

**U. S. GEOLOGICAL SURVEY
RESEARCH SCIENTIST RECORD**

Please Circle One:

Research Grade Review (RGE)

Equipment Development Grade Evaluation (EDGE)

1. NAME: Thierry M. Work
2. DATE PREPARED: July 21, 2015
3. DUTY STATION: National Wildlife Health Center - Honolulu Field Station
4. REGION: Midwest Region
5. CLASSIFICATION TITLE, SERIES, AND GRADE: Veterinary Medical Officer GS-0701-14 (Wildlife Disease Specialist)
6. DATE OF ENTRANCE ON DUTY: October 12, 1992
7. DATE OF LAST PROMOTION: May 4, 2004
8. DATE OF LAST RESEARCH GRADE PANEL REVIEW: December 2011
9. EDUCATION:

Residency, Wildlife Medicine, 1988-1990, University of California, Davis (UC Davis)
Master of Preventive Veterinary Medicine, 1988-1990, UC Davis.
Doctor of Veterinary Medicine, 1984-1988, UC Davis.
Master of Science, Entomology, 1983-1986, UC Davis.
Bachelor of Science Cum Laude, Entomology, 1979-1983, Texas A&M University.
10. TECHNICAL TRAINING RECEIVED:

Workshop on histology of corals, Washington, DC (June 2000)
Workshop on molecular genomics of corals, National Conservation Training Center, West Virginia (June 2009)
DOI small boat training, Honolulu, Hawaii (June 2012)
USGS-Supervisory Challenge, Sacramento, California (January 2013)
USGS-Leadership 101, Minneapolis, Minnesota (April 2015)
11. PROFESSIONAL EXPERIENCE:
 - a. PRESENT ASSIGNMENT:

From: 1992-Present

Project Leader Honolulu Field Station. As head of the National Wildlife Health Center's Honolulu Field Station, I direct the center's wildlife health programs for coral reefs, sea turtles, and endangered birds and mammals that span Hawaii, remote islands, US territories, and Compact of Free Association countries of the eastern, central and western Pacific (an area > five times the size of the US). Due to the complexities associated with remote locations, a large breadth of species (plants, corals, molluscs, echinoderms, fish, reptiles, birds, mammals), and the dynamic relationships between hosts and pathogens in diverse taxa, the station excels in development of innovative field and laboratory tools to understand causes and drivers of disease in wildlife and their impacts on marine and terrestrial ecosystems. I supervise the station's three technicians that assist our wide ranging activities including outreach efforts and unique problem-solving skills that make our science highly relevant to natural resource managers and society at large.

Sea turtle health (34%): Principal Investigator. I lead a threatened and endangered sea turtles health assessment program in the Pacific. Major components include: A) research on pathogenesis of a tumor disease (fibropapillomatosis-FP) that affects green turtles globally; B) investigation of causes of mortalities of neritic and pelagic phase sea turtles; C) capacity building to aid organizations nationally and overseas to assess sea turtle health. Due to the lack of available tools to investigate sea turtle health and inability to cultivate and manipulate marine microbes such as the herpesvirus associated with FP, I led the de-novo development of tools to understand disease pathogenesis and to implement and deploy diagnostic tests. This required that I be well-versed in vast array of disciplines including epidemiology, proteomics, immunology, molecular biology, pathology, bioinformatics, and microbiology among others. This program has led to several breakthroughs such as identification of the potential cause of FP (herpesvirus), effects of FP on survival of turtles, and how the herpesvirus is shed from infected turtles thus providing insights on spread of the virus in the environment. A blood test for the virus is in development in my laboratory. My international and national collaborations, presentations at meetings, peer reviewed literature, online outreach material, and numerous workshops on sea turtle health gives this program a prominent international reputation. Major funding: USGS, NOAA.

