

# Angel C. Alcala: Naturalist, Conservationist, Icon

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## INTRODUCTION

March 01, 2019 marked the 90th birthday of the Philippine's premiere herpetologist and National Scientist Dr. Angel Chua Alcala. He is also regarded as the father of community-based no-take marine reserves in the Philippines. Apart from major scientific contributions ranging from terrestrial biology to marine biology, his public service career greatly impacted national policies and conservation programs, many of which became models not just in the Philippines but throughout the ASEAN countries and even beyond.

There have been numerous accounts on the life and major scientific works of A.C. Alcala, many highlight his lifetime achievement and public service awards, including the Ramon Magsaysay Award (regarded as the Nobel Prize equivalent in Asia) in 1992. The most recent biography entitled "A Love Affair with Mother Nature: A Biography of National Scientist Angel Chua Alcala" (Rodriguez-Olmedo & Guerrero 2017), described mostly his personal life and touched briefly on his career history, most importantly how the multi-awarded scientist and Emeritus Professor from Silliman University values nature.

This paper, as a birthday tribute, briefly describes A.C. Alcala's early contributions in vertebrate biology and how his career ultimately shaped Silliman University as a leading Philippine institution in vertebrate biology research and later on in the marine sciences.

### **From Boyhood Naturalist to World-Renowned Scientist**

Angel Alcala was born on March 1st, 1929 in a rural village in Caliling, Cauayan, in Negros Occidental. He was the eldest of 10 children of Porfirio Alcala and Crescenciana Chua, the former a public school teacher and his spouse a daughter of a Chinese migrant. Back then, the nearby forest was still pristine and the coral reefs teemed with abundant fishery resources. As a boy, as he often recalled, his playground was the nearby reef where the bottom was a colorful underwater landscape where marine creatures (e.g. turtles) swam freely and unmolested by people. His sister Julieta also recalled that the young and highly inquisitive Angel, while growing as an adolescent, was assigned by his father to plow the small family

farm, located near the forest and he often stayed in a small nipa hut for several days. While attending high school at Kabankalan town, some 40 km away, he and other students would often walk every week back to their village as public transportation was still scarce then. Those long hikes along forested hills in the countryside were his early encounters with nature, preparing Angel to become a scientist in the years to come.

He received a BSc in Biology (*Magna cum laude*) at Silliman University in 1951. Right after graduation, Alcala taught biology at a local school in Marbel, South Cotabato. Upon the invitation of Professor Dioscoro S. Rabor, who was the head of the Biology Department at that time, he returned to Silliman University and joined the faculty. A year later, Alcala married Naomi Lusoc, and their marriage produced six children (Estrilda, Angelo, Grace, Moses, Emily, and Ely), 17 grandchildren and five great-grandchildren.

In 1953, as an instructor of biology at Silliman University, he joined an expedition led by S. Dillon Ripley II (an American ornithologist at Smithsonian Institution) and Professor Rabor in the highlands of Canlaon, where the team collected the last known specimen (actually a pair but only a female was recovered) of the rare Negros fruit dove (*Ptilinopus arcanus*).

In 1956, as a young biologist, Alcala went back to his childhood playground (i.e. forest of Caliling) and had his first herpetological discovery there when he found the eggs of the direct-developing (no tadpole stage) frog *Cornufer guentheri* (now known as *Platymantis negrosensis*). He described this species along with his American mentor, a visiting Professor at Silliman University at the time, Dr. Walter C. Brown (Alcala & Brown, 1957). Prior to this paper, Alcala's first herpetological paper was on the amphibians of Mt. Halcon and Mt. Canlaon (Brown & Alcala, 1955), followed by several papers on the life-history and ecology of amphibians (e.g. Alcala, 1955a & b, 1956, 1957; Alcala & Brown, 1956; Alcala & Rabor, 1957; Brown & Alcala, 1957) and reptiles (Alcala & Reyes, 1957) on Negros Island. His first systematic paper dealt with a review of the Philippine lizards of the genus *Lygosoma* (*Leiolopisma*) (Brown & Alcala, 1956). In 1958, he and his colleagues (Dioscoro Rabor, his former professor and former fellow student Rodolfo B. Gonzales) at the Biology Department of Silliman University updated the vertebrate records of Negros Island

(Alcalá, 1958; Rabor *et al.* 1958).

