, and *Little Al in Big Trouble*. Teachers used these workshops to build exercises and learning materials for use in their classrooms. Evaluation of the workshops was universally positive and constructive.

Experiential learning to complement formal classes was delivered through engagement of students in village and market monitoring, and with the nest protection programme at Wau Creek in the Kikori hinterlands and on Turuvio Island on the coast. Students engaging productively with these activities were rewarded with scholarships to cover school fees and associated education costs.

Engagement with PNG Universities was via support for volunteer work experience students from UPNG and Divine Word University (Madang) to visit the site and engage in project activities, and paid work experience graduates to engage in village surveys and evaluation of community perceptions of the project and outcomes. Delivery on this aspect of the project was constrained somewhat by logistic issues and delays in establishing the research facilities at Wau Creek.

Postgraduate research support was provided to a research Masters Student, Ms Yolarnie Amepou, recruited from PNG Institute for Biological Research (PNG IBR). The Piku Project has provided the opportunity for one of PNG's brightest young people to flourish both nationally and internationally. She is a promising young scientist and advocate for science and what it can bring to the table to assist decision-making. She won student

prizes for best presentation at conferences in the USA and Fiji, and is one of only 8 recipients world-wide to receive full travel support to attend the World Congress of Herpetology in China later this year. In 2015, Ms Amepou was recipient of the Pride of PNG Award for Women (Environment Division) for her work. She is building invaluable capacity and experience in working with different cultures, so important in PNG. She has a promising career ahead of her.

The Piku Team engaged in a wide range of outreach and communication activities. This included regular press releases, featuring the Piku project regularly in company reports, newsletters and brochures in print and online, radio interviews, participation in workshops, working with POM Nature Park on Environment Day each year and other public functions, making seminal contributions of specimens to the collections of the PNG National Museum and Art Galleries, and public awareness activities in the broader Kikori Community. A Facebook site, *Saving Piku – PNG's Pignosed Turtle*, provides a means of communicating blow-by-blow reports on project activities to a wide audience, including the 512 current subscribers, many of them PNG nationals.

A highlight of the Piku Team's achievements was the successful establishment of the Wau Creek field station by landowner Frank John and the Rupahi Clan. This landowner initiative was made possible by the support of the Piku project, through guidance and advice, funds for materials and labour, engagement of Frank John as a 'ranger' to undertake turtle nest protection, assistance with movement to and from the field station, and recruitment of paying visitors to the facility. Exxon-Mobil PNG staff visited the facility this year with Aird Hills Wildlife Management Area personnel for sharing of ideas. The vision for the Wau Creek protected area is to have it recognized by the national Conservation, Environment and Protection Agency (CEPA) as a Wildlife Management Area, and to establish avenues of income for Frank John and the Rupahi Clan to offset their losses from preventing logging and ceasing harvest activities. Stages 2 and 3 of the protected area are under discussion.

Research outcomes, the generation of new knowledge relevant to the community in its decision-making, has resulted in a number of scientific papers in leading journals which include PNG nationals as co-authors, national and international conference presentations including two keynote addresses and award of prizes for best presentation, seminars and networking with the international conservation community on new information that relates to the conservation status of the pig-nosed turtle.

We know have a much better understanding of the biology of the pig nosed turtle, and can demonstrate greater community awareness of the species and biodiversity conservation issues more generally. Importantly, there is much greater acknowledgement by the community that the pig nosed turtle is in decline. This is critically important because if the community is not aware of the problem, they will be unlikely to engage in engineering solutions.

We are also now in a more defensible position to provide practical advice to the community on options to affectively address the decline – adopt a reasoned balance

between restricting harvest of adult nesting female turtles and restricting the harvest of eggs in the hinterland nesting areas. Such advice might be to continue to harvest the eggs at some level of moderation, and to benefit from incidental catch of adult and sub-adult turtles while fishing, but refrain from harvesting nesting mothers.

Recommendations

General

- The goodwill generated by this project, and the commitment of key elements of the community to understanding the challenges and options before them is an excellent foundation for continued engagement by the industry to achieve enduring change. The project should continue.

Environmental Education

- Expand the teacher training, and engagement with the school curricula, to the Omati and Kutubu communities.

Community-led Conservation

- Continue the market and village monitoring of pig nosed turtle harvest, but with a stratified sampling design to improve focus to ensure reproducible and defensible data are collected on the levels of harvest, consumption and trade. We need to be able to confidently track trends in turtle abundance and identify recovery if it occurs.
- Consolidate the Wau Creek initiative, with formal recognition under PNG national regulations as a Wildlife Management Area. This will involve an influential champion in Port Moresby to obtain CEPA approval.
- Additional negotiations are required to secure material support from the East Kikori Local Level Government (LLG) and the Gulf Provincial Government. Commitment by the forestry industry to support the Wau Creek initiative through injection of funding will diversify the support for the initiative and so provide resilience. Crowd-funding is another option that should be explored.
- Subsequent expansion of the protected area to incorporate adjacent limestone ridges and pinnacles to the north (referred to by the locals as the “mountains”) – of no value to forestry -- and other Siri River lands owned by the Rupiha Clan.
- Support a coordinated approach to establishing a coastal zone protected area, as a broad initiative, bringing in the villages of Goari, Apeowa and Veraibari to an agreement for sustainable management of this important region.
- Work with the Aird Hills Wildlife Management Area team to clarify their vision for conservation and sustainability in their region, and determine if they wish to pursue the options currently taken by the Rupiha Clan. If so, assist them to achieve their vision.

- Establish a ranger program, akin to the land management Djelk Rangers program operating in Arnhem Land of northern Australia, to provide employment opportunities associated with conservation initiatives.

Research

- Diversify the avenues of funding for research projects in the Kikori, including opportunities for postgraduate research students.
- Facilitate researchers to undertake work in the Kikori region by providing advice, logistic support and access to the Wau Creek field station and other opportunities at Aird Hills and elsewhere.
- Undertake a stock analysis, using modern molecular techniques, to determine the extent of the Carettochelys population that includes the Kikori, to identify the spatial scope of the unit that should be the focus of management.

Outreach and Communications

- Support the redesign and production of the three childrens' books to bring them to a higher professional standard, and design and produce an additional two books, for circulation to the next cohort of students in the Kikori lowlands, the Lake Kutubu catchment and the Omati lowlands.
- Capitalise on the new biodiversity coming to light through surveys and research with the production of posters (e.g. Frogs of Wau Creek) and field guides (Marine and Freshwater Turtles of New Guinea) for circulation and sale nationally and internationally.

2. Background

- The pig-nosed turtle (*Carettochelys insculpta*) has a high profile internationally, being the last member of its family, and restricted in distribution to the southern rivers of Papua New Guinea and scattered localities in northern Australia.
- The pig-nosed turtle has a high profile locally as a favoured traditional food and important source of protein for local villagers. Both the international community and the local community have an interest in the sustainable management of this species.
- Recently, the pig-nosed turtle has received national and international attention from the media, owing to the confirmed population decline and conservation activities in Kikori (Eisemberg, 2011) and intensive illegal traffic in the species in Indonesian Papua.
- Flagship species have an important role in conservation, where there may be broad benefits of building constituency behind conservation generally, and a commitment to establishing protected areas and habitat management that have much broader conservation benefits. The pig-nosed turtle has all of the attributes of a flagship

species, to focus community attention and marshal community support behind sustainability biodiversity initiatives more generally.

3. Aim

- To capitalize on the unparalleled opportunity presented by the pig-nosed turtle and the social and cultural context of the Kikori lowlands to engage with the local communities to achieve positive outcomes for sustainability and conservation of the natural resources of the region.

4. Statement of Significance

- Opportunity to engage in community-led conservation of an iconic species of national and international significance.
- Investment in the youth of Papua New Guinea through school and university programs to promote a conservation ethic.
- Building on the strong research base established by company-assisted research in 2007-2012, in which the key challenges and knowledge gaps have been met.
- Capacity to leverage support for ongoing conservation initiatives from government sources and leading NGOs, particularly in the establishment of new protected areas within the lowland Kikori.
- Consistent with the aim to leave a long-term legacy of improved sustainable development opportunities in areas where the company operates.

5. Outcomes -- Environmental Education

Kikori and the Gulf Province more generally present particular challenges in education. Diversity of prior learning, and literacy in particular, within schools, school closures and difficulty in attracting and retaining teachers have led to some of the lowest standards of education in PNG. The PNG Government has a declared literacy rate of 52%, which is an average nationwide. However, the literacy rate in Gulf Province assessed in 2009 and 2010 by ASPBAE Australia Ltd and the PNG Education Advocacy Network (PEAN)[1] revealed a literacy rate of just 4.4%, well below the national average. Even in Primary Schools, the literacy rates were only 6.6% literate, 53.8% semi-literate and 39.6% illiterate. Low literacy in communities and classrooms is a challenge, but the situation

[1] ASPBAE Australia Ltd and PNG Education Advocacy Network (2011) PNG Education Experience Survey and Literacy Assessment. A Report on five Provinces, New Ireland, NCD, Chimbu, Sandaun and Gulf Provinces. ASPBAE Australia Ltd.

also presents opportunity for a program such as the Piku Project to add real value from a low base.

In this context, education is an essential component of capacity building. We targeted at five levels:

- *Engaging with school curricula* and training teachers at primary and secondary level;
- *Experiential learning* – engaging members of the community with the on-ground conservation and research activities;
- *Working with PNG universities* to provide opportunity for promising young undergraduates to visit Kikori and engage with the program;
- *Postgraduate research training* – supporting research masters students;
- *Outreach* – engaging with environmental education and awareness programmes in more generally.

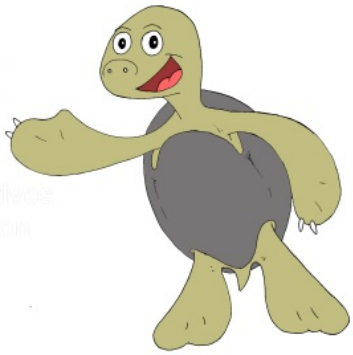
Engaging with school curricula

Teaching and learning about the environment and sustainability are now part of the curriculum for all levels of education in PNG, including pre-service primary teacher colleges and primary schools[2]. Education in Kikori is on one hand very challenging, because of the diversity of student prior learning, the difficulty in keeping schools open and retaining teachers, but on the other hand presents substantial opportunities for a program such as ours to add real value. Teachers in Kikori are particularly greatful for any support that they can recieve from diverse quarters, including the Piku Team.

Curricular materials

The Piku team has designed and printed a range of curricular materials as follows.

- **Kiddies Book – The Adventures of Piggy on the Kikori**
  (Elementary School upwards)

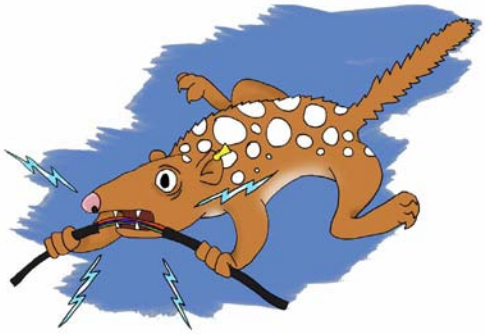
  This delightfully illustrated book tells the story of Piggy the pig-nosed turtle in the Kikori Delta, from the day they hatch out from the egg and grow to adults who in turn lay eggs. It tells of how temperature in the nest determines if the hatchling turtle is a boy or a girl, the life pressures faced by the turtles as they grow to adulthood, and the interactions they have with humans. The book is laced with challenging exercises and puzzles, and finishes with the important message that we need to be careful if we want piggy to be swimming the Kikori in the future.

[2] PNG_Dept_of_Education, *Teacher education national curriculum guidelines* 2004, Port Moresby: PNG Dept of Education.

- **Kiddies Book – Monty and the Lake Kutubu Invasion**
  (Grade 6 to High School)

This book, also delightfully illustrated, tells the story of Chris the Carp who inadvertently found himself a long way from home. He found himself in the very special Lake Kutubu nestled in the headwaters of the Kikori River. Chris causes great consternation for Monty and among the local native fish of Lake Kutubu, many of which are found nowhere else and greatly value their home. Although initially they come to accept Chris, he does what carp do, is resented and becomes deeply unhappy, and Monty and the local fish hatch a plan to relocate Chris back to where he came from, through cooperation with a local cassowary and a resident scientist. The lesson in this book is to beware of bringing exotic fish from far away into our sensitive natural environment.

- **Kiddies Book – Little Al in Big Trouble**
  (Grade 6 to High School)



Disposable packaging and other rubbish is growing problem for local communities and for the world. It is estimated that one third of marine mammals have some plastic in their guts, and birds in he most remote regions of our vast oceans die with all manner of plastic in their craws. This book tells the story of Al the somewhat mischievous Quoll, discovers a pile of garbage dumped outside the village. He invites all his friends to a feast, only to find they are plagued by plastic snares, gum in their hair, and tin cans around their necks. He at first convinces his friends to extract retribution from the village, until it is discovered that no malice was intended. The animals and the people work together to find solutions to this problem.