Coral reef health (33%): Principal Investigator: I lead a program to understand health of tropical coral reef ecosystems in the Pacific. Components include: A) research to develop field and laboratory tools to understand health of corals, echinoderms, and reef fish; B) investigations of unusual mortality events in coral reefs and associated organisms; C)

capacity building in Pacific Island nations to establish coral reef health monitoring programs. Historically, coral reef health programs were confounded by inferring causes of disease based solely field signs of lesions in corals. I developed a standardized system to describe gross lesion in corals that lends clarity to the health monitoring process and is now being applied in coral disease surveys globally. I am also at the forefront of applying biomedical tools to understand coral disease, and this program has provided insights on potential causes and pathogenesis of several coral diseases in the central and western Pacific. I am now applying this process to understand health of echinoderms that, as major grazers, are keystone species in marine ecosystems. Because the biomedical literature on these animal groups is very limited, our efforts are building the foundational groundwork for understanding pathogenesis of disease in marine invertebrates. Major funding: USGS, NOAA, University of Hawaii.

Recovery of threatened and endangered birds and mammals in the Insular Pacific (33%): Principal Investigator; I lead a program to investigate health of threatened and endangered native birds and mammals. Components include: A) research on causes of mortality and pathogenesis of disease in listed species; B) advising state and federal conservation agencies on management actions to enhance endangered species recovery efforts; C) capacity building for state, federal, and territorial agencies to monitor terrestrial wildlife health. Understanding causes of death in endangered birds and mammals poses significant challenges (small numbers of animals, difficulty in getting specimens, lack of baseline data). I have led efforts to rapidly identify diseases of management importance in threatened and endangered species and built a database containing health records for 185 species of terrestrial vertebrates in the Pacific Basin. These factors have made HFS a center of excellence on wildlife health depended upon by myriad federal, state, and territorial agencies in the Pacific Basin. For instance, the USFWS, National Park Service, State of Hawaii, and remote territories have repeatedly depended on my guidance for recovery and management of at least 8 endangered species. I was also the lead veterinarian and developed tools to safely clinically manage birds during successful reintroduction of critically endangered Laysan ducks and Nihoa millerbirds to their native range. Finally, my workshops on wildlife health translate science to a broader public. Major funding: USGS, USFWS.

NAME AND TITLE OF SUPERVISOR, TEAM LEADER(S), OR PROJECT CHIEF(S): Dr. C. LeAnn White, Chief, Wildlife Epidemiology and Emerging Disease Branch-NWHC.

12. SIGNIFICANT RESEARCH ACCOMPLISHMENTS (Numbers in brackets in narrative refer to peer-reviewed papers listed in bibliography)

a. RECENT CAREER ACCOMPLISHMENTS (since last RGE review in 2011)

Coral reef health

Background: Coral reefs and associated organisms are declining; however, progress to determine exactly why this is so has been slow. Understanding the causes and drivers of mortality is critical to formulate potential management options to decrease their impacts.

Results: A systematic review of 469 papers from 1965 to 2013 revealed that all the papers in the peer-reviewed literature incriminating various pathogens (typically bacteria) as cause of coral death do not withstand rigorous biomedical scrutiny (106). Tissue loss lesions in corals in the Central Pacific (87, 92), New Caledonia (108), Micronesia (113), and the Eastern Pacific (104) are associated with fungi, algae, helminths or ciliates, and newly discovered parasitic corals (88). Host response and associated pathogens of white syndrome in the dominant coral *Montipora capitata* vary in time and space with no evidence that bacteria are causing disease (94) although diseased tissues of *Acropora* corals with tissue loss do have different bacterial flora than normal tissues (93). Newly discovered tissue-associated symbiotic bacteria in corals are widespread in the Pacific and may explain dominance of particular coral genera on reefs, coral immunity, and evolution (107). Epizootic cyanobacterial infections are disproportionately affecting dominant *Montipora* in Kauai (111) and can also affect coralline algae in Micronesia (100). Fungal disease in coralline algae is influenced by ocean acidification (105). Lectins can differentiate coral cells (110).

Role: I am playing a leading role in redefining how coral disease is investigated and am laying the foundational groundwork for case definitions of several coral diseases. For most studies, I identified the questions, designed the study, secured the funding and collaborations, carried out the field and laboratory investigations, analyzed, and wrote up the results. In some studies, I was the mentor or principal advisor of students.