In 1960, Alcalá obtained his M.A. (Biological Sciences) at Stanford University through a Fulbright/Smith Mundt Graduate Scholarship. His thesis on the breeding behavior of frogs on Negros Island was published *in toto* (Alcalá, 1962). At Stanford, his scientific training was enhanced not just by Dr. Brown but also through his interactions with prominent scientists, including Dr. George S. Myers (a well-known ichthyologist and evolutionist). Both W. Brown and G. Myers served as members of Alcalá's thesis committee. Alcalá even collected samples from Lake Lanao that G. Myers used as basis for his paper on the endemic fishes of Lake Lanao (Myers, 1960). In 1961, Brown & Alcalá (1961a) published a paper describing the populations of amphibians and reptiles of Cuernos de Negros massif. This paper has now become a useful baseline of information on the herpetofauna, especially amphibians that can be used as indicators of climate-related changes. The young scientist probably anticipated the usefulness of collecting ecological data when he explained to his mentor that while his main task was to collect specimens for systematic study, he also collected pertinent information on abundance as well as other ecological information (e.g. temperature, humidity, etc.).

From March to May 1961, Alcalá led the Stanford-Silliman Expedition to Palawan, which resulted in the discovery of a new species of sphenomorphid lizard *Sphenomorphus palawensis* (Brown & Alcalá, 1961b) and a new species of gekkonid, *Gekko athymus* (Brown & Alcalá, 1962). In 1963, Alcalá was awarded the John Simon Guggenheim Memorial Foundation Fellowship for Natural Sciences at Stanford University where he completed his Ph.D. (Biological Sciences) in 1966. Since then, with W. Brown's collaboration, Alcalá published a series of herpetological papers and books, either as singly or co-authored, describing new species of amphibians (Brown & Alcalá, 1963a, 1967, 1970, 1974, 1977, 1982, 1994; Brown *et al.* 1997a,b,c, 1998), lizards (Brown & Alcalá, 1963b, 1978, 1980), snakes (Alcalá, 1969), and findings on related topics such as ecology (Brown & Alcalá, 1964, 1970a; Alcalá & Brown, 1966, 1967, 1969; Alcalá, 1967, 1986b), reproduction (Alcalá & Brown, 1982; Brown & Alcalá, 1983), and zoogeography of herpetofauna (Brown & Alcalá, 1970b, 1986b; Alcalá & Brown, 1997).

While working continuously with colleagues and younger generations of biologists, Alcalá's publications not only increased in terms of number but also expanded in terms of scope. These included studies of endoparasites of land vertebrates (Crook & Alcalá, 1968; Laviña & Alcalá, 1969), the ecology of birds (Gonzales *et al.* 1968; Alcalá & Sanguila, 1969; Gonzales & Alcalá, 1969a; Alcalá & Alviola, 1970;

Carumbana & Alcalá, 1974; Alcalá & Carumbana, 1980), and mammals (Alcalá & Brown, 1969; Alcalá & Alviola, 1970; Alcalá, 1970; Guerrero & Alcalá, 1973; Heaney & Alcalá, 1987), and the distribution of amphibians (Rabor & Alcalá, 1969) and reptiles (Ross *et al.* 1987 on snakes; Ross & Alcalá, 1983 on the Philippine crocodiles).

Alcalá studied other aspects on the biology of frogs that may aid in taxonomy and systematics, such as the vocalizations of frogs (Alcalá *et al.* 1986; Brzoska *et al.* 1986; Brown *et al.* 2002; Diesmos *et al.* 2002). Using new technologies such as molecular phylogeny, Alcalá and colleagues were able to re-define certain vertebrate taxa, especially amphibians, resulting in the description of several new species.