- **Radio Plays – Book and CD**
  (Listening from Elementary School, Reading from Grade 6 upwards)

Joshua Keme Murepu – Kikori Primary

The school children of Kikori conceived and presented a series of short radio plays, each featuring a local wildlife species of particular importance to them, and each with a conservation message. This booklet is illustrated by the children themselves, to provide context to the plays which are in English, Motu and Tok Pisin. Learn from

Bart the barramundi, Cassie the cassowary, Matt the fruit bat and Walter the water-rat. The book is accompanied by a CD of the plays, presented by the Kikori children as broadcast by Radio Kikori and Radio

Teacher workshops

Teacher workshops were conducted in each of 2014, 2015 and 2016 once the curricular materials arrived in Kikori (Fig 1). These workshops followed earlier workshops, prior to this contract, on the subject of sustainability and the environment, using as its focus, the childrens' book *The Adventures of Piggy on the Kikori*.

The 2014 teachers' workshop focused on Monty and the Lake Kutubu Invasion, and was delivered to teachers from the Lake Kutubu Catchment.

"This workshop is very good because in my district and community we have invasive species and I have come to understand that we have so many."
Mr Dairo Joe - Veraibari Elementary school

The 2015 teachers' workshop focused on the importance of the environment, biodiversity, and the threats they face. It was focussed on the second book, *Monty and the Lake Kutubu Invasion*. Fifteen teachers attended, from five elementary schools -- Babaguna, Bisi, Ero, Kikori (n=2), Veraibari – four primary schools -- Airdhill, Kikori (n=3), Veiru, Veraibari (n=2) -- and one vocational school -- St Joseph's Vocational (n=2).

Fig 1. School teachers work up curricular materials based on the *Little Al in Big Trouble* book which addresses pollution in the environment.

The 2016 teachers' workshop focused on environmental management and in particular the impact of pollution on the environment, focussing on use of the third book, *Little Al in Big Trouble*. Eighteen teachers from seven elementary schools -- Babaguna, Bisi, Ero, Irimuku, Kakarau, Kikori, Omati -- six primary schools – Aird Hills, Apeowa, Bisi, Kikori, Kitomave, Veraibari -- one secondary school -- Kikori (n=2), one vocational school (St Joseph's Vocational (n=2).

"Its timely and the workshop should be held every year before school starts and the findings of research should be made available in booklets for the schools to learn more."
Mr Timothy Wama - St Joseph's Vocational School.

These workshops provide opportunity for exchange of information and perspectives in both directions. The Piku Team provides hard to obtain curricular materials and suggestion for their use in meeting environmental education objectives in the class room, whereas the teachers, who know their students, their learning challenges, and their prior learning better than anyone, are able to translate the materials into learning plans to take back to the classroom, and to better inform us on needs.

The 2016 workshop also benefited from a visit by Kikori's education department personnel, which included the Elementary Teacher trainer, who assisted Elementary teachers in the development of their lesson plan during the workshop.

Teacher Evaluation: Each workshop finished with a formal evaluation by participants.

The teachers greatly valued the workshops (Fig 2), with 65% of participants going so far as to rank the workshops 10 out of 10 and no participant gave a ranking below 6 out of 10 Participants appreciated gaining knowledge of invasive species, biodiversity and environmental management generally, pollution, and turtle conservation. Many commented on the value of the lesson plans.

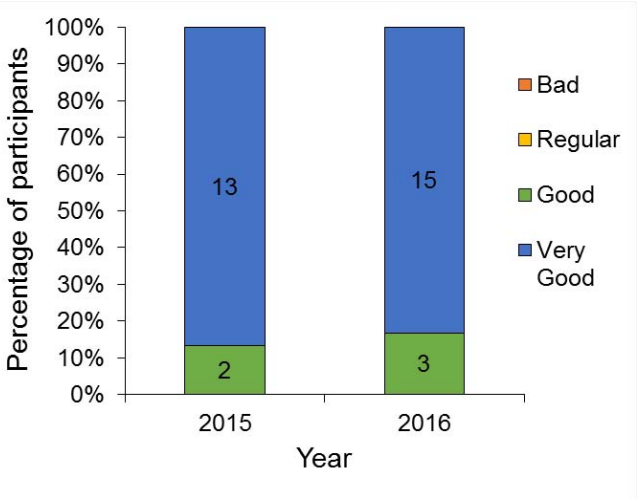


Fig 2. Teacher evaluation of the teacher workshops in each of 2015 and 2016.

Nevertheless, participants tendered many suggestions for improvement. They wanted more workshops of longer duration, and better timed to fit in with their busy schedules. They appreciated that their costs of attendance were covered, but would like to see an allowance paid also. They would liked to have seen more printed materials in addition to verbal and powerpoint presentations that they could transfer easily to school materials, and that would better enable them to retain their learnings. They would like to see greater community awareness of their engagement in these workshops, and to have more schools involved. A trip to Wau Creek as part of the workshop was suggested.

These are all matters that we will take on board in future iterations of the workshop, should our contract be renewed, and ensure that participants can see clearly the influence their feedback has had on the workshop programme.

Lessons in Schools

The Piku team took every opportunity to respond to invitations extended by a teacher or the headmaster/headmistress to deliver lessons in the schools (Fig3).

Environmental lessons 1-2hour duration were delivered on topics such as Why my environment is important, Pollution,

Fig 3. Grade 4 and 5 students from Kopi Primary School reading *Monty and the Lake Kutubu Invasion* while having a lesson with the Piku team about Invasive species on February 2016.

Invasive species, and Extinction. School lessons began in 2013 with a visit to the St Joseph Vocational School. Early in 2014 lessons coincided with the hatching of pig-nosed turtle eggs, delivered at Kikori Primary School. Between 2014 and 2016 environmental classes were given at Aird hills Primary and Elementary schools, Veraibari Primary School, Veiru Primary School, Kopi Primary School, Kitomave Primary School and Kikori Primary School.

Our last lesson was on human impacts to the environment for the grade 12 biology class at the Kikori Secondary School in March 2016.

These lessons enabled continued contact with teachers after the teacher workshops and complemented the planned curriculum.

Fig 4. Our posters combine with posters created by the school children, here at Aird Hills Community School, to give a powerful message to students and their parents alike.

Student Evaluation: In 2016, we undertook a formal evaluation of the Piku supported school activities. In May 2016, during the school break, students were invited to fill an evaluation form. Students from Kitomave (15-Apr-16), Aird Hills (18-Apr-16), Veiru (23-Apr-16) and Kopi (24-Apr-16) primary Schools participated in this activity. Depending on their level of literacy, students from grade 3 to 7 filled the basic evaluation questionnaire, while students from grade 7 to 8 filled the complete evaluation questionnaire.

It is important to note that students completed the evaluation on the basis of their engagement with the Piku project broadly, in the markets, engaged in the village and market monitoring, when their households were surveyed, and in the classroom.

The basic evaluation questionnaire was answered by 81 students. These students reported a very favourable response to their engagement with the Piku Team (Fig 5).

"They came and gave us lollies and told us some stories. They ask us what is our environment and we give answers."
Medlin Deloko, Aird Hills School, Grade 8

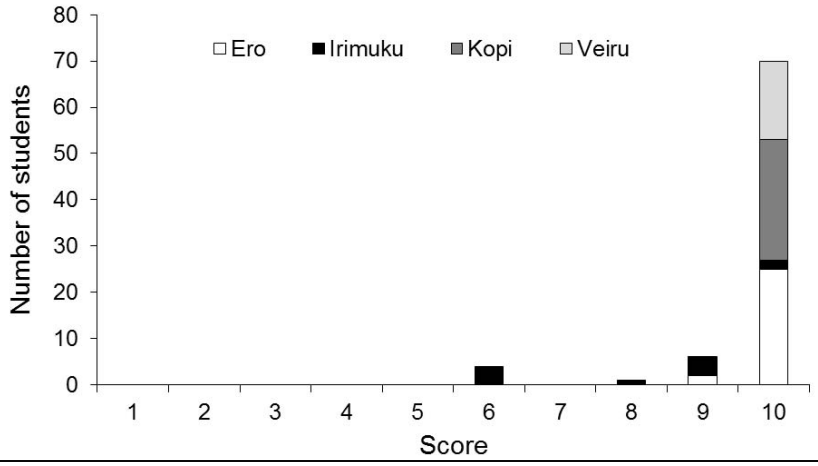


Fig 5. Student basic evaluation of the Piku project, ranked on a scale of 1 (worst) to 10 (best), and broken down by school.

The complete evaluation was undertaken by 36 students with a high level of literacy, from Irimuku/Kitomave (grade 7 and 8 = 8 students, 15-Apr), Ero/Aird Hills (grade 8 = 11 students, 18-Apr), Veiru (grade 8 = 11 students, 23-Apr) and Kopi (grade 8 = 6 students, 24-Apr) primary schools. Over 70 % scored the project as 10 out of 10 (Fig 7). One student scored the project with the minimum score (1), but rated the project as "very good", which may have resulted from misunderstanding the scoring system (No. 1 as highest).

"I learn how to manage my resources and environment and also I want to learn how to keep my environment clean and healthy and also I learn how to manage marine life."
Samson Kevin, Kitomave School, Grade 7

Fig 6. Every child in the Kikori lowlands, and for recent editions, in the Kutubu catchment, receive a copy of the childrens books. For some, it is their first book.

If we disregard the monitoring activities, the favourite activities, from the student perspective, was working with the books and the environmental lessons. Irimuku students particularly valued the drawing activities (Fig 8).

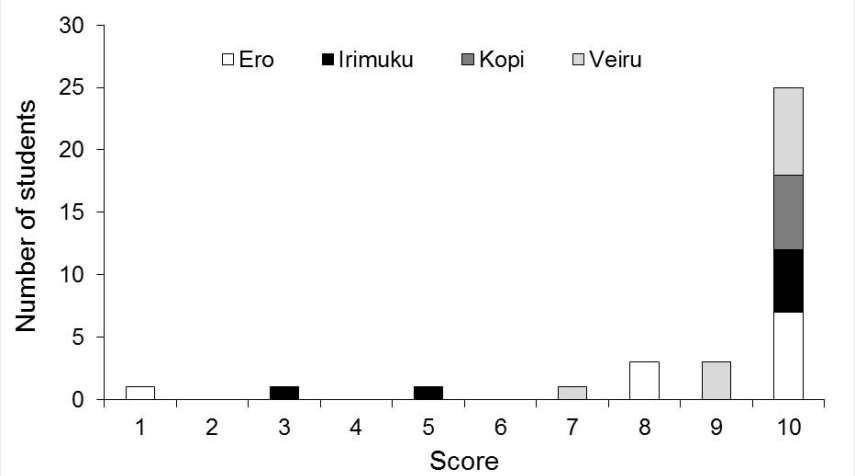


Fig 7. Scores given by school children, in the complete evalutation, for their experience with engagement with the Piku project on a scale of 1 (worst) to 10

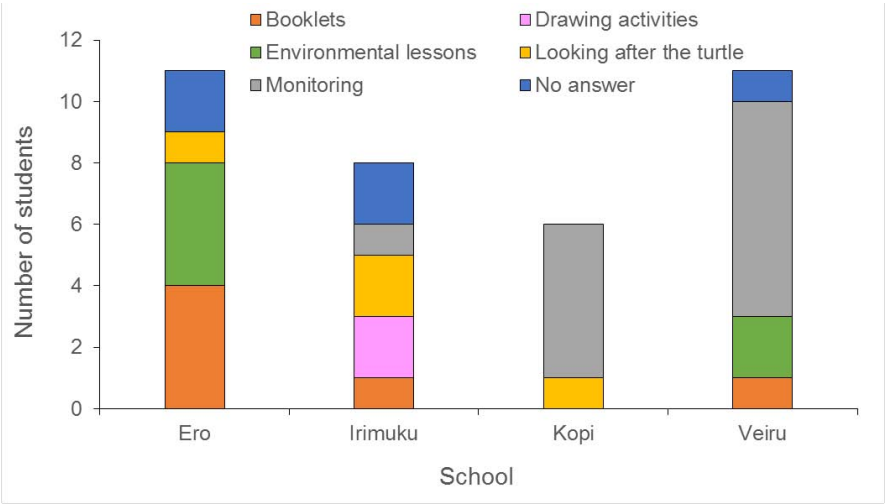


Fig 8. Value placed on engagement with the Piku Project as seen through the eyes of school children.

Experiential Learning

In the context of village life, experiential learning, that is, learning by doing, is one of the most effective ways of reinforcing and complementing learning that can occur under more formal classroom settings. Experiential learning draws its strengths from providing relevance, by encourages students to draw together and integrate their knowledge and understanding in a real-world context.

Village and market monitoring

Volunteer students were engaged in monitoring of village harvest and consumption of pig-nosed turtles (Fig 9). These students record the daily and weekly harvest on data sheets designed with their input. Information recorded includes the name of the hunter, how many turtles were captured, their size, the method of capture, and its final destination (consumed, traded within the village, market).

Fig 9. Student volunteers work with Piku employee Wilda Hongito to prepare for the coming season of monitoring turtle harvest in their villages.

By the end of the last season, students were monitoring harvest and consumption in 21 villages, and were drawn from 9 schools in the region. The students were provided with uniforms bearing the Piku logo and the necessary stationery.

The quality of data returned was assessed, and students who committed enthusiastically and effectively to the monitoring program were provided scholarships to cover fees and other essential costs of their education. Of the 42 students engaged in 2015/16, 39 were allocated scholarships to an average value of PGK 61.54 and a total value of PGK 2400.