Impact: Forty years of coral reef studies has shown little progress on understanding causes of coral reef decline because investigators have adopted an inductive approach presupposing causation. In contrast, I propose a deductive approach to investigating coral reef health that reveals many newly discovered organisms associated with lesions and provides a firm foundation to understand causation and disease pathogenesis in corals. These findings also reveal existence of new tissue-associated bacterial symbioses adding a new dimension to existing knowledge of algal symbioses in this ecologically important group of organisms. Our studies of coralline algae disease are the first of their kind

and are important because these plants provide the foundation for coral larvae settlement on reefs.

Sea turtles

Background: Sea turtles are threatened or endangered globally. Fibropapillomatosis (FP), a condition that causes external and internal tumors and that is a major cause of stranding in green turtles in Hawaii and affects green turtles worldwide. FP is closely associated with a herpesvirus, but we cannot grow this virus in the lab thus preventing us from experimentally confirming its role in disease causation and developing tests to detect exposure to the virus prior to manifestation of disease.

Role: I am considered a leading authority on sea turtle health and fibropapillomatosis as evidenced by multiple international collaborations (Mexico, Brazil) and publication of scientific studies and outreach material. I am developing critical laboratory tools to help us understand sea turtle disease and have led or co-hosted several international workshops on sea turtle health.

Results: The genome of chelonid herpesvirus 5, the putative causative agent of the tumor disease, marine turtle fibropapillomatosis, (FP) was sequenced and its genes identified (89). FP is found more often in green turtles residing in ecologically degraded marine habitats in Brazil (85), but there is no compelling link with environmental contaminants and presence of the disease in Hawaii (103). The virus is shed more often from smaller than larger tumors, and there is evidence that superspreaders may play an important role in transmission of FP (109). A general interest article was written to communicate findings of FP to a wider public (99).

Separately, captive green turtles with ulcerative dermatitis are immunocompromised (95), a countercurrent system plays an important role in endothermy of endangered leatherback turtles (102), and the pink spot on the head of leatherback turtles turns out to be a "skylight" that plays an important role in migration phenology (101). I also developed a method to humanely euthanize green turtles for consumption for use by aboriginal communities in Australia (98).

Impact: Sequencing the genome of the virus associated with FP will open myriad new possibilities such as the ability to generate virus proteins that can be used to develop diagnostic tests for the virus and to shed light on disease pathogenesis. The studies on virus shedding were groundbreaking and were the first to document that tumors associated with herpesvirus can play an important role in shedding. Second, the existence of superspreaders will significantly affect mathematical models FP designed to understand deeper ecological questions such as spread of viruses in marine wildlife. Finally, our findings have useful research and management implications in that animals with many small tumors are more likely to shed virus, and these tumors could be useful source of

material in attempts to culture the agent in the laboratory. The leatherback skylight findings generated widespread public interest and were prominently featured in Science News and Smithsonian allowing USGS science to reach popular audiences.

- b. OTHER CAREER ACCOMPLISHMENTS (numbers in brackets refer to references in bibliography)

Coral health

Background: See coral health above.

Results: Synthesis papers were published highlighting the important role that biomedical science and veterinary medicine could play in helping us understand disease in coral reef ecosystems (63) as well as how microbiology could help advance our knowledge of coral disease (66). An international workshop on coral histology led to a document now available online outlining basics of this field for researchers wanting to use this tool in their studies (53). A standardized nomenclature for describing coral lesions now exists as do standardized tools to help investigators assess coral diseases in the field (54, 59, 65). Dark spot disease in the Caribbean and the Pacific is closely associated with a fungus (62). The evidence that growth anomalies (tumors) in corals are actual cancer is mixed at best (60) but their distribution does have a nexus with human populations (81). We have started to characterize basic physiological processes in corals such as wound repair (76). We have identified several potential pathogens (helminths, fungi, algae) associated with white syndrome (a tissue-loss disease that has caused massive declines of corals in the Caribbean) in the Pacific (80). An invasive anemone associated with a shipwreck is wiping out the reefs on Palmyra Atoll NWR (61).