From 1955-2018, Alcalá contributed to a total of 270 publications (including books), 158 of which dealt with marine biology, 57 (36%) on the impact of marine reserves in enhancing exploited fish stocks, while the remaining papers involved reviews on the management aspect (31 papers), biology of marine invertebrates (28 papers, 13 of which were on toxicology), general coral reef ecology (22), fisheries (17), and basic fish biology (8). He also published some papers on other topics such as marine mammals (1), marine turtles and sea snakes (2), mangroves (2), algae (5), seagrass (2), as well as on rivers (2). The remaining 112 publications were on terrestrial biology topics (mainly involving vertebrates): herpetology (90), ornithology (6), mammalogy (7), general vertebrate biology (5), parasitology (2), textbooks and laboratory manuals (2). Based on the latest information available (2018), Alcalá and co-authors have described a total of 51 species (29 amphibians and 22 reptiles).

### **The Conservationist**

While Dioscoro Rabor was a Philippine pioneer in Philippine vertebrates (also considered as the Father of Philippine Wildlife Biology), R.B. Gonzales (after whom the SU Biology Museum was named) was the first to study the breeding biology of the rare Philippine Eagle (Gonzales, 1968). This paper by Gonzales was probably one of the earliest studies done by Filipino biologists, including Alcalá, to emphasize the adverse effects of human activities and habitat loss on the fate of rare and threatened vertebrate species (Gonzales & Alcalá, 1969b) and the need to conserve them. With a handful of newly described taxa and equipped with new information on records of vertebrates on Negros Island, Rabor *et al.* (1970) updated their 1958 list. Later, Heaney *et al.* (1987) provided an annotated list and conservation status of Philippine mammals. One of the rarest and largest cave-dwelling Bare-backed Fruit bat (*Dobsonia chapmani*) was thought to be extinct until it was rediscovered by a team led by Ely Alcalá (Angel's youngest

son) in 2001 (Alcalá *et al.* 2004). The community in Pinamayan, Cauayan in southwestern Negros has been organized by the younger Alcalá to protect the remaining forests in the area. The People's Organization received awards for protecting the remaining forest and habitat of this rare fruit bat.

Alcalá and Charles "Andy" Ross began a collaborative program on the Critically Endangered Philippine Crocodile (*Crocodylus mindorensis*), first at Silliman University and later on involved a partnership with the private sectors through the Crocodylus Porosus-Philippines Inc. (a non-government organization composed of six crocodile farms). These farms are recipient of captive-bred *Crocodylus porosus* from the government-funded Crocodile Farming Institute (CFI) in Palawan. The first successful breeding program for *C. mindorensis* happened at the breeding facility at Silliman University Marine Laboratory (later renamed as A.C. Alcalá Environmental & Marine Science Laboratories in 2009 by then SU President Ben S. Malayang III). The laboratory was established by Alcalá in 1974 out of salvaged materials from the old SU Science Complex. In a separate section below, the history and scientific impact of this "makeshift laboratory" in the field of marine biology will be described briefly. Although some may assumed that the crocodile breeding program pioneered by Alcalá at Silliman University halted decades ago, this is not the case. Some of the first female offsprings obtained from the captive breeding program were actually brought to the crocodile farm owned by J.K. Mercado in Kapalong, Davao del Norte, mated with males there and eventually produced juveniles. Upon the advice of Alcalá, these juveniles were reared in spacious enclosures where they forage without significant human interaction, in preparation for a soft-release program in at least three sites in Mindanao, including the Paghongawan Marsh in Siargao Island (see Manalo & Alcalá, 2015). This program was part of the commitment of the crocodile farmers, mentored by Alcalá and Ross, to conserve the Philippine Crocodile.