A formal evaluation of the quality of the experience as judged by the students themselves (2015-16 cohort) was undertaken by consulting 20 students selected on availability from 14 villages -- Aedio (n= 2), Apeowa (1), Babeio (1), Bisi (2), Doibo (1), Ero (2), Goare (1), Irimuku (1), Kikori (2), Kuru (2), Lalau (1), Omo (2), Veiru (1), and Waira (1). These students were drawn from 5 schools – Aird Hills Primary (n = 2), Kikori Primary (11), Kikori Secondary (4), Kitomave Primary (1), Veiru Primary (2). The school grades from which they were drawn ranged from 4 to 10.

The evaluation was very positive. Of the 20 participants, 16 (80%) viewed the monitoring in a very positive light, 3 (15%) viewed it as good, and one student was neutral in their view. None regarded the experience as bad.

"I was convinced and happy to be part of the pig nosed turtle to work peacefully in my community and the team."
Opsy Enipo, Irimuku Village, Kitomave Primary

Students were asked if they would like to continue in the next season, and 90% responded yes (Fig 10). Most cited the reason as the work being enjoyable, and the value of new knowledge gained, but 20% of respondents indicated that the payment of scholarships was an important factor influencing their willingness to continue participation (Fig 10).

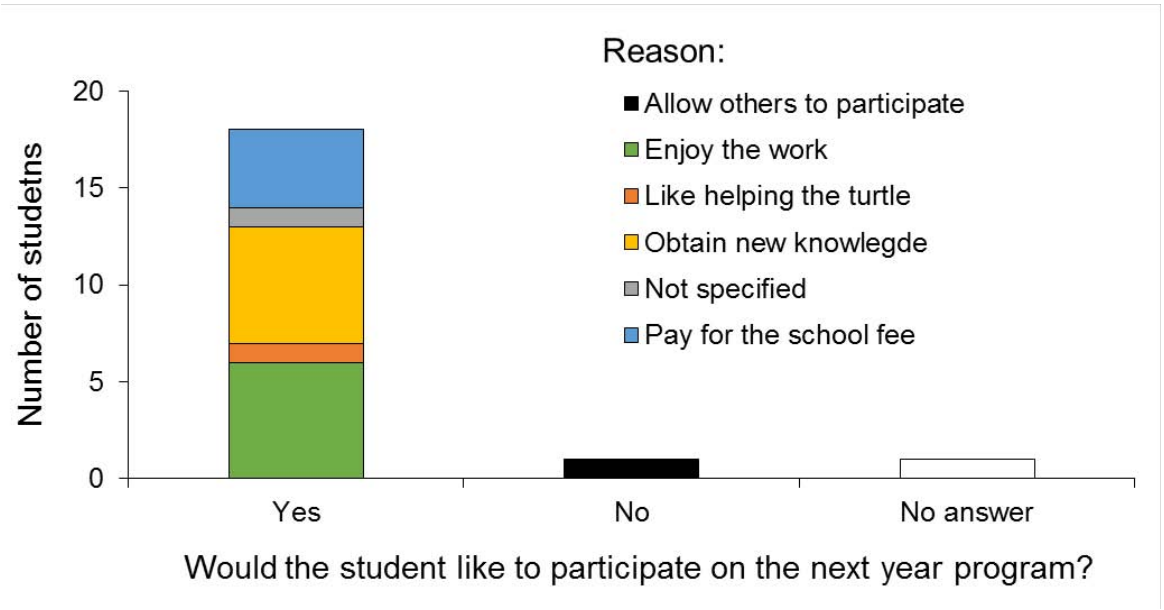


Fig 10. Results of an evaluation of why students were willing to continue participation in the monitoring program.

Students (45%) identified the key learning outcomes of their experience best grouped as knowledge of "monitoring technics" which related to learning how to perform surveys and record data. This was followed by learning about turtle conservation (25%) or conservation and environmental management more generally (1 respondent). Five respondents (25%) were unclear on the learning outcomes.

"With the Piku Project I had learnt idea of recording data for the pikus and piku eggs and also other turtles. And also I had learnt the effect that will lead to to piku extinction when human being don't manage piku wisely."
Johnathan Tratare, Omo Village, Kikori Secondary

Wau Creek Research and Monitoring

Wau Creek protected area and the associated monitoring programme provide an excellent opportunity for student engagement in experiential learning. Student visits to Wau Creek began in 2013 with two students from Kopi Primary School and nine students from Waira village accompanying landowner Frank John and researchers. They learnt about how this clan was protecting turtles both

by restricting harvesting of turtles and nests within the protected area as well as active protection of nests from goannas using chicken wire and by other means.

As part of their agreement with Frank John and the Rupahi clan, scholarships have been paid for selected students in Kikori schools who have volunteered to assist with the turtle monitoring at Wau Creek. A total of PGK 1675.00 has been paid in scholarships since the 2014 school year for a total of nine (9) students via Frank and the other four families of the clan.

Wau Creek research facilities were built and ready to accommodate the first guests in 2014, allowing more substantial engagement by volunteers. These included three students from the University of Divine Word and the University of Papua New Guinea. These students were attached to the project for eight (8) weeks on work experience, one week at Wau Creek.

Working with PNG universities

Engagement with PNG Universities is an area that could do with more sustained attention. The Piku Team draws its staff from PNG IBR and UPNG, with notable examples being honours graduates Yolarnie Amepou and Wilda Hungito respectively. With the research facilities in place in Wau Creek we have hosted three research experience students, one each from UPNG Environmental Science (Elija Kaile), UPNG Biology (Marcus Pesco) and Divine Word University Environmental Health (Ian Labiti). Following his time with us, Marcus Pesco has gone on to do an Honours degree with PNG IBR.

The University of Canberra and the Divine Word University have signed a formal MOU to enable greater collaboration in student supervision, and to place Yolarnie Amepou in an academic environment when out of Kikori.

The Piku Team has variously given presentations at UPNG in Port Moresby and Divine Word University in Madang.

Delays in completing the facilities at Wau Creek and logistics associated with travel have prevented greater engagement.

Postgraduate research training

We engaged a research student enrolled through the Institute for Applied Ecology at the University of Canberra to undertake a Master of Applied Science on the nesting biology of the pig nosed turtle and on the efficacy of the intervention at Wau Creek. Yolarnie Amepou came with strong recommendations from the PNG IBR in Goroka, where she had undertaken an honours on the harvest of sea cucumbers in New Ireland. Her candidature finishes at the end of 2016.

During her candidature, Ms Amepou has delivered oral presentations on her work at the 8th New Guinea Biological Conference in Lae, the 50th Anniversary Conference of the Australian Society of Herpetologists, the third Oceania Congress of the Society for Conservation Biology in Fiji, the 13th TSA Annual Symposium on the Conservation & Biology of Tortoises & Freshwater Turtles in Texas, USA, and is scheduled to speak at the World Congress of Herpetology in China in August of 2016.

As testimony to her capability, Ms Amepou won or shared the student prize for best presentation at both the Oceana Conference in Fiji and the TSA conference in the USA. She is one of only 8 recipients world-wide of a full travel scholarship to attend the World Congress for Herpetology in China.

Fig 11. The Award, Pride of PNG for Women [Environment] was accepted on Yolarnie's behalf by her sister [2nd from left]. Ms Amepou gave her acceptance speech by video link.

In this, Ms Amepou has been an outstanding ambassador for PNG women in science, a role she enthusiastically embraces, and recognition of this came with the award in 2015 of the Pride of PNG Award for Women (Environment) presented by the First Lady of PNG, Lynda Babao O-Neill (Fig 11).

These amazing women are 'true agents for change. These are women who do not crave the limelight, the public recognition, but who saw needs required in their communities, took responsibility upon themselves to address those needs, found realistic solutions with the little that they had, and implemented those solutions, making differences to the lives of which they touched.'
Lynda Babao O-Neill, First Lady of PNG

The Piku Project has provided the opportunity for one of PNG's brightest young people to flourish both nationally and internationally as a promising young scientist and advocate for science and what it can bring to the table to assist decision-making. She is building invaluable capacity and experience in working with different cultures, so important in PNG. She has a promising career ahead of her.

"Here we have the women pioneers, boundary breakers, visionaries. Caring hearts in creative hands"
Mahesh Patel, Chairman of CPL Group

Ms Amepou's contribution to science is also evident, in advance of completing her degree, where she has contributed to a number of scientific papers in leading journals.

Eisemberg CC, Amepou Y, Rose M, Yaru B, Georges A. 2015. Defining priority areas through social and biological data for the pig-nosed turtle (*Carettochelys insculpta*) conservation program in the Kikori Region, Papua New Guinea. Journal for Nature Conservation 28:19-25.

Eisemberg, C., Rose, M., Yaru, B.*, **Amepou, Y.** and Georges, A. 2015. Salinity of the coastal nesting environment and its association with body size in the estuarine pig-nosed turtle. Journal of Zoology, London 295:65–74.

Thomson, S.A., **Amepou, Y.**, Anamiato, J.* and Georges, A. 2015. A new species and subgenus of Elseya (Testudines: Pleurodira: Chelidae) from New Guinea. Zootaxa 4006:59–82.

Georges, A., Eisemberg, C., **Amepou, Y.** and Manasi, E.* 2014. Turtle Conservation Challenges in Papua New Guinea Turtle Survival August 2014:22-24.

* Other PNG nationals included as authors

Other papers in preparation or submitted, in addition to those that will emerge from her thesis, are an invitation to publish an article in Pacific Conservation Biology, which she has accepted, and an invited article on the project in the international specialist magazine, the Tortoise, published in the USA, which she has submitted.

Outreach and Communications

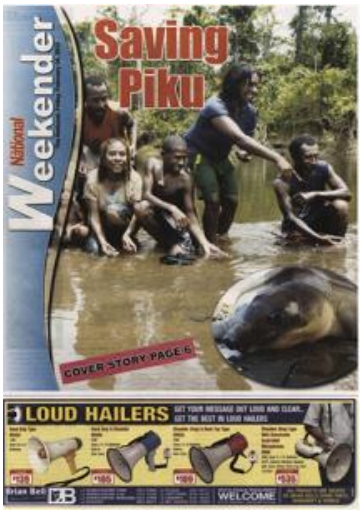
The Piku Team has been very active in outreach to the community more broadly, acting through multiple channels.

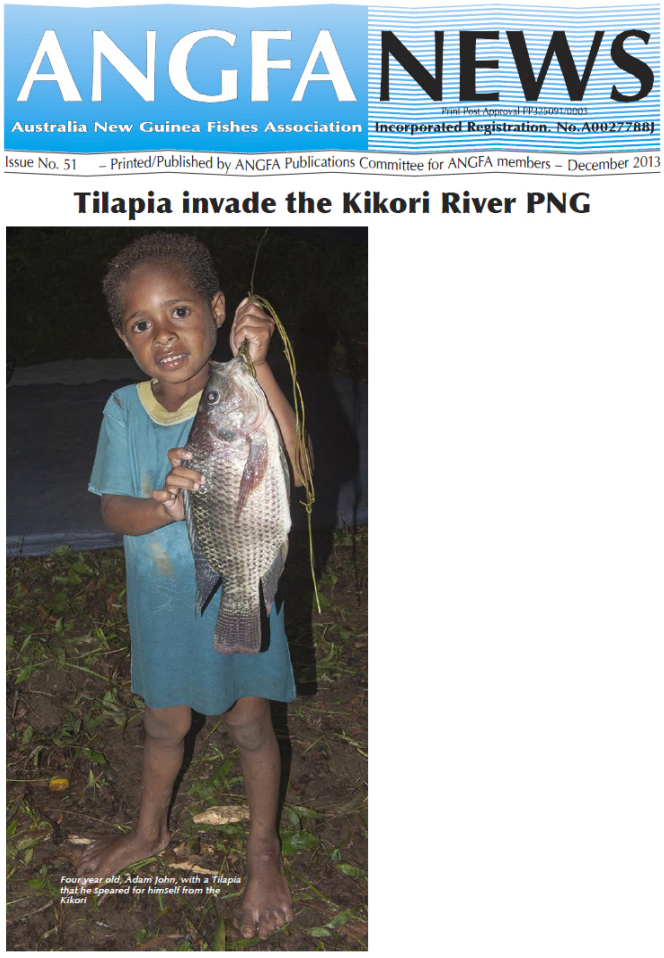
Newspapers and other printed media

The Piku Team has released numerous press releases and undertaken several radio and television interviews (Fig 12).

Fig 12. Masters student Yolarnie Amepou gives an enthralling interview on ABC Radio Broome, in Australia, on the Piku Project and how it is engaging the community in conservation and environmental sustainability.

Media releases bring the Piku project to the attention of the PNG public broadly, and the contribution made by PNG LNG and Exxon-Mobil PNG.





This contribution has been communicated to the PNG by the Company community through a variety of forums, with compelling messages on the role of the petroleum industry in the domain of the natural environment.

Saving Piku

In Papua New Guinea, ExxonMobil partnered with conservation groups to protect a one-of-a kind turtle.

The pig-nosed turtle has helped sustain the communities in Papua New Guinea's Kikori Delta for generations. ExxonMobil is working to ensure they will continue to be around for generations to come.

The turtle, called Piku by locals, is found in Papua New Guinea and Australia's Northern Territory. In recent decades it has been overharvested for its protein-rich meat and eggs. When ExxonMobil launched development of a major liquefied natural gas (LNG) project in the region in 2012, the Piku population was already threatened.