Role: I took a leading role to conceptualize and apply the tools currently used to investigate disease in wildlife to coral reefs. This has included developing novel techniques and standardized approaches and protocols. I also carried out field sampling, data analyses, synthesis, and write ups for peer-reviewed literature.

Impact: The initial documentation of an invasive anemone and its spread in 2011 at Palmyra resulted in the USFWS appropriating \$6 million to remove the shipwreck from the reef thereby providing a clear demonstration of the applicability of my work. The coral disease investigation methods we have developed have been successfully employed to carry out disease surveys in corals from American Samoa, Palmyra, and Hawaii. The use of systematic biomedical approaches to coral disease is changing the field in that researchers are beginning to recognize that progress in our understanding of coral disease can only be made using a balanced approach that looks at the host, the agent, and the environment. This is evidenced by changes in nomenclature that are now

being adopted by the coral research community and are appearing in peer-reviewed literature.

Sea turtle health

Background: See sea turtle health above.

Results: One of the major threats to green turtles in Hawaii is fibropapillomatosis, a tumor disease that is the most significant cause of stranding in the archipelago (44, 58) but that, uniquely in the world, appears to be declining in Hawaii (67). Tools developed to assess immune response in sea turtles ((25, 30, 35, 69) and used to compare immune status of healthy and diseased animals showed that there is no evidence that immunosuppression predisposes turtles to tumors (38, 41). There is compelling evidence at the molecular level that herpesviruses are associated with tumors and that these viruses vary geographically (24, 37, 46). Leeches could be a potential vector of herpesvirus in green turtles (43). It is unlikely that pelagic phase green turtles have FP, but it is likely that they acquire parasites after recruitment to neritic foraging pastures (51). Turtles caught as bycatch in the North Pacific longline fishery die from a combination of wet and dry drowning, and females are disproportionately affected (39,77).

Role: I have taken the lead in or been a significant collaborator in the aforementioned studies including procuring samples, carrying out laboratory analyses, analyzing data, and writing up results and am a leading authority on sea turtle health. Because of my expertise in this arena, I have been invited to present workshops on sea turtle health in several countries (Taiwan, Mexico, Papua New Guinea, Costa Rica, Guatemala).

Impact: The development of molecular tests to document herpesviruses and their potential role in tumor formation in green turtles was a game changer that allowed exploration of questions regarding transmission and viral ecology of the disease. The development of tools to assess immune status of green turtles permitted addressing important ecological questions regarding the role of immunosuppression in tumor diseases of wildlife. That mostly female turtles are killed as bycatch in the longline fishing industry has important demographic implications for longer term health of sea turtle populations.

Endangered birds

Background: Hawaii and the Pacific islands have the highest per-capita number of endangered birds in the world, so mitigating losses is critical.

Results: The parasite *Toxoplasma gondii* was likely responsible for failure of repatriation of endangered Hawaiian crows into their native range (36). The worm *Echinuria uncinata* was partly responsible for halving the population of critically endangered Laysan ducks on Laysan Island (their

only habitat) (45). Ducks were successfully reintroduced to Midway (56, 70), but their populations there plummeted after botulism outbreaks (78). We developed methods to safely translocate endangered Palila that were used successfully reintroduce endangered birds to their native range (32). Finally, we established baseline hematology values for various seabird species in the Pacific (16, 18, 29) that were used to assess health (18, 23) and help the USFWS to prioritize areas for remediation of lead contamination on Midway Atoll NWR (19).

Role: I took a leading role in most of the studies above, conceptualizing, generating, interpreting and reporting findings to agencies. I routinely advise federal, state, and territorial agencies on ways to reduce impacts of disease and other causes of death on threatened and endangered species.

Impact: We showed that crows can be released into their native habitat providing that feral cats (the definitive host of *T. gondii*) can be eliminated. Laysan duck studies prompted the USFWS to initiate translocation to Midway without translocating *Echinuria*, and our botulism finding has changed management of Midway NWR to focus more on endangered waterfowl. Avian translocation methods we developed are routinely used throughout Hawaii. Lead poisoning studies in albatross on Midway guided remediation efforts during transfer from the US Navy to the USFWS.