Another breeding facility that was established at Silliman University for the conservation of threatened vertebrate species was the Alfredo Y. Reyes Botanical & Zoological Garden, named after Alcalá's botanist colleague at the Biology Department. This facility was under the auspices of the Biology Department through the Center for Tropical Studies (CenTrop). As a rescue center it was instrumental in the conservation of endemic mammals such as the Visayan Spotted Deer, *Rusa alfredi* (Alcalá & Alcalá, 1994) and the first successful breeding of the Negros Bleeding-heart Pigeon *Gallicolumba keayi* in 2007 (Lastica *et al.* 2014). It serves as an educational facility where the general public and the students learned basic ecology, threatened flora and fauna, and some conservation measures.

### **The Teacher and Institution Builder**

Alcalá spent most of his early years teaching at the Biology Department of Silliman University starting as an Instructor (1952-1962) and then as Department Chairman (1968-1970). He held various administrative positions such as the Director of the University Research Center (1969-1975), Dean of the College of Arts & Sciences (1972-1975), and eventually became University President (1991-1992). He relinquished this final position upon his appointment as the Secretary of the Department of Environment & Natural Resources (DENR) from 1992-1995. He later became the first Chairman of the Commission on Higher Education (CHED) from 1995-1999. Alcalá also reached out to other Philippine institutions, identified and trained promising researchers. In one instance, one master-level student from the University of the Philippines-Los Baños (UPLB) repeatedly wrote to then DENR Secretary Alcalá hoping that he could learn from the respected herpetologist. Despite his hectic schedule, Secretary Alcalá surprised the said student by personally visiting him at UPLB campus and together with top DENR officials and aides, conducted several lectures on herpetology at UPLB. With support from Alcalá, that student earned his very own laurels as a herpetologist. Dr. Arvin C. Diesmos is now a leading Filipino herpetologist and heads the Herpetology Section of the Zoology Division of the Philippine National Museum of Natural History (NMNH). He through Alcalá and W. Brown became a close collaborator of Dr. Rafe M. Brown of Kansas University. Diesmos and R. Brown continued the collaboration initiated by Alcalá and W. Brown and described several additional new species of amphibians and reptiles.

Faculty members and even administrators elsewhere in the country, when confronted by Alcalá as to why they are not engaged in research often present heavy teaching loads as their main excuse. He would just respond by sharing his various creative teaching strategies to cope up with big classes at Silliman University and at the same time pursue research. He and colleague R.B. Gonzales developed a laboratory manual for zoology students (e.g. Alcalá & Gonzales, 1975). Moreover, recognizing the lack of more relevant reference materials on vertebrate biology for college students, not just in Silliman University but also throughout the country, he wrote the textbook entitled *Philippine Land Vertebrates* (Alcalá, 1976). As a visiting professor in Tunghai University, Taiwan (1975-1976), he co-authored a paper on the reproductive biology of rice frog *Rana limnocharis* (Alexander *et al.* 1979). He and wife Naomi also published a similar study but on *R. c. cancrivora* on Negros Island (Alcalá & Alcalá, 1980). In 1983, the government-sponsored Guide to Philippine Flora & Fauna book series was published including his two volumes: Amphibians and Reptiles

(Vol. X) and Poisonous Animals (Vol. XII). In 1998, an illustrated field guide was published (Alcala & Brown, 1998).

Appendix A provides an updated list of all AC Alcala's publications on vertebrate biology from 1955-2018.

### **The Founder of Silliman University Marine Laboratory and Father of Community-based Marine Reserves**

In 1974, Alcala established the Silliman University Marine Laboratory (SUML), which in 2009 was renamed as the Dr. Angel C. Alcala Environmental and Marine Sciences Laboratories. The "prototype" building served as the facility for Biology faculty members who were also doing their own research apart from teaching duties.