As part of its project development process, ExxonMobil not only looks at production potential, it also factors in how the project might impact the local environment and surrounding communities. The assessment for the $19 billion PNG LNG project determined that ExxonMobil's presence in the area wouldn't negatively impact the Piku population. Still, the company viewed the problem of the diminishing turtle, which was on the International Union for Conservation of Nature's Red List of Threatened Species, as an important issue.

"The Piku population was in severe decline, given they are a traditional food source for local populations," said Andrew Barry, who leads ExxonMobil's operations in Papua New Guinea. "They were about to be hunted out of existence." In addition to losing an important element of regional biodiversity, failure to protect Piku turtles from local hunters would have also wiped out critical clues on the evolution of freshwater turtles.

A year before beginning construction, ExxonMobil stepped in with funding for a local initiative known as the Piku Conservation Project. Jointly led by Australia's University of Canberra and the Biological Research Institute of the University of Papua New Guinea, the Piku Project aims to bring awareness to the importance of protecting this endangered reptile. It also seeks to generate jobs by, among other things, training field agents to closely monitor nesting sites. Current staff includes a research officer, a ranger, assistant rangers and more than 50 volunteers.

University of Canberra professor Arthur Georges described the program as more than just protecting an important turtle species, saying, "It is about building community awareness of the need for environmental sustainability."

ExxonMobil has invested close to $1 million in the Piku Conservation Project. The funding has helped distribute more than 15,000 books to teach schoolchildren about the importance of protecting the endangered turtle. Some of the money also went to produce radio plays with pro-conservation messages.

Taking any species off the endangered list is a monumental task. One notable success, though, was the establishment of a community-led protected area at Wau Creek in the lowland headwaters of the Kikori. The Piku Conservation Project is currently lobbying local authorities to turn Wau Creek into a national wildlife management area.

ExxonMobil is committed to protecting the country's unique environment for future generations. "We invest in programs like this because it supports and encourages environmental protection. The Piku Project is a good example of how community-led conservation initiatives can lead to real results."

Peter Graham, Managing Director, ExxonMobil PNG, Oct 6, 2014

Protect Tomorrow, Today

We operate in an environmentally responsible manner to protect the rich biodiversity of Papua New Guinea.

ExxonMobil supports Piku project

EXXONMobil PNG Limited supported the Piku conserv-ation project with more than K290,000 in funding this year.

On Twitter

Our partner—The Piku Conservation Project—enlists locals to protect the Piku turtle.

ExxonMobil PNG's conservation project uncovers new species

ExxonMobil PNG Limited's commitment to conservation funding has resulted in the discovery of a new turtle species in New Guinea.

Participation in Workshops

Yolarnie Amepou presented on the Piku Project and Kikori's community-led management of the pig-nosed turtle in Broome, Western Australia in June 2016, at a workshop organised by WWF for people interested in indigenous conservation and management. This was followed by an interview with ABC Radio Kimberley.

Frank John and the Rupahi Clan have established a protected area on their lands to provide a safe area for nesting by the pig nosed turtle, with associated benefits for the adjacent forests and biota more generally.

Frank John recently presented on his initiative at the Communication Conservation Practice Workshop held in Port Moresby, organised by the Mama Graun Conservation Trust, and drawing together researchers from across PNG. There he outlined progress toward establishing the Wau Creek protected area and getting it recognised in legislation, and his vision for the future of the area. Other participants in the workshop included CEPA, NGOs, other landowners, the extractive industry and all interested parties of the protected areas network in PNG.

The Wau Creek initiative has received its core funding and logistic support from the Piku Project since its inception with logistic support from WWF. This initiative is covered later in more detail under the section on *Community Led Conservation*.

The Piku Project has been presented at a number of conferences and seminars between 2012 and 2016. Details are provided in the section *Research*.

Facebook: Saving Piku – PNG's Pig Nosed Turtle

A public Facebook group has been established to build constituency behind the Piku Project, nationally and internationally. As of 26-Jun-16, the site has 512 members from across the globe, including some leaders in turtle conservation internationally, and importantly, a large number of PNG nationals.

"Thanks for updating me every time. Miss you"
James Nelson, Kerevat National High School,
East New Britain Province
(former Piku Project Market Monitor)

.

"Uplifting to see such important conservation work on the ground. What amazing Turtles"
Bruce Bury, USGS Forest and
Rangeland Ecosystem Science Center

" you're doing so great. I wish I was there with you doing the job of piku monitoring in Kikori. ..Sounds interesting to me. Thanks"
Jerry Poikarikeri, from Waira Village
living in Port Moresby

This Facebook site provides subscribers with a blow by blow account of exciting findings and developments in the Piku Project, along with some stunning photos and videos. The site is considered an important step should we move to crowd funding of the Wau Creek initiative.

Port Moresby Nature Park

The Piku Team has engaged with Port Moresby Nature Park on two fronts. First we have mounted stalls and displays as part of the overall program of activities of the park on Environment Day each year and on other occasions. Second, we have provided pig nosed turtles to the Park for display purposes and in a collaboration to trial a headstarting programme.

Our involvement in the Environment Days has been an exceptional success, with our Piku stall creating a great deal of interest from parents and children alike.

Children are encouraged to engage in a range of activities drawing from out books and the puzzle pages included in them (Fig 13). It is because of their attraction to children that these materials are of exceptional educational value.

Fig 13. Piku research assistant Wilda Hungito works with the children of Port Moresby using exercises taken from our children's books.

The **head-starting program** has been a success in the sense that the staff of the Port Moresby Nature Park have got the husbandry right – all of the 47 hatchlings that we supplied are doing well and growing. Pig nosed turtles have temperature-dependent sex determination, with males produced at temperatures below 32°C and females produced at above 32°C[3]. The hatchlings were taken from nests that were destined to be destroyed by flooding, and so have a sex ratio that reflects that which would normally occur in the wild.

The Australian Minister for Foreign Affairs, *Julia Bishop* visited the Port Moresby Nature Park in November, 2015. She was interested in the Park's ties with Australian-based partners, including the University of Canberra. She showed particular interest in the pig-nosed turtle head-start program, and is pictured holding a piku on her visit.

Aussie Foreign Affairs Minister visits Nature Park

BY: ttaule
15:49, November 11, 2015

288 READS

We plan to release them when they are 2 years old, subject to CEPA approval, when they will be of a size likely to be beyond that at which they are most subject to predation. In the meantime, the turtles are available for display purposes to increase public awareness of the species and its plight.

[3] Webb, G.J.W., Choquenot, D. and Whitehead, P.J. (1985) Nests, eggs, and embryonic development of *Carettochelys insculpta* (Chelonia: Carettochelidae [sic]) from Northern Australia. *Journal of Zoology*, Series B **1**: 521-550.

Engagement with the Kutubu Kundu and Digaso Festival

The Piku Team presented its wares at the 2013 Kutubu Kunda and Digaso Festival held in the village of Daga in the southern highlands.

The Kutubu Kundu (drum) and Digaso (oil) festival is held annually as an initiative by the Kutubu Foe language group, with the support of WWF and Oil Search, and draws cultural contributions from villages as far away as Verabari on the Kikori coast.

We took the opportunity of the festival to launch our second book in the series, Monty and the Lake Kutubu Invasion, most appropriate for the region.

The Piku Team, comprising project officer Eric Manasi, masters student Yolarnie Amepou, consultant Carla Eisemberg, and program leader Arthur Georges got into the swing of things with face paint and other adornments, before engaging with the local communities on the Piku Project and educational materials.

Again, it was the children who seemed most impressed with what we had to offer, enthusiastically engaging in the puzzles and exercises that were including in the Monty and the Lake Kutubu Invasion book. We plan to extend the Piku Teams activities to Lake Kutubu in the next phase of the project.

Top previous: The colourful banner used to launch the new book *Monty and the Lake Kutubu Invasion* at the Kutubu Kundu and Digaso Festival.

Bottom previous: Yolarnie Amepou receives her face paint in preparation for the festival.

Left: Children from Daga Village enjoy working with the puzzles and exercises included in the new book, which was later distributed to all schools

Contributions to the PNG National Museum and Art Galleries

The Piku Team has made some seminal contributions to the biological collections of the PNG National Museum. First, the Piku Team lodged two specimens, a male and a female, of the chelid turtle Elseya branderhorsti that were passed to us by people of the Transfly.

The species was first described in 1914 by a Dutch scientist Peter A. Ouwens, then Director of the Java Zoological Museum and Botanical Gardens. He published his brief description in the journal *Contributions a la Faune des Indes Néerlandaises*. Unfortunately the specimen was subsequently lost.

Lodging these specimens with the PNG National Museum and Art Gallery puts an end to much confusion that arose from the loss of the reference specimen. We now have museum specimens upon which to hang the hat of *Elseya branderhorsti*. We subsequently set the new specimens as formal replacements[4], now housed at the PNG National Museum.

"It is so pleasing to see these important specimens lodged with the National Museum in PNG rather than with an overseas museum. Lodging type specimens with the Museum will increase its standing internationally, and encourage researchers from overseas to visit the museum and its collection".
Jim Anamiato, Acting Curator, PNG Museum

Second, the Piku Team contributed specimens to a molecular study that examined species boundaries in the *Elseya novaeguineae* complex, a group of turtles of uncertain status[5]. This work led to the formal description of a new species of turtle, *Elseya rhodini*, and we lodged the holotype and paratypes with the PNG Museum. This both increases the standing of the Wau Creek protected area, where Yolarnie Amepou and Frank John obtained the specimens, and the standing of the museum.

[4] Thomson, S.A., Amepou, Y., Anamiato, J. and Georges, A. 2015. A new species and subgenus of *Elseya* (Testudines: Pleurodira: Chelidae) from New Guinea. Zootaxa 4006:59–82.

[5] Rhodin AGJ, Genorupa VR. 2000. Conservation status of freshwater turtles in Papua New Guinea. Chelonian Research Monographs 2:129–136.

As part of the establishment of the protected area at Wau Creek by local landowner Frank John and the Rupahi Clan, surveys are being undertaken opport-unistically of the local flora and fauna. The most recent survey was of the frogs, and a representative series of specimens, some new species, were sent to the PNG National Museum for curation and future reference. This commitment to document the flora and fauna of the Wau Creek protected area will continue as an investment in knowledge of PNG's unique biota.

Engagement with the Local Community

Activities conducted by the Piku Project within Kikori each year are displayed in posters in shops and schools throughout Kikori so the community is aware of why and what the project is doing around them (Fig 14).

Fig 14. Awareness Posters for building awareness in the Kikori community on noticeboards in the main Kikori store, Delta Store.

Local assistants from the coast and upriver nesting sites trained in collecting turtle nesting information are taught why this is important, and how the information can be applied. These local assistants then explain in their own language to other villagers what they learnt and understood.

We have been invited to many community meetings where information is also exchanged. Villagers have assisted in providing the Piku project with juvenile turtles accidently caught n fishing nets for measurement and part of their engagement in the project.

Local landowners have participated in pig-nosed turtle hatchling releases on their lands and participated as volunteers to the Kikori primary school hatchling activities at the end of the nesting season in 2014 helping students and each other understand the pig-nosed turtle life cycle and their roles in it.

Evaluation: The Piku Project is engaged with 23 villages (Including Kikori Township), from six language groups (Table 1, Fig 19). Household surveys were undertaking in a subsample of seven villages with different levels of Project involvement to guage interest and understanding of the Piku Project activities between 2013 and 2016. These

villages were Apeowa, Goare (Kerewa), Irimuku, Kopi, Waira (Rumu) and Ero, Wowou (Porome) (Fig 19).

Fig 15. Apeowa villagers proudly display the juvenile pig nosed turtles they retained for our examination.

Fig 16. Frank John and family release hatchling turtles in the first successful year of beach protection at Wau Creek. The project supported 10 field assistance for work at Wau Creek.

Fig 17. Field assistants from Apeowa/Babai villiage release hatchlings on Mairimiri sand bar off Banana Island, on the coast. The project supported 16 field assistants for coastal work.

Table 1. Activities by Villages involved in the Piku Project from 2013 to 2016. All villages were surveyed for levels of harvest and consumption; All but Kemei (no longer occupied) recieved the recent project report. Abbreviations: E, elementary school; P, primary school; H, High school. The Piku Team engaged at the level of Primary and High School.

Language group	Village	Level of involvement	Schools	School Activities	Nesting Research	Formal Community meetings
Foroba	Omo	Low	E[2]		No	1
	Sera	Low	None		No	0
	Kuru	Low	None		No	0
Rumu	Lalau	Medium	E[3]		No	2
	Ario	Low	None		No	2
	Waira[1]	High	None		Yes	1
	Kopi[1]	Medium	E,P[3]	Yes	No	0
	Ogomabu	Low	E	No	No	0
	Irimuku[1]	Medium	E,P	Yes	No	0
Kibiri	Veiru	Medium	E,P	Yes	No	0
	Babeio	Medium	with Veiru	Yes	No	0
	Doibo	Low	E[2]		No	0
Porome	Ero[1]	Medium	E,P	Yes	No	0
	Wowou[1]	Low	E	No	No	0
Kerewo	Samoa	Low	E	No	No	2
	Apeawa[1]	High	P[4]		Yes	4
	Babaguna	Low	None		No	1
	Bisi	Low	E,P[2]		No	0
	Aedio	Low	None		Yes	1
	Goare[1]	High	None		Yes	1
	Kemei	Low	None		No	0
Urama	Veraibari	High	E,P	Yes	Yes	1

[1] Villages visited during the April 2016 survey to access Project awareness and level of satisfaction

[2] School no longer open

[3] School reopened in 2015, after extended closure

[4] School reopened in 2016, after extended closure

Fig 18. UPNG work experience graduate, Fiona Manu, conducting a household survey in Ero Village, April 2016, on the level of awareness of and satisfaction with the Piku Programme of activities.