13. SCIENTIFIC LEADERSHIP

FUNDING I routinely seek extramural funding to support science at the HFS including developing ideas for and writing grants to various agencies. I have brought in as PI or Co-PI ca. \$200,000 in NOAA funding for sea turtle work, ca. \$60,000 from the State of Hawaii and ca. \$100,000 from USFWS for coral work in the form of competitive grants (Science support program) or interagency agreements. I am currently aco-PI in a recently submitted NSF grant looking at climate change and health of coralline algae.

COLLABORATION I collaborate with Federal, state, municipal, or territorial governments as well as various academic institutions and NGOs in the US or overseas. In these collaborations, I am looked upon as a lead for health aspects of the project (laboratory diagnostics, formulation of diagnostic approaches or investigative paths). This is evidenced from >80 institutions from various countries (France, Italy, Brazil, Switzerland, Senegal, New Caledonia, Australia, Costa Rica, Taiwan, Palau, Papua New Guinea, Guatemala, Mexico, American Samoa, Tahiti) to which I have provided scientific information or with whom I have had co-authorships.

SCIENCE CENTER I have participated in several interview panels for hiring of NWHC scientists, and Center Leadership has solicited my input

on various aspects of science management such as database design, diagnostic work flow, and setting priorities for science projects. The HFS is often held as an example for innovative and creative ways to carry out high-impact science with a high return on research dollars invested.

MENTORSHIP Since the inception of the HFS, I have mentored 45 students in veterinary schools or graduate programs from 8 countries. The demand for internships at HFS far outstrips supply of available postings.

PROGRAM LEADERSHIP The HFS has a global reputation of advancing knowledge of wildlife health in tropical marine and terrestrial ecosystems. I am regularly sought out to provide expertise on determining cause of death for threatened and endangered species for various management agencies in both the US and internationally. Reports generated from our diagnostic service are regularly used to inform management of endangered wildlife. My fluency in French and Spanish has led to invitations to present numerous international workshops on coral and sea turtle health (see outreach below) in Latin America. The HFS' reputation exemplifies the mission of the USGS which is to "...serve the nation by providing reliable scientific information..." and its breadth of expertise overlaps at least two missions of the agency (Ecosystems and Environmental Health).

SCHOLARSHIP The HFS is a center of excellence on diseases of tropical marine and terrestrial ecosystem, and the scientist is sought to speak at professional meetings to share information internationally (see scientific presentations). I served in leadership capacity in multiple capacities for the Wildlife Disease Association, the premier international scientific society dedicated to study of wildlife health, including Assistant Editor of the Journal of Wildlife Diseases, chairing various committees, election to Council, Vice President, and most recently, President. I was appointed co-chair of the International Union for the Conservation of Nature Marine Turtle Specialist Group-Oceania Region.

14. SCIENTIFIC AND PUBLIC SERVICE

a. CURRENT MEMBERSHIPS IN PROFESSIONAL SOCIETIES:

International Union for the Conservation of Nature (IUCN) Wildlife Health Specialist Group (2005-present)

IUCN-Marine Turtle Specialist Group (2009-Present)

Co-Chair IUCN-MTSG-Oceania Region (2013-Present)

Wildlife Disease Association:1989-Present

Chair of Student Awards Committee since 2000-2005

Member Student Awards Committee: 2000-2007
Member Nominations Committee: 2006-2008
Member of Council: 2008-2010
Vice President: 2011-2013
President: 2014-2015
Sigma Xi: 2002-Present