Also in December of 1974, Alcala (with an approval from the Oslob Municipal Council) set up the first working marine reserve in Sumilon Island, a small coralline island off the southern tip of Cebu Island and approximately 14 km from Silliman University's newly established Marine Laboratory. The reserve was only 750 m x 100 m surrounded by a fringing reef to a maximum depth of 30 m. Alcala's establishment of Sumilon Marine Reserve predates by a year the establishment of Australia's Great Barrier Reef Marine Park in 1975. At Sumilon, researchers and students conducted studies on marine organisms, including echinoids and fish harvest yields. Alcala's report on fish yield on Sumilon's coral reef (Alcala, 1981) was read by a young marine biologist named Dr. Garry R. Russ. Russ then traveled to the Philippines and initiated a long-term collaboration with Alcala, which persisted to this day. He then began his underwater fish surveys at Sumilon which documented an increasing trend in fish biomass inside the reserve (Alcala & Russ, 1990).

In 1980, a change in local politics negatively impacted Alcala's marine reserve demonstration project. New mayors elected in Oslob and Santander towns did not support the marine reserve project. Silliman University sought help of the national government, thereby aggravating further the local politicians causing serious security concerns for the island caretaker. In addition, fishing violations including the use of muro-ami (drive-net fishing) occurred in 1984 to 1985. Alcala learned from this experience as to why Sumilon had partly failed. Aside from political factors, Alcala concluded that the lack of a committed community living on Sumilon was an important factor. Armed with knowledge and prior experience, he then relocated his project to nearby Apo Island which had about 700 residents. Alcala's team involved anthropologists to better understand the behavior of the people and also deployed community organizers help educate the locals. The community leaders agreed but on the condition that if the experiment failed to show increase in fish abundance as promised by Alcala and

his team, the demonstration ends as well. What began as a one-year contract became a long-term commitment and became the first few successful "community-managed marine reserve" and served as a model project not just in the Philippines but also elsewhere. With an unspoiled coral reef, tourism began to flourish at Apo Island and as of 2017, the Protected Area Management Board (PAMB) realized an annual income of PhP 12 Million. The continued scientific underwater surveys at Apo Island since 1983 showed that the decades of protection effort resulted not just in the recovery of fish biomass and species richness of exploited fish species inside the no-take zone but also in the adjacent fished areas, known as the spill-over effect (Russ 2002; Russ *et al.* 2004; Abesamis *et al.* 2006a & b; Russ & Alcala, 2004, 2010a & b).

Russ and Alcala's collaboration has spanned 35 productive years. Both jointly received the Pew Fellowship for Marine Conservation based on the Apo Marine Reserve establishment as 'template.' A dozen more reserves were subsequently established by Alcala and his team in the Bohol Sea alone. There are currently about 1,800 declared no-take marine reserves in the country (see Cabral *et al.* 2014; <http://www.mpa.msi.upd.edu.ph>), undoubtedly influenced by the success of Apo Island Marine Reserve. At the national arena, one should bear in mind that while Alcala was the DENR Secretary, he also influenced this 'forestry-oriented' agency to initiate marine conservation programs. Without any doubt the crafting of the Philippine Fisheries Code in 1998, mandating local government units to manage their own marine resources, including the establishment of marine reserves, was influenced by the earlier findings from the Apo Island Marine Reserve. Management histories of Sumilon and Apo marine reserves and their influence on national marine resource policy have been described in greater details by Russ and Alcala (1999).

### **The Birth of SUAKCREM**

In 1999, after his tenure as CHED Commissioner, Alcala founded a new research center (Silliman University-Angelo King Center for Research & Environmental Management-SUAKCREM). The center was established through financial support from the Angelo King Foundation and is located at the 2nd floor of the main building of the former SUML. This center is directly under the supervision of Silliman University's Board of Trustees and operates with funds from research projects to augment the existing initial fund provided by the Angelo King Foundation.

For a comprehensive list of AC Alcala's publications in marine biology and related topics (1957-2018) refer to Appendix B.



### **The Public Servant**

Alcalá's dedication is not limited to scientific endeavors but also as a public servant and reformer. He served as the DENR Secretary (1992-1995) during the administration of then President Fidel V. Ramos. During his tenure as secretary, he initiated a number of reforms in favor of the marginalized people who are dependent on natural resources. His strong stance against unplanned development sometimes raised some concern from influential politicians. A major conflict was with a prominent politician and owner of a logging concession who threatened and attempted to bribe Alcalá so that the logging concession, terminated by then President Cory C. Aquino, be re-opened. This attempt never succeeded.