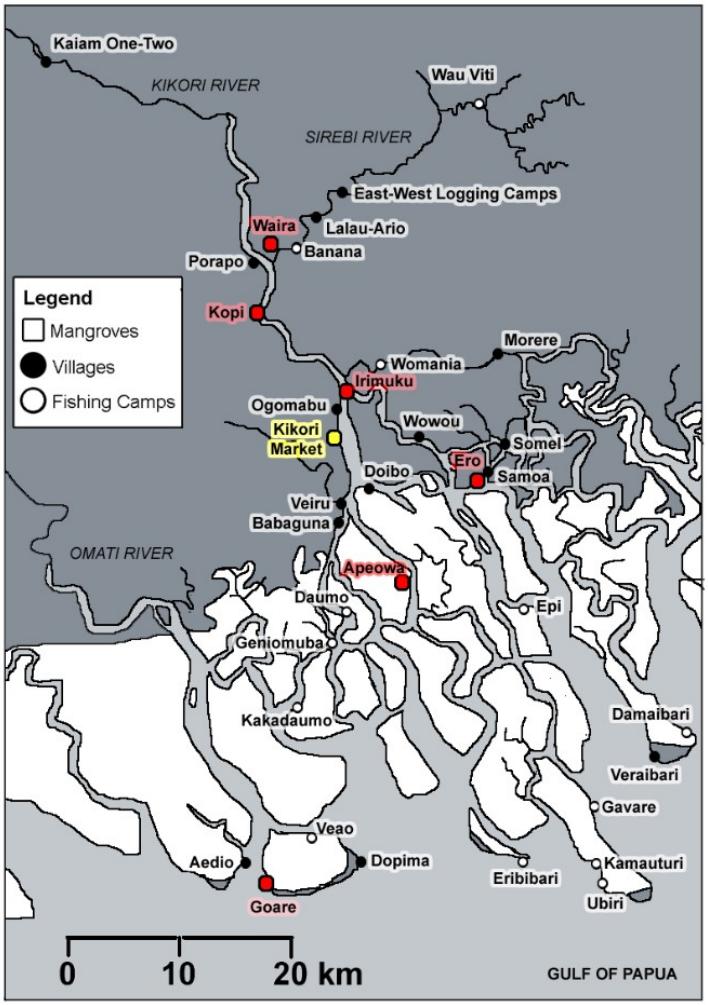


Fig 19. Villages surveyed during the 2016 household survey (red) in the project area.

We performed household semi-structured interviews in in 2009 and 2016. Sampling of households within villages was based on a systematic sample design, where we sampled a fraction of the community (e.g. every 2nd, 3rd, or 4th household). The specific sampling fraction for each community was deter-mined by dividing the total number of households in the village by the maximum sample size we aimed to collect (n = 20). In villages with less than 20 households, all available households were surveyed.

During both 2009 and 2016 surveys the following questions were asked: How many people leave in this household? What is the highest level of education in this household? How many canoes and/or dinghies people from this household have? Does someone from this household have a boat motor? If yes, is it working? While fishing, do you use net as one of main fishing devices? Have you or someone from this household ever captured a pig-nosed turtle or their eggs? If the answer was yes, the turtle Hunter was asked the following questions: How many turtles/nests approximatelly you harvest per year? Have you ever sold pig-nosed turtle's meat or eggs in the Market? If you compare the number of pig-nosed turtles in the water when you were a child with now do you think the number of pig-nosed turtles now have increased, are in decline or have not changed (same numbers)? To avoid bias, this second survey was conducted in Tok-Pisin by Fiona Manu (Fig 18), who has not been involved previously with the Piku Project.

Table 2 – Household attributes (± Standard Errors) for the seven villages surveyed.

Attribute	Size		Highest level of education (YR)		No. canoe/dinghies	
Year	2009	2016	2009	2016	2009	2016
Apeowa	6.7 ± 0.6	9.9 ± 1.2	5.1 ± 0.7	5.9 ± 0.6	1.6 ± 0.3	1.7 ± 0.3
Ero	8.2 ± 0.7	6.1 ± 0.7	7.7 ± 0.6	9.3 ± 0.7	1.3 ± 0.2	1.4 ± 0.2
Goare	5.1 ± 0.8	6.5 ± 0.8	5.2 ± 1.2	4.6 ± 1.2	1.3 ± 0.3	0.9 ± 0.2
Irimuku	6.9 ± 0.5	7.8 ± 0.6	7.4 ± 0.5	8.3 ± 0.7	2.0 ± 0.3	1.6 ± 0.3
Kopi	7.8 ± 0.6	7.8 ± 0.9	9.9 ± 0.8	9.6 ± 0.4	2.1 ± 0.3	1.8 ± 0.3
Waira	--	6.8 ± 0.7	--	8.4 ± 1.3	--	2.5 ± 0.5
Wowou	7.7 ± 1.0	7.5 ± 0.7	8.0 ± 1.0	8.8 ± 0.9	2.1 ± 0.3	1.3 ± 0.2

It was encouraging to learn that the majority of households recognized the Piku Project (percentage recognition ranging from 60% of households in Apeowa and Ero, to 100% in Goare and Waira) (Fig 20). This is a remarkable result, given the size of some of these villages (up to 1,000 people), and is testimony to the effectiveness of our awareness programs.

With the possible exception of Apeowa Village (see Turuvio Island and Region below), the level of satisfaction with the project by the Kikori communities was very high, and the general view was that they would wish the project to continue. Only 3% of respondents did not want the project to continue.

When asked to define their feelings towards the project, 87% of the households regarded the Piku Project as “good” or “very good” and 52% gave the project a score of 10 out of 10 (Figure 21). The average score was 8.3 out of 10. Only 4% of the households rated the project with a score less than 5. Feelings about the project were mostly related to the household personal experience with the project. Waira Village had the most positive view of the project and Apeowa the least postive.

When we asked for suggestions for improvement, the most common request was for “generating more awareness in the villages” (19% of households). Other suggestions were “more community engagement” (7%), “more conservation actions” (5%), “incentives (usually financial or material) for locals involved” (4%), “more school activities” (4%), more research (2%) and “encouragement of customary practice (1%). Although responses varied in different villages, a request for “more awareness” was cited by households all villages surveyed.

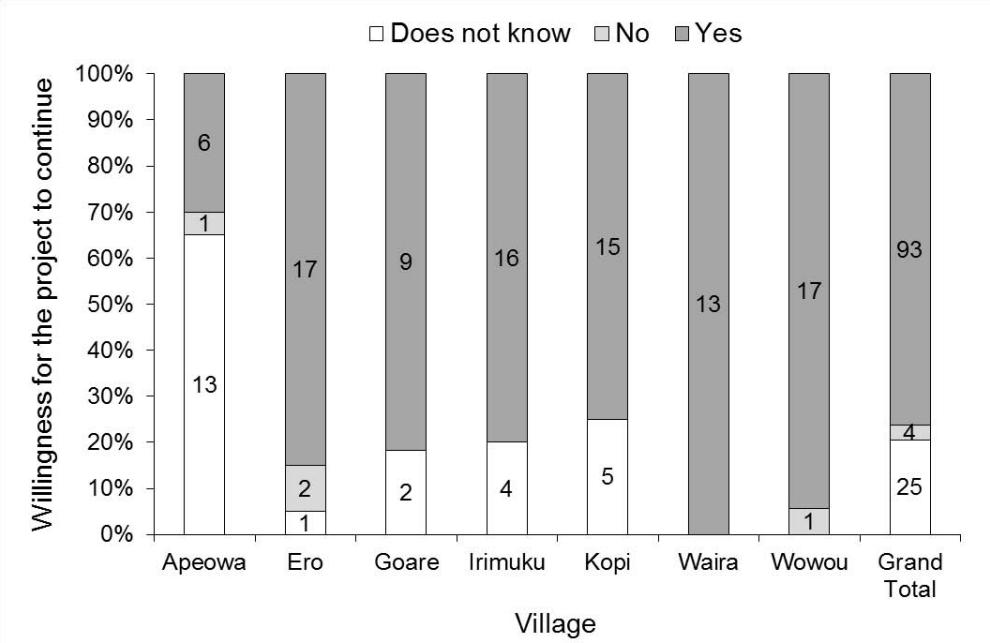


Fig 20. Level of recognition of the Piku Project among households in the villages surveyed.

Some representative examples of the feedback on this point that we received are:

"*The Watemu* [Piku] *Project should provide more pictorial aids used during awareness. For example: Posters, electronic media, booklets, management plan."*
Gabriel Robert, Wowou

"The Uwo [Piku] *Project should have assistants in each village and not get another village assistant to work in someone else's village. Nominated village assistants should be paid a salary."*
Idau Eda, Goare

"The Piku Project should encourage customary practice. Discourage young people, babies and women of reproductive age from eating Piku and Pikure (egg). The team should do more village awareness and visit the village more often."
David Kupere, Kopi

"The Piku Project should increase awareness, encourage youth involvement to protect Piku and the environment."
Epi Kaipu, Irimuku Village

This mismatch with village expectation is clearly a function of the number of Piku Team members on the ground – only two, Yolarnie Amepou and Wilda Hungito – and the volunteer students do not have the capacity to deliver on this request.

Following on from our demonstration that the pig nosed turtle is in decline, it is important to determine if this observation is acknowledged by the community, because if they are not aware of the problem, they will be unlikely to engage in engineering solutions.

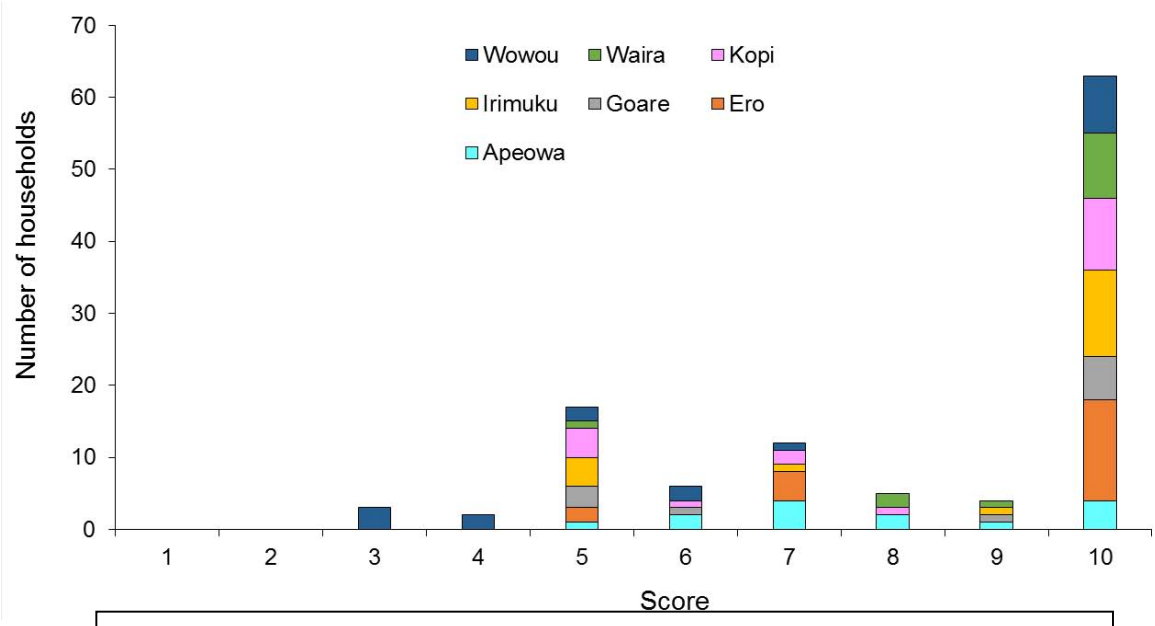


Fig 21. Scores out of 10 given by households when asked to rate their overall view of Piku Project engagement with them and their village.

A companion survey was undertakine In 2009, and 15% of households then believed the pig nosed turtle population, their "fishery", was increasing, 45% believed it stable, and only 35% of the households believed the turtle population was in decline. It was gratifying to see that after eight years of activities designed to raise awareness, in 2016, only 1% believe that the population is increasing, 22% believe that the population is stable, and 55% of households believed that the pig-nosed turtle population is in decline.

There is no clear evidence that this change in belief on the status of the population has translated to changes in the intensity of harvest of turtles or their eggs. Reduced availability of the turtle and its eggs may not yet be sufficient to trigger concern leading to action.

6. Outcomes -- Community-led Conservation

Our approach to community-led conservation is distinctive. First we recognize that coming over the top of a community, particularly one as complex as in the Kikori lowlands, with western perspectives on conservation and sustainability and pursuing an agenda no matter how compelling the evidence in support, is unlikely to be successful. This is true whether the agent of change is a government, a forestry, mining or petroleum company, or well-intentioned foreign researchers or conservationists.

Our approach has been to identify within the communities, individuals with the vision and commitment to take action on their lands to conserve the environment, and work with them to achieve their vision. We assist them to negotiate benefits to offset the economic losses of setting aside their lands, and their success in gaining such benefits

and their passion is communicated within their broader community to build interest and constituency.