b. TECHNICAL PRESENTATIONS

1. **Work, T.M.** "Why are they dying?....The Honolulu Field Station and its role in determining causes of wildlife mortality in Hawaii and the Pacific". Hawaii Environmental Education Association, July 1994, Hilo, Hawaii (INVITED).
2. **Work, T.M.** and M. Smith. Diagnostic findings on Laysan albatross on Midway with specific reference to lead. Joint Conference, American Association of Zoo Veterinarians/Wildlife Disease Association/American Association of Wildlife Veterinarians, East Lansing, Michigan, 1995. (PRESENTED).
3. **Work, T.M.** and J. Hale. Causes of mortality in owls in Hawaii. Joint Conference, American Association of Zoo Veterinarians/Wildlife Disease Association/American Association of Wildlife Veterinarians, East Lansing, Michigan, 1995. (PRESENTED).
4. **Work, T.M.**, J. G. Massey, L. Johnson and P. C. Banko. Effects of translocation treatments on survival and health of native and non-native passerines. 67th Annual Meeting of the Cooper Ornithological Society, Hilo, Hawaii, 1997. (PRESENTED).
5. **Work, T.M.** and R. A. Rameyer. Monitoring health of tropical pelagic seabirds in Hawaii. 67th Annual Meeting of the Cooper Ornithological Society, Hilo, Hawaii, 1997. (PRESENTED).
6. **Work, T.M.** and G. H. Balazs. Causes of sea turtle mortality in Hawaii. 17th Annual Symposium on Sea Turtle Conservation and Biology, Orlando, Florida, 1997. (PRESENTED).
7. **Work, T.M.** and R. A. Rameyer. Monitoring health of tropical pelagic seabird populations in Hawaii. 25th Annual Pacific Seabird Group Meeting, Monterey, California, 1998. (PRESENTED).
8. **Work, T.M.**, R. E. Raskin, G. H. Balazs and S. Whittaker. 1998. Morphologic and cytochemical characteristics of green turtle (*Chelonia mydas*) blood cells. 18th International Sea Turtle Symposium, Mazatlan, Mexico, 1998. (PRESENTED).

9. **Work, T.M.**, G. H. Balazs, J. Caset, S. Quackenbush, J. Rovnak, R. Casey, P. Bowser, D. Docherty, M. Moore, R. Raskin, and S. Whittaker. Fibropapillomatosis of green turtles in Hawaii...what's new? 47th Annual Wildlife Disease Association Conference, Madison, Wisconsin, August 1998. (PRESENTED).
10. **Work, T.M.** and R. A. Rameyer. Monitoring health of tropical pelagic seabird populations in Hawaii. 47th Annual Wildlife Disease Association Conference, Madison, Wisconsin, August 1998. (PRESENTED).
11. **Work, T.M.** (Chairman). Symposium on monitoring marine ecosystem health. Joint Conference American Association of Zoo Veterinarians/American Association of Wildlife Veterinarians, Omaha, Nebraska, October 1998. (INVITED).
12. **Work, T.M.**, J. Gregory Massey, B. A. Rideout, C. H. Gardiner, D. B. Ledig, O. C. H. Kwok, and J. P. Dubey. Fatal toxoplasmosis in free-ranging endangered `Alala from Hawaii, the travails of endangered species re-introduction. 48th Annual Wildlife Disease Association Conference, Athens, Georgia, August 1999. (PRESENTED).
13. **Work, T.M.**, R. A. Rameyer, G. H. Balazs, C. Cray, and S. P. Chang. Immunology of green turtle fibropapillomatosis in Hawaii. 48th Annual Wildlife Disease Association Conference, Athens, Georgia, August 1999. (PRESENTED).
14. **Work, T.M.**, R. A. Rameyer, G. H. Balazs, C. Cray, and S. P. Chang. Immunology of green turtle fibropapillomatosis in Hawaii. 20th Annual International Symposium on Sea Turtle Biology and Conservation, Orlando,, Florida, March 2000. (PRESENTED).
15. **Work, T.M.** and R. A. Rameyer. Why monitor seabird health. 2nd International Conference on the Biology and Conservation of Albatrosses and Other Petrels. Honolulu, Hawaii, May 2000. (PRESENTED).
16. **Work, T.M.** Marine turtle fibropapillomatosis. 131st Annual Meeting of the American Fisheries Society, Phoenix, Arizona, August 2001. (INVITED).
17. **Work, T.M.** and R. A. Rameyer. Assessing health of coral reefs in the Pacific. 50th annual meeting of the Wildlife Disease Association, Pilanesberg, South Africa, July 2001. (PRESENTED).