Threats from development proponents were not new to Alcalá. For example, he was successful in opposing a proposal from a certain politician to put up a hotel in the vicinity of the Twin Lakes Balinsasayao-Danao Natural Park. In another instance, he stopped a proposed road to traverse the rainforest there. Alcalá was also quick to stamp out a proposed project of a geothermal company to drill portions of this natural park as part of their exploratory activities.

### **Recognitions and Awards**

In recognition to his extensive studies on Philippine herpetofauna, Alcalá became the only Filipino to be elected as an honorary foreign member of the American Society for Ichthyology & Herpetology in 1982. Several taxa of animals have been named after Alcalá as a token of appreciation for his numerous scientific achievements. For example, the frog *Ingerana* has been renamed *Alcalus*, the only member of the sub-family Alcalaenae (see Brown *et al.* 2015). *Sanguirana everetti* (formerly *Rana everetti*) was re-named *S. acai*, after his nickname and initials ACA (Brown *et al.* 2017). *Sanguirana tipanan* was named after W. Brown and Alcalá's long-term collaboration (Fuiten *et al.* 2011). A species of Wolf Snake (*Lycodon alcalai* Ota & Ross, 1994), a Mountain Keelback (*Opisthotropis alcalai* Brown & Leviton, 1961), and a subspecies of snake (*Cyclocoronus lineatus alcalai* Leviton, 1965) were also named after him. Other species were named after his family members such as the frog *Platymantis naomii* after his wife (Alcalá *et al.* 1998), the frog *Platymantis lawtoni* and skink *Sphenomorphus lawtoni* after his brother and valuable fieldworker Lawton C. Alcalá (Brown & Alcalá, 1974, 1980). He also worked on toxic marine crabs (Garth & Alcalá, 1977) and one species was named after him, *Demania alcalai* (Garth, 1975). Another species named after him is the turbellarian (*Syndesmis alcalai*) from a sea urchin (Komschlies & Vande Vusse, 1980). Another invertebrate, a pycnogonid (*Ammothella alcalai*) was described by Child (1988).

As already mentioned, Alcalá's dedication and passion not just in the scientific world but also in the public service were initially recognized when he received the Ramon Magsaysay Award in Public Service in 1992. On June 06, 2014, Alcalá was conferred the rank and title of National Scientist by President Benigno S. Aquino through Presidential Proclamation No. 782. Just recently, he received the Ocean Legend Award, as Father of Marine Protected Areas in the Philippines, awarded by the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) during the East Asian Seas (EAS) Congress in 2018.

In retrospect, National Scientist Angel C. Alcalá devoted his life to teaching, research, and government service for the benefit of the Filipino people. On his 90th birthday, colleagues and friends stand in awe and reflect profoundly on his many scientific and civic contributions.

My personal observation as to why and how ACA has achieved such prestige in his career can be gleaned from his daily routine such as taking care of his beloved Ipil (*Intsia bijuga*) trees. The way he takes care of his staffs and collaborators is analogous to how he planted his trees. First, he selected healthy seeds with potential to grow, personally watered them, removed the strangling vines and pests, and protected them from grazing goats. In the same manner, he chose the right people to work with, nurtured them, and protected them when necessary.

During Prof. Garry Russ's conferment ceremony as Doctor of Science, honoris causa at Silliman University, he said and I quote: "My career is nothing but basking on the reflected glory of such a great man." and "To Angel, it is not just all about the fish, but the welfare of the people."

### **ACKNOWLEDGEMENTS**

I am grateful to Emily Alcalá Layos (ACA's daughter and administrative assistant) and Julieta Alcalá Luchavez (ACA's sister), both of SUAKCREM, for kindly allowing me to use AC Alcalá's extensive list of publications and career records. Like many of his colleagues, I have always benefited from lengthy discussions with Professor Alcalá about his career as a naturalist and his tireless effort to further understand the natural world.