We, the Piku team, assist with funding initially and logistic support, but we do not in any way challenge the ownership of the initiative, which remains with the landowners and their clans. This is considered essential for the sustainability of the initiative, long after the Piku Team has disengaged.

Wau Creek

Fig 22. The Rupahi Clan have worked hard to establish a field station at the Wau Creek site to facilitate engagement by students from the Kikori region and from universities. They have a charging schedule and accept visitors in the drier months of November-December.

The first initiative is that of Wau Creek, on the lands controlled by the Rupahi Clan and the Frank John family, in the Seribi River catchment of the Kikori forested limestone plains. The objective of this initiative is to assist the community in conserving the exceptional biodiversity of the region while at the same time providing sustained employment opportunities to offset what would otherwise be income from more environmentally damaging enterprises.

Frank John's vision is to set aside from forestry and other impacts a portion of his clan's lands, rich in biodiversity and with important nesting areas for the pig nosed turtle, as a protected area to complement the Wildlife Management Area already formerly established at Aird Hills in the Kikori delta. His hope is that this can be done in such a

way as to generate a sustainable income for his broader family to offset the economic losses forgone by preventing forestry activities, and by limiting access to the pig nosed turtle and other traditional resources.

Fig 23. The Rupahi Clan make their way up Wau Creek to the field station for another session of monitoring the pig nosed turtle nests. The Kiride Queen, named after a community competition, and painted by a local artist, is the Piku Team's vessel.

To this end, Frank John has negotiated with his clan on the area to set aside, surveyed its boundary with GPS fixes, and struck an agreement with the forestry interests to exclude this area from forestry. He has constructed basic research facilities to support a modest eco-tourism programme (Fig 22), including sleeping, eating and toilet facilities, and a series of pathways and bridges to assist navigation through the forest. This infrastructure was funded by the Piku Project, providing initial employment for Frank John, his family, and the broader Waira community who were engaged in securing and constructing the roofing and wall materials. The Piku Project also loaned Frank John a 40 hp outboard motor and covered the costs of fuel to allow the necessary access to Wau Creek (Fig 23).

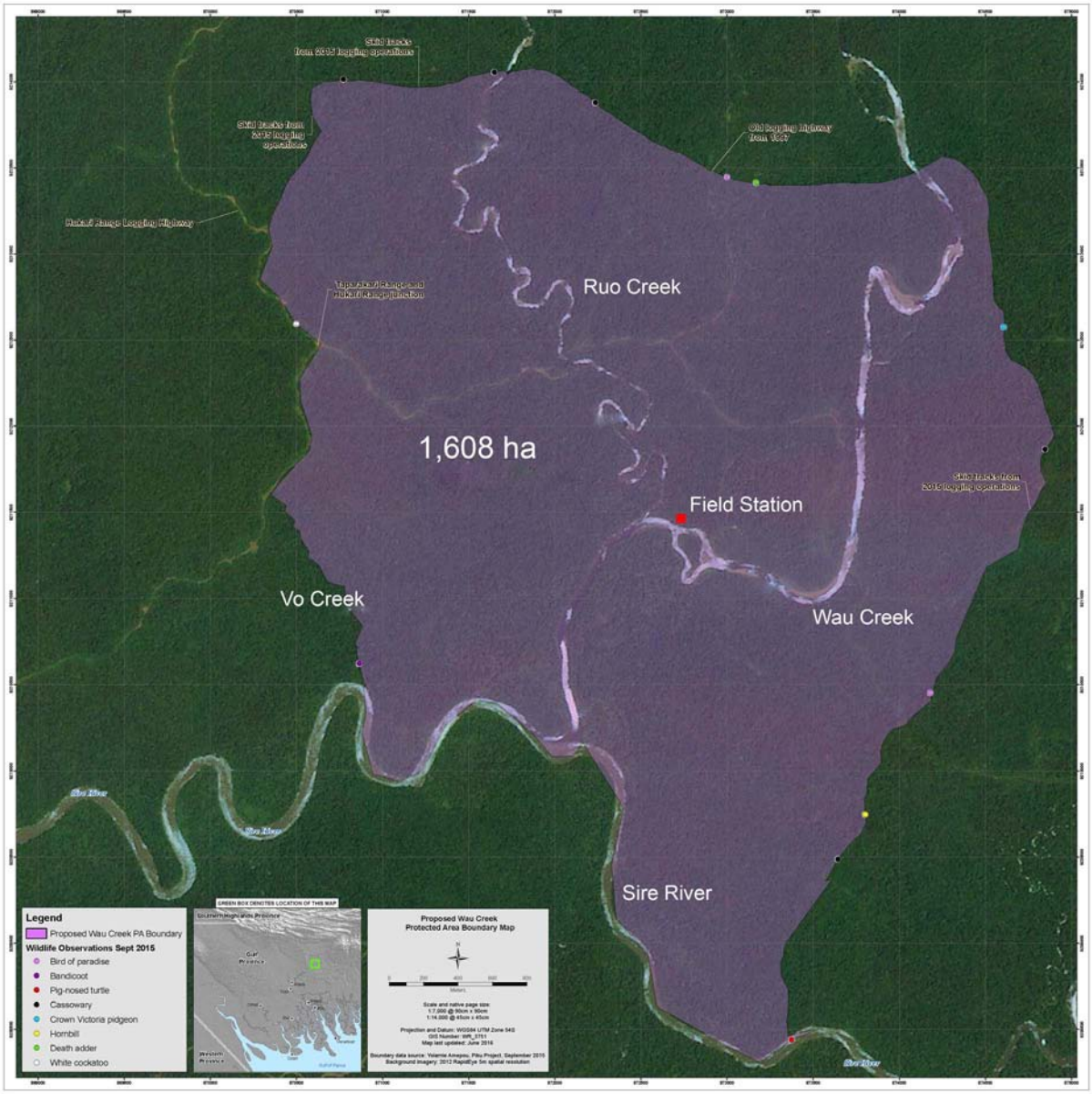


Fig 24. A map of the Wau Creek protected area established by Frank John and the Rupiha Clan (Rumu Language Group). The area is of 1,608 ha (19.2 km perimeter) and clothed in closed mesophylic vine forest. Pig nosed turtles nest on the sand bars of Sire River, Wau Creek and Ruo Creek. Wau and Ruo creeks are protected from human harvest. The Rupahi Clan is seeking to have the area designated as a Wildlife Management Area.

The Piku Team uses and pays for these facilities when undertaking their research at Wau Creek, and it is hoped that other research teams will do the same. Frank has invited, through the Piku Team's networks, individuals to visit Wau Creek and experience its beauty and diversity first hand, and to assist him in generating an inventory of flora and fauna at the site. First to visit, in 2015, were Deb Bower and Simon Clulow who assisted with frog surveys and paid for the experience. Together, they identified 29 species of frogs at Wau Creek (Fig 26), some new to science, and a number of remarkable reptiles

(Fig 27). Building this inventory at Wau Creek, together with describing new species using specimens from the Wau Creek site, are essential components in documenting its value as a potential Wildlife Management Area under CEPA regulations.

Invitations to visit in 2016 have been extended to interested parties from the Fisheries Department, PNG University of Natural Resources & Environment (Vudal Campus), James Cook University and the University of Canberra, with a focus on assisting Frank in identifying the fishes of Wau Creek and the macroinvertebrates. We anticipate five paying guests in 2016, which is a good start.

Fig 25. Exxon-Mobil Biodiversity Coordinator Jane Mogina (standing second from right) and the Aird Hills WMA committee visit Frank John (right) and the Wau Creek Research Facility to share ideas.

The current boundaries of the protected area at Wau Creek should be considered Stage 1. Stage 2 could be the incorporation of adjacent limestone ridges and pinnacles to the north (referred to by the locals as the "mountains") which are not available to Forestry because of potential erosion. These are on Rupahi lands. Stage 3 could be the extension of the protected area to cover adjacent lands of the Sire River catchment to the east, held by clans of Kuru and Sire, thus broadening the benefit in ways seen as desirable by these clans. Stage 2 and 3 would be predicated on success in establishing Stage 1 as a functioning reserve delivering the benefits envisaged by Frank John, in terms of conservation outcomes and economic returns.

The Wau enterprise and those like it face many challenges if it is to become a success, that is, sustainable and independent of the Piku Project. While a formal agreement has

been struck between the Forestry industry and the Rupahi Clan on Stage 1, an immediate objective is to have the Wau Creek protected area designated as a Wildlife Management Area by CEPA, with the support of the East Kikori Local Level Government (LLG) and the Gulf Provincial Government.

The second challenge relates to access. With the closure of the Kikori Airport, access to the Wau Creek site is very difficult, and it is unlikely that Frank John will be able to attract paying visitors to the site until this is rectified. It is a matter for the local Kikori Community and local councilors to pursue as an investment in growth of local enterprise.

The third and critical issue relates to financial viability. Owing to the nature of the facilities and its remote location, the sort of visitors that can be attracted are scientists interested in addressing research questions at the site, research students, the more intrepid of adventurers, and locals interested in seeing biodiversity conservation in action. Numbers are always likely to be low. We are exploring avenues of crowd funding through the University of Canberra Foundation, and already direct any returns from the sale of books to the Rupahi Clan. However, the viability of this initiative is likely to require sustained foundation support from the Petroleum Industry, as part of their overall commitment to biodiversity conservation.

One option is to support a ranger program, akin to the successful Djelk Ranger Program in Arnhem Land of northern Australia. This could be rolled out for all protected areas in the region, providing employment opportunities at a range of levels.

There are some obvious parallels. The Djelk Indigenous Protected Area covers 6,672 square kilometres. After many years of consultation and development it was declared a protected area in September 2009. Landowners from more than 102 clans were consulted and all gave their full support for the declaration of the IPA and the endorsement of The Djelk Rangers and their management activities.

The rangers are now responsible for a range of activities associated with land and environmental management, including control of weeds and invasive animal pests, cultural site protection and biodiversity monitoring as well as providing support to Outstation (=village) residents.

One could envisage similar responsibilities being taken on by a team of Kiride Rangers (Kirede = Kikory River Delta) whose activities are centred on, but not exclusively so, the Wildlife Management Areas and other sites of conservation and cultural value.

Fig 26. Examples of the diversity of frogs at Wau Creek that astonished both the Piku Team and the Frank John Family. In 10 days, we found 29 species of frog, some new to science all within a short walking distance of the research station. Refer to the Saving Piku facebook page for identifications.

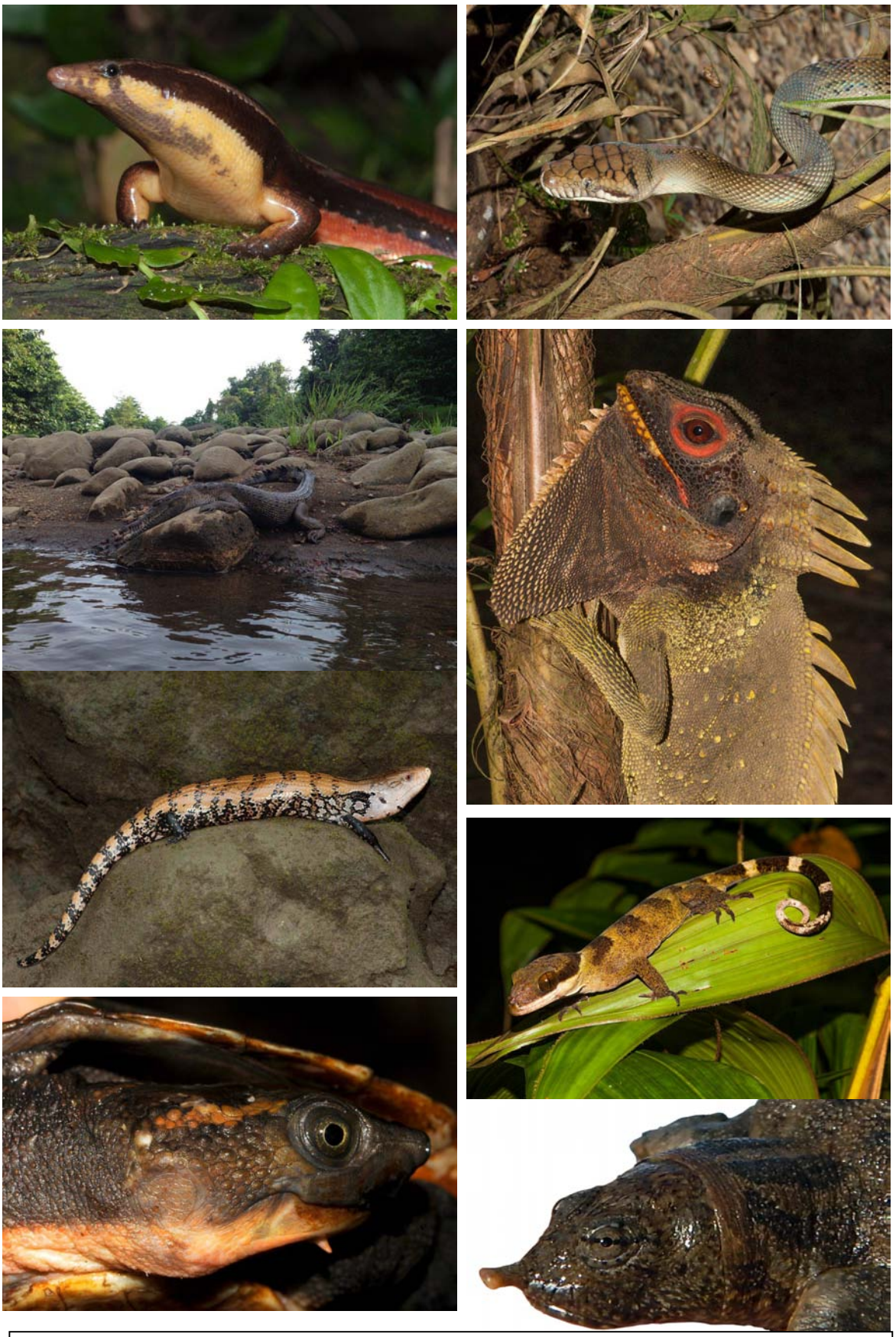


Fig 27. Reptiles of Wau Creek, in addition of course to the pig nosed turtle. As with the frogs, we see astonishing diversity and some spectacular forms. Refer to the Saving Piku facebook page for identifications.