18. **Work, T.M.** Principles of mortality investigation in wildlife (presentation 1). Annual Meeting of Wider Caribbean Sea Turtle Conservation Network, Miami, Florida, April 2002. (INVITED).
19. **Work, T.M.** Performing a sea turtle necropsy. Annual Meeting of Wider Caribbean Sea Turtle Conservation Network, Miami, Florida, April 2002. (INVITED).
20. **Work, T.M.,** G. Balazs, M. Wolcott and R. Morris. Bacteremia in free-ranging Hawaiian green turtles with fibropapillomatosis. 22nd Annual Sea Turtle Symposium, Miami, Florida, April 2002. (PRESENTED).
21. **Work, T.M.,** G. Balazs, M. Wolcott and R. Morris. Bacteremia in free-ranging Hawaiian green turtles with fibropapillomatosis. 51st Annual Meeting of Wildlife Disease Association, Humboldt, California, August 2002. (PRESENTED).
22. **Work, T.M.** Evaluating coral health in the Pacific. 28th Eastern Fish Health Workshop, Gettysburg, Maryland, April 2003 (INVITED).
23. **Work, T.M.** Marine turtle fibropapillomatosis in Hawaii. 34th Annual International Association of Aquatic Animal Medicine Conference and Workshop, Kona, Hawaii, May 2003. (INVITED).
24. **Work, T.M.,** R.A Rameyer, G. Takata and M.L. Kent. Pathology of native and introduced reef fish in Hawaii. 52nd Annual Wildlife Disease Association Conference, August 2003. (PRESENTED).
25. **Work, T.M.** Role of disease in coral reef ecosystems. Coral Reef Assessment in Mitigation Endeavors. Workshop August 2003 (PRESENTED).
26. **Work, T.M.** Marine turtle fibropapillomatosis. Aquatic Animal Models of Human Diseases Conference, Manassas Virginia, September 2003. (INVITED).
27. **Work, T.M.** Importance of wildlife diseases; Methods used to investigate diseases of wildlife; Diseases of marine turtles; Practical on doing necropsies of sea turtles. Presentations (in Spanish) at workshop at Polytechnic Institute of Cancun and Interactive Aquarium at Cancun, Mexico. Dec 5-6 2003 (INVITED).
28. **Work, T.M.** Importance of wildlife diseases; Methods used to investigate diseases of wildlife; Diseases of marine turtles; Diseases of Aquatic waterfowl; How to necropsy sea turtles. Lectures (in Spanish)

given in wildlife management course at University of Quintana Roo, Mexico, Dec. 8-9 2003 (INVITED).

-----Presentations since last promotion (5/4/2004)-----

29. **Work, T.M.** Workshop on marine turtle longline post-hooking mortality sponsored by NOAA-NMFS-Office Protected Resources, Jan 15-16 2004 (INVITED).
30. **Work, T.M.** Methods of investigating coral diseases-Samoa as an example. CDHC Coral Disease and Health Consortium Workshop on Coral Diseases, Madison Wisconsin, 23-28 April 2004 (INVITED).
31. **Work, T.M.** Evaluating health in coral reefs. 53rd Annual Joint Conference AAWV-WDA-AAZV., San Diego, California 29 Aug-3 Sept 2004 (PRESENTED).
32. **Work, T.M.** So you want to be a wildlife veterinarian? 53rd Annual Joint Conference AAWV-WDA-AAZV. San Diego, California 29 Aug-3 Sept 2004 (INVITED).
33. **Work, T.M.** Retrospective pathology survey of green turtles (*Chelonia mydas*) with fibropapillomatosis in the Hawaiian islands, 1993-2003. 25th Annual Sea Turtle Symposium, Athens, GA, Jan 16-21 2005 (PRESENTED).
34. **Work, T.M.** Surveillance for WNV in Hawaii. Conference on West Nile Virus in North America (five years later lessons to be learned) , Ontario, Canada, 20-22 April 2005 (INVITED).
35. **Work, T.M.** Coral Reef Programs (National and International), Annual convention of the American Veterinary Medical Association, Minneapolis, MN, 18 July 2005 (INVITED).
36. **Work, T.M.** Diseases in coral reefs, Annual convention of the American Veterinary Medical Association, Minneapolis, MN, 18 July 2005 (INVITED).
37. **Work, T.M.** Diseases of Corals. Annual convention of the American Veterinary Medical Association, Minneapolis, MN, 18 July 2005 (INVITED).
38. **Work, T.M.** Sea turtle necropsy, diseases and anatomy. Bermuda Aquarium, Bermuda 5 August 2005 (INVITED).