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**No. Appendix A. List of AC Alcalá's research publications in the field of vertebrate biology and systematics (1955-2018).**

- 1 Brown, W.C. & A.C. Alcalá, 1955. Observations on amphibians of the Mount Halcon and Mount Canlaon areas, Philippine Islands. *Silliman Journal*, 2: 93-102.
- 2 Alcalá, A.C., 1955. Observations on the life history and ecology of *Rana erythraea* Schlegel on Negros Island, Philippines. *Silliman Journal*, 2: 175-192.
- 3 Alcalá, A.C., 1955. Notes on the eggs and egg laying of some amphibians on Negros Island, Philippines. *Silliman Journal*, 2: 102-106.
- 4 Alcalá, A.C., 1956. *Kaloula picta* on Negros Island. *Silliman Journal*, 3: 144-146.
- 5 Brown, W.C. & A.C. Alcalá, 1956. A review of the Philippine lizards of the genus *Lygosoma* (*Leiopolisma*). *Occasional Papers of the Natural History Museum of Stanford University*, 3: 1-10.
- 6 Alcalá, A.C. & W.C. Brown, 1956. Early life history of two Philippine frogs with notes on deposition of eggs. *Herpetologica*, 12:241-246.
- 7 Alcalá, A.C., 1957. Philippine notes on the ecology of the giant marine toad. *Silliman Journal*, 4: 90-96.
- 8 Alcalá, A.C. & W.C. Brown, 1957. Discovery of the frog *Cornufer guentheri* on Negros Island, Philippines with observations on its life history. *Herpetologica*, 13: 182-184.
- 9 Alcalá, A.C. & A.Y. Reyes, 1957. Notes on the habitat of the scincoid lizard *Brachymeles gracilis taylori* Brown. *Copeia*, 1957 (2): 144.
- 10 Alcalá, A.C. & D.S. Rabor, 1957. Breeding habit and variation of *Kaloula conjuncta negrosensis* Taylor on Negros Island, Philippines. *Silliman Journal*, 4: 14-16.
- 11 Brown, W.C. & A.C. Alcalá, 1957. Viability of lizard eggs exposed to sea water. *Copeia*, 1: 39-41.
- 12 Alcalá, A.C., 1958. Amphibians of Negros Island including two new records. *Silliman Journal*, 5(2): 171-173.
- 13 Rabor, D.S., A.C. Alcalá & R.B. Gonzales, 1958. A brief list of land vertebrates of Negros Island. *Silliman Journal*, 5(3): 286-300.
- 14 Rabor, D.S. & A.C. Alcalá, 1959. Notes on a collection of amphibians from Mindanao Island, Philippines. *Philippine Journal of Science*, 88(3): 335-344.
- 15 Brown, W.C. & A.C. Alcalá, 1961. Populations of amphibians and reptiles in submontane and montane forests of Cuernos de Negros, Philippine Islands. *Ecology*, 42: 628-636.
- 16 Brown, W.C. & A.C. Alcalá, 1961. A new sphenomorphid lizard from Palawan Island, Philippines. *Occasional Papers of the California Academy of Sciences*, 32: 1-4.
- 17 Brown, W.C. & A.C. Alcalá, 1962. A new lizard of the genus *Gekko* from the Philippines. *Proceedings of the Biological Society of the Washington*, 75: 67-70.
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**No. Appendix A cont. List of AC Alcalá's research publications in the field of vertebrate biology and systematics (1955-2018).**

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**No. Appendix A cont. List of AC Alcalá's research publications in the field of vertebrate biology and systematics (1955-2018).**

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**No. Appendix A cont. List of AC Alcalá's research publications in the field of vertebrate biology and systematics (1955-2018).**

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- No. Appendix A cont. List of AC Alcala's research publications in the field of vertebrate biology and systematics (1955-2018).**
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**No. Appendix B. List of AC Alcala's research publications in the marine and aquatic sciences (1957-2018).**

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