Turuvio Island and region

Turuvio Island is an important nesting region on the Kikori Coast, and an example of the interaction between the dynamic coastline and the turtles. The island arose from the sea around 2001, and progressively built from a sand bar clear of vegetation, through a series of successional stages, to the vegetated island it is today. The turtles heavily used the island for nesting when it was a sand bar with little vegetation, and their stereotyped nesting (centred on the predictable king tides) made them an easy target for harvesting by local people. One hunter, in little over an hour, was seen to turn 21 nesting turtles on their backs, to later collect them and hold them for distribution to their extended family and for trade in villages and the Kikori market. This level of harvest of nesting females is clearly unsustainable and such harvest is considered a major contributing factor to the recent decline of the species[6].

The Piku Team was very keen to engage with the local people to establish a protected area, including Turvio Island, Banana Island and associated sand bars (Fig 28). However, the situation became extremely complex. Unlike the Wau Creek initiative where we were dealing with a single Clan, the coastal situation involved many clans and indeed language groups. Ownership over land is not as clear as it might be in the west, and is closely tied to benefit. Lands with agreed ownership are embedded in a matrix of lands where the ownership is not clear (analogous perhaps to “commons”), because the lands are not of particular benefit. Bring in a pipeline, or show interest in an island that has recently emerged from the sea, and the new potential benefit leads to lengthy and often heated discussion of ownership. So it was with Turuvio Island.

[6] Eisemberg, C.C., Rose, M., Yaru, B. and Georges, A. 2011. Demonstrating decline of an iconic species under sustained indigenous harvest - the pig-nosed turtle (Carettochelys insculpta) in Papua New Guinea. Biological Conservation 144:2282-2288.

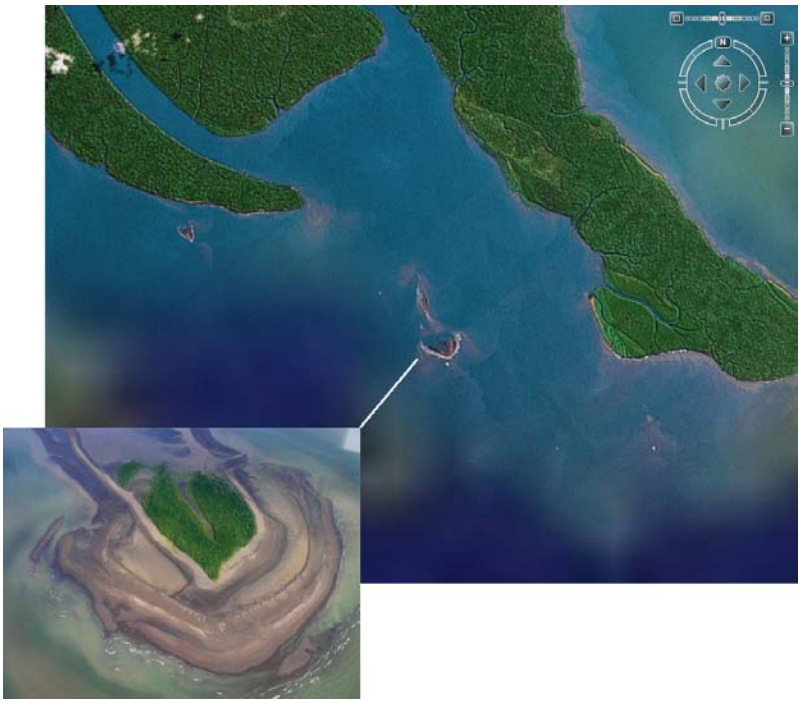


Fig 28. *Previous page:* Local villagers are devastatingly efficent at harvesting nesting turtles, taking advantage of their stereotyped nesting habits. These 21 turtles were collected by one hunter in little over one hour.

Left: Turuvio Island emerged from the sea in 2001 and progressively went through a series of successional stages to become a vegetated island. Turtle nesting declined over time during this process.

Notwithstaning widespread support for the project, receipt of benefit through engaging with the Piku Team led to considerable tensions in some villages among those who would accompany us and those who were left behind on any one trip. Achieving balance across trips was not sufficient and delegating the decision to the community on who goes and who stays did not relieve the tensions. The following feedback from the household surveys shows the diversity of views and feelings of unrest in Apeowa Village, relating largely to perceptions of lack of equity in access to opportunities brought by the project.

"Sometimes we really want to eat Uwo, but when we see Yolarnie we don't go out to get Uwo at Banana Island.

We want equal participation of Apeowa and Babai in Uwo Project, especially when taking boys to Banana Island. When selecting youths to go to Banana Island, be fair and give chance to each family."
Owen Baono, Babai Village

"Apeowa is a big village and Yolarnie only takes selected villagers from Babai to work with her. People from Apeowa feel left out."
Woubi Aukaia, Apeowa Vilage

"I don't want the project to continue. Uwo project hasn't done anything for the village. It doesn't pay the boys properly for staying 2 to 3 weeks at Banana Island. We have closed Banana Island. Yolarnie bought a dinghy for Frank John and did not buy a dinghy for us."
Nonoga Kisu, Apeowa Village

"I want the Uwo [Piku] *Project to go to Aedio where I am chief of eight clans and we have good beaches for Uwo to nest. If project can network with me, it will be easier to go work in Aedio."*
Ba'au Iave, Goare Village

Our recommendation is that the coastal area be part of a broader initiative, bringing in the villages of Goari, Apeowa/Babai and Veraibari, and bringing in the Piku Team, the Pidu (dolphin) Team, and other parties interested in coastal zone management to establish a coastal and marine zone protected area.

The iron and mineral sands exploration licences recently let in the region[7] would suggest early and proactive consideration of the non-consumptive values of the coastal zone should be a priority.

Aird Hills

We have not engaged with Aird Hills communities on the pig nosed turtle beyond that outlined in the sections above on Monitoring and Outreach and Communication. There are no nesting areas for the pig nosed turtle in the vicinity of Aird Hills, though there are important feeding grounds in the area.

This is a priority for consideration should we be issued in future.

7. Outcomes -- Knowledge Generation

Science, as a method of obtaining evidence in support of belief, decisions and actions, has a complementary role to that played by the many other considerations that come to bear on a community faced with change and associated challenges. As Applied Ecologists[8], the role of the Piku Team, was to identify knowledge gaps affecting the Kikori communities in charting their future. One example of this involved gathering evidence and engaging the community in gathering that evidence, to demonstrate that the pig nosed turtle was indeed in decline[9], giving a voice to the elders who had made that observation but who had largely been ignored.

We know have a much better understanding of the biology of the pig nosed turtle, and can demonstrate greater community awareness of the species and biodiversity conservation issues more generally. Importantly, there is much greater acknowledgement that the pig nosed turtle is in decline. This is critically important because if the community is not aware of the problem, they will be unlikely to engage in engineering solutions.

We are also now in a more defensible position to provide practical advice to the community on options to take to affectively address the decline.

[7] Mayur Resources, http://mayurresources.com/png-iron-ore/

[8] Georges, A., Hone, L.J., and Norris, R.H. 2008. Applied Ecology. Pp. 227-232 in S.E. Jorgensen and B.D. Fath (Eds). *Encyclopedia of Ecology*, Volume 1, 1st Edition. Oxford: Elsevier.

[9] Eisemberg, C.C., Rose, M., Yaru, B. and Georges, A. 2011. Demonstrating decline of an iconic species under sustained indigenous harvest -- the pig-nosed turtle (*Carettochelys insculpta*) in Papua New Guinea. Biological Conservation 144:2282-2288.

The current focus of the research is on evaluating the efficacy of the protection of nests and nesting turtles at Wau Creek, part of the activities associated with the Wau Creek protected area initiative. Analysis of these data is part of the thesis work of Yolarnie Amepou and so are not yet complete, but conclusions can be drawn now.

- The beach protection from human and other predators (principally goannas) is effective and dramatically increases hatchling success compared with adjacent areas (Sire River).
- In areas where human harvest is prohibited, but goannas remain free to predate on nests, goanna predation replaces human harvest to a substantial degree (Fig 29). This is a defining result, with substantial implications for managing the turtle. Flooding is another major source of mortality of nests that are protected from human harvest.
- Future attempts at active protection may need to find management actions to take both predation (chicken wire) and flooding (relocation of nests) into consideration.

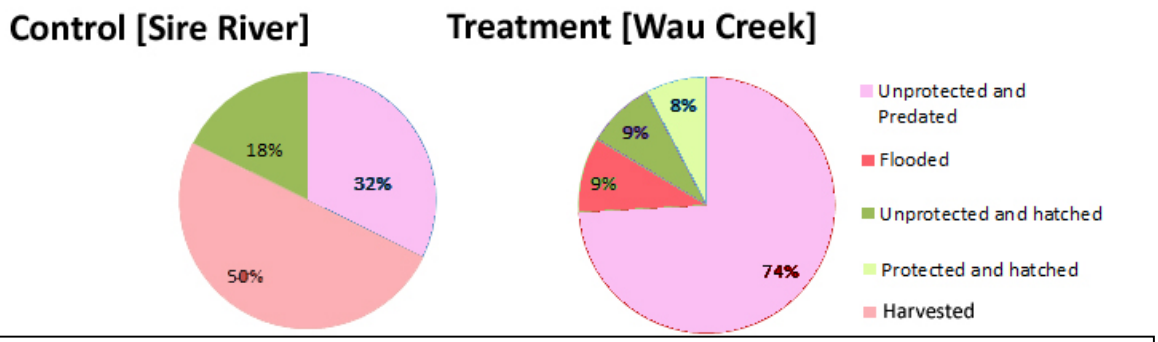


Fig 29. Comparison of the goanna predation rates in a control region where human harvest is unregulated (Sire River) with Wau Creek where human harvest is prohibited. Note that goanna predation almost fully compensates for the absence of human harvest in Wau Creek.

- A reasoned balance needs to be struck between restricting harvest of adult nesting female turtles and restricting the harvest of eggs in the hinterland nesting areas, taking into account the above observations. The advice should be continue to harvest the eggs at some level of moderation, but refrain from harvesting nesting mothers at a time when they are most vulnerable. The message of taking action to ensure a sustainable supply of eggs for future generations is thus defensible.

The data in support of these conclusions will be presented more fully in Ms Amepou's thesis and publications arising.

We have also been active in assessing the level of harvest (Fig 30), to build upon the data showing a declining trend in the consumption of eggs and turtle meat locally in villages and through the markets. Preliminary comparisons between the data presented by Eisemberg et al.[7] does not indicate a dramatic decline in consumption in our study area between 2008/9 and 20015/16. There was a notable decline of catch in the coastal villages of Babai, Dopima, Aedio and Kemei, but the village of Babai has relocated to

Apeowa, and the remaining villages to Kikori Township. Their continued access to the coast has been hindered by exceptionally dry weather and difficulties in securing potable water at the coast.

We believe our data will support a similar recommendation to the communities in the delta and associated coast – adopt a reasoned balance between restricting harvest of adult nesting female turtles and restricting the harvest of eggs in the hinterland nesting areas. Continue to harvest the eggs at some level of moderation, and to benefit from incidental catch of adult and sub-adult turtles while fishing, but refrain from harvesting nesting mothers at a time when they are most vulnerable.

Again, the data in support of these conclusions will be presented in Ms Amepou's thesis and publications arising.

Fig 30. Variable volumes of pig nosed turtle eggs and meat pass through the Kikori and Serebi Markets each year. We monitor closely the trade in these commodoties.

Scientific Journals

A secondary objective was to publish the findings of the research, thus giving the project scientific credibility, bringing the plight of the turtle and the efforts of the community in protecting it to national and international attention, and contributing strategically to the body of science more generally. Our research findings under this contract are as listed below, and full details can be obtained by referring to the full papers.

Eisemberg, C. and Berra, T.M. 2016. Fish species sold in the Kikori market, Papua New Guinea, with special reference to the Nurseryfish, *Kurtus gulliveri* (Perciformes: Kurtidae). Fishes of Sahul. Journal of the Australia New Guinea Fishes Association 30(1):942-949.

The Kikori River has about 100 species of freshwater fishes with the equal highest percentage of endemism of any drainage system in New Guinea. The Nurseryfish

(*Kurtus gulliveri*) is a distinctive euryhaline species from southern New Guinea and northern Australia where it is not known to be a commercial species. We report for the first time, the commercial use of Kurtus gulliveri, from the Kikori River estuary which was the most common species sold in the market.

Lynch, J., Kalamanga, E. and Ospina, G.A. 2016. Socio-ecological aspects of sustaining Ramsar wetlands in three biodiverse developing countries. Marine and Freshwater Research 67, in press.

While many developing countries harbour significant biodiversity and socio-cultural resources, they have substantial development pressures. The authors of this paper explore the similarities in issues around wetland conservation and sustainability in three developing countries using case studies of internationally significant wetlands in Tanzania, Colombia and Papua New Guinea, in this case Lake Kutubu.

Eisemberg CC, Amepou Y, Rose M, Yaru B, Georges A. 2015. Defining priority areas through social and biological data for the pig-nosed turtle (*Carettochelys insculpta*) conservation program in the Kikori Region, Papua New Guinea. Journal for Nature Conservation 28:19-25.

This paper combines distributional and social data to define priority areas for conservation of the pig-nosed turtle in the Kikori lowlands. ***Piku Team contribution***: Central to the project.

Eisemberg, C., Rose, M., Yaru, B.*, Amepou, Y.* and Georges, A. 2015. Salinity of the coastal nesting environment and its association with body size in the estuarine pig-nosed turtle. Journal of Zoology, London 295:65–74.

Extant estuarine and freshwater animals show a variety of adaptations to marine life, which could reflect transitional stages in a gradual evolution from freshwater to the sea. Our aim was to identify the temporal and spatial environment associated with pig-nosed turtles *Carettochelys insculpta* coastal nesting in the Kikori Region, Papua New Guinea. ***Piku Team contribution***: Central to the project.

Eisemberg, C.C., Rose, M., Yaru, B.* and Georges, A. 2015. Spatial and temporal trends in pig-nosed turtle (Carettochelys insculpta) harvest in Papua New Guinea. Oryx 49:659-668.

Management of wildlife use by communities living a partially traditional lifestyle is usually more successful when the interactions between those communities and the environment are well understood. We mapped the harvest areas for the Vulnerable pig-nosed turtle *Carettochelys insculpta* for six language-groups in the Kikori region of Papua New Guinea and compared harvest parameters between different areas and language-groups and, when possible, between 1980–1982 and 2007–2009. ***Piku Team contribution***: Central to the project.

Thomson, S.A., Amepou, Y.*, Anamiato, J.* and Georges, A. 2015. A new species and subgenus of *Elseya* (Testudines: Pleurodira: Chelidae) from New Guinea. Zootaxa 4006:59–82.

The New Guinea freshwater turtle, *Elseya novaeguineae* is a long-term, widespread resident of New Guinea and has been subject to substantial vicariance in one of the most geologically dynamic regions on earth. Thus, it should come as no surprise that the taxonomy of this turtle is poorly resolved. In this paper, we restrict *Elseya novaeguineae* to the Birds Head region of New Guinea, west of the Langguru Thrust and Fold Belt; we resurrect from synonymy *Elseya schultzei* for the populations north of the Central Ranges; and we describe a new species, *Elseya rhodini*, for the populations to the south of the Central Ranges. ***Piku Team contribution***: The type locality for this new species is Wau Creek; also the neotype and paratypes of *Elseya branderhorsti*.

Georges, A., Zhang, X., Unmack, P., Reid, B.N., Le, M. and McCord, W.P. 2014. Contemporary genetic structure of an endemic freshwater turtle reflects Miocene orogenesis of New Guinea. Biological Journal of the Linnean Society 111:192-208.

The island of New Guinea lies in one of the most tectonically active regions in the world and has long provided outstanding opportunity for studies of biogeography. Several chelid turtles, of clear Gondwanal origin, occur in New Guinea; all species except one, the endemic *Elseya novaeguineae*, are restricted to the lowlands south of the Central Ranges. We use mitochondrial and nuclear gene variation among populations of *E. novaeguineae* throughout its range to test hypotheses of recent extensive dispersal versus more ancient persistence in New Guinea. Its genetic structure bears the signature of Miocene vicariance events. The driving influence on genetic structure appears to have been isolation arising from a combination of: (1) the early uplift of the Central Ranges and establishment of a north-south drainage divide; (2) development of the Langguru Fold Belt; (3) the opening of Cenderawasih Bay; and (4) the deep waters of the Aru Trough and Cenderawasih Bay that come close to the current coastline to maintain isolation of the Birds Head through periods of sea level minima. ***Piku Team contribution***: Provided tissue samples from the Kikori.

Magazines and Newsletters

Amepou, Y, 2016, The Piku Project: Saving Papua New Guinea's Pig-nosed Turtle. The Tortoise Magazine, in press.

This article discusses the pig-nosed turtle and the Piku project in Kikori. It explains the culture setting of Kikori and the interactions between the turtle and people in Kikori. It talks about the decline and how the Project works with communities in helping them manage an animal so significant to them.

Georges, A. 2014. Invasion in our northern connections BRIDGING, Newsletter of the Peter Cullen Water & Environment Trust 11:18.

This article discusses the threat of fish invasions to Australia via Torres Strait, particularly climbing perch.

Georges, A., Eisemberg, C., Amepou, Y.* and Manasi, E.* 2014. Turtle Conservation Challenges in Papua New Guinea. Turtle Survival August 2014:22-24.

This article discusses some of the challenges facing turtle conservation in New Guinea.

Georges, A. 2013. Tilapia invade the Kikori River, PNG. ANGFA News (Australia New Guinea Fishes Association 51:1,4.

The Piku Team reports its observations on the advance of the invasive fish, Tilapia, in the Kikori River.

Keynote Addresses

Georges, A. 2014. Missionaries, mercenaries, misfits, and manna from heaven. 50th Anniversary Meeting of The Australian Society of Herpetologists, Greenhills Conference Centre, Canberra, ACT. January 29-31, 2014.

Georges, A. 2014. Missionaries, misfits and manna from heaven -- Challenges of turtle conservation in Papua New Guinea 12th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles.

Conference presentations

Amepou, Y.*, Eisemberg, C., Lynch, J. and Georges, A. 2014. Community engagement in the conservation and management of the declining pig-nosed turtle (*Carettochelys insculpta*) in Kikori, Papua New Guinea. 8th World Congress of Herpetology, Hangzhou, China, 15-21 August 2016.

Amepou, Y.*, Eisemberg, C. and Georges, A. 2014. The effect of inundation patterns on pig-nosed turtle nest mortality at coastal and riverine areas of Kikori, Papua New Guinea 50th Anniversary Meeting of The Australian Society of Herpetologists, Greenhills Conference Centre, Canberra, ACT. January 29-31, 2014.

Eisemberg, C. and Berra, T. 2014. Notes on the Sale of the Nurseryfish (Kurtus gulliveri) in the Kikori Market, Papua New Guinea Joint Meeting of Ichthyologists and Herpetologists, Chattanooga, Tennessee, 30 July – 3 August, 2014.

Eisemberg, C. and Georges, A. 2014. Pig-nosed Turtle (Carettochelys insculpta) -- Coastal-riverine nesting dichotomy in the Kikori River, Papua New Guinea: choice and trade-offs Joint Meeting of Ichthyologists and Herpetologists, Chattanooga, Tennessee, 30 July – 3 August, 2014.

Eisemberg, C.C., Amepou, Y.*, Manasi, E.*, Rose, M., Yaru, B.* and Georges, A. 2014. Using biological and social data to identify priority areas for Carettochelys insculpta conservation in the Kikori regions, Papua New Guinea 12th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles. Pp 27.

Amepou, Y, Eisemberg, C, Lynch, J and Georges A. 2015. Community-led Conservation and management of the Declining Pig-nosed turtle (Carettochelys insculpta) in Kikori, Papua New Guinea. 13th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles, Tuscon, Arizona, United States of America. 6-9 August 2015.

Amepou, Y, Eisemberg, C, Georges, A, Manasi, E, Lynch, J. 2014, Nesting Biology of the pig-nosed turtle in Kikori and conservation initiatives. Society for Conservation Biology Oceania, Suva, Fiji, July 9-11, 2014.

Manasi, E, Eisemberg, C, Amepou, Y, Jeffery S, Lynch, J and George, A. 2014. Community-led conservation of the Pig-nosed turtle of the Kikori River, PNG. Society for Conservation Biology Oceania, Suva, Fiji, July 9-11, 2014.

Eisemberg, C. and Georges, A. 2013. A pibotal temperature for the pig-nosed turtle (Carettochelys insculpta) in the Kikori River, Papua New Guinea. 37th Meeting of the Australian Society of Herpetologists, Point Wolstoncroft, Lake Macquarie, New South Wales, Jan 29 to Feb 1, 2013. Pp 60.

Amepou, Y.*, Eisemberg, C. and Georges, A. 2012. Community-led Conservation of Carettochelys insculpta in Kikori, Gulf Province, Papua New Guinea. The 8th New Guinea Biological Conference, June 28-29, 2102, Foreset Research Institute, Lae, PNG.

Eisemberg, C., Rose, M., Amepou, Y.* and Georges, A. 2012. The Piku Project: Pig-nosed Turtle (Carettochelys insculpta) community-led conservation in the Kikori region of Papua New Guinea. Regional Conference of the Society for Conservation Biology, Oceania, September 20-23, 2012, Charles Darwin University, Darwin, NT, Australia.

Seminars

Amepou, Y, 2015. A Study of the nesting and reproductive biology of the Pig-nosed turtle (*Carettochelys insculpta*) and the efficacy of its community-based management in Kikori, Papua New Guinea. Confirmation Seminar, Divine Word University, Madang, Papua New Guinea, July 8 2015.

Georges, A. 2013. Stories of PNG. Dinner presentation at the Science Educators Association of the ACT, Pod Food, Pialligo ACT, November 8.

Georges, A. 2013. The Kikori Project: Science underpinning community-led conservation and environmental education in the Kikori Delta, PNG. Research School of Biological Sciences, Australian National University, May 16, 2013.

Amepou, Y.*, Eisemberg, C.C. and Georges, A. 2012. Yumi lukautim Piku: Pik- nus trausel, 5 toea Trausel bilong Papua New Guinea [Taking care of Piku: the Pig-nosed turtle, Papua New Guinea's 5 toea turtle]. Poster presented at Goroka Show, PNG Independence Day, Goroka, September 16, 2012.

8. Recommendations for the Future

General

- That support continues to support community-led conservation initiatives and environmental education activities of the sort delivered in this project. The goodwill generated by this project, and the commitment of key elements of the community to understanding the challenges and options before them is an excellent foundation for continued engagement by the industry to achieve enduring change.

Environmental Education

- Expand the teacher training, and engagement with the school curricula, to the Omati and Kutubu communities.

Community-led Conservation

- Continue the market and village monitoring of pig nosed turtle harvest, but with a stratified sampling design to improve focus to ensure reproducible and defensible data are collected on the levels of harvest, consumption and trade. We need to be able to confidently track trends in turtle abundance and identify recovery if it occurs.
- Consolidate the Wau Creek initiative, with formal recognition under PNG national regulations as a Wildlife Management Area. This will require an influential champion in Port Moresby to obtain CEPA approval.
- Additional negotiations are required to secure material support from the East Kikori Local Level Government (LLG) and the Gulf Provincial Government. Commitment by the forestry industry to support the Wau Creek initiative through injection of funding will diversify the support for the initiative and so provide resilience. Crowd-funding is another option that should be explored.
- Subsequent expansion of the protected area to incorporate adjacent limestone ridges and pinnacles to the north (referred to by the locals as the "mountains") – of no value to forestry -- and extend the protected area to cover adjacent Rupahi lands of the Sire River to the east, broadening the benefit in ways seen as desirable by the Clan.
- Support a coordinated approach to establishing a coastal zone protected area, as a broad initiative, bringing in the villages of Goari, Apeowa and Veraibari to an agreement for sustainable management of this important region. Bring in the Piku

Team, the Pidu (dolphin) Team, and other parties interested in coastal zone management to establish a coastal and marine zone protected area. This is considered beyond the Piku Teams capacity to negotiate.

- Work with the Aird Hills Wildlife Management Area team to clarify their vision for conservation and sustainability in their region, and determine if they wish to pursue the options currently taken by the Rupiha Clan. If so, assist them to achieve their vision. The leverage of the pig nosed turtle as a flagship would need to be on mangroves and feeding grounds, and harvesting intensity of turtles, rather than nesting.
- Establish a ranger program, akin to the land management Djelk Rangers program operating in Arnhem Land of northern Australia, to provide employment and opportunity associated with and offsetting the costs of community-led conservation initiatives in the Kikori Delta, hinterland and coastal regions.

Research

- Diversify the avenues of funding for research projects in the Kikori, including opportunities for postgraduate research students.
- Facilitate researchers to undertake work in the Kikori region by providing advice, logistic support and access to the Wau Creek field station and other opportunities at Aird Hills and elsewhere. In return, both the Piku Team and the ExxonMobil PNG Ltd should expect early access to their findings and research highlights.

Outreach and Communications

- Support the redesign and production of the three children's books to bring them to a higher professional standard, and design and produce an additional two books, for circulation to the next cohort of students in the Kikori lowlands, the Lake Kutubu catchment and the Omati lowlands.
- Capitalise on the new biodiversity coming to light through surveys and research with the production of posters (e.g. Frogs of Wau Creek, Fig 23) and field guides (Marine and Freshwater Turtles of New Guinea) for circulation and sale nationally and internationally.

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