39. **Work, T.M.** Sea turtle stranding and necropsy workshop. NOAA-NMFS, Long Beach, California. 11-12 August 2005 (INVITED).
40. **Work, T.M.** Current knowledge of coral disease in US Territories/freely associated states. Coral Health & Disease in the Pacific Vision for Action. Honolulu Hawaii, June 19, 2006. (INVITED).
41. **Work, T.M.** Parasites in paradise, Impacts of parasitic diseases on Hawaiian fauna. 143rd AVMA annual convention and American Association of Veterinary Parasitologists. Honolulu, Hawaii. July 18, 2006 (INVITED).
42. **Work, T.M.**, G.S. Aeby, S.L. Coles. Growth anomalies in acroporid corals from the Indo-Pacific. February 2006. Ocean Sciences Meeting (AGU), Honolulu, Hawaii (PRESENTED).
43. **Work, T.M.**. Disease in tropical marine ecosystems. Russian-American Conference on Wildlife Diseases, Moscow, Russia. 12-15 March 2007 (INVITED).
44. **Work, T.M.**. Overview of disease concepts. Marine Conservation and Health NSF Integrative Training in Ecology, Honolulu, Hawaii, 8 March 2007 (INVITED).
45. **Work, T.M.**. Diseases in tropical marine ecosystems. C. L. Davis Foundation Veterinary Pathology Seminars, Madison, Wisconsin, 4-6 April, 2007 (INVITED).
46. **Work, T.M.** Sea turtle and coral disease. 89th annual meeting AAAS Pacific Division, Kamuela, Hawaii, 19 June 2008 (INVITED).
47. **Work, T.M.** Partnerships between management and research help increase our understanding of coral diseases in marine ecosystems. 2008 Hawaii Conservation Conference Honolulu, Hawaii., 30 July 2008 (PRESENTED).
48. **Work, T.M.** Diseases in marine ecosystems in Hawaii, USGS Microbiology Meeting, Estes Park, Colorado, 15 October 2008 (PRESENTED).
49. **Work, T.M.** and G. S. Aeby. Overview of coral disease research in Hawaii and Pacific, Pan-Pacific coral health and disease workshop, Kailua-Kona, Hawaii, 6 February, 2009 (INVITED).

50. **Work, T.M.** Causes of bat mortality in Pacific and guidelines on submitting specimens to HFS, Opeapea workshop, Honolulu, Hawaii, 12 May, 2009 (PRESENTED).
51. **Work, T.M.** The role of biomedical and veterinary science in elucidation of disease in marine ecosystems, Hawaii Conservation Conference, Honolulu, Hawaii, 2009 (INVITED).
52. **Work, T.M.**, J. Klavitter, M. Reynolds, and D. Blehert. Avian botulism and proventricular nematodes: a case study in translocated endangered Laysan ducks (*Anas laysanensis*) on Midway Atoll. 58th Annual International Conference of the Wildlife Disease Association, Semiahmoo, Washington, 8 August, 2009 (PRESENTED).
53. **Work, T.M.** G. S. Aeby, and J. E. Maragos. Phase shift from coral to corallimorph dominated reef associated with a shipwreck at Palmyra Atoll NWR. 58th Annual International Conference of the Wildlife Disease Association Semiahmoo, Washington, 8 August, 2009 (PRESENTED).
54. **Work, T.M.** Partnerships between management and research help increase our understanding of coral diseases in marine ecosystems, 16th Annual Conference of the Wildlife Society Monterey, California, 28 September 2009 (INVITED).
55. **Work, T.M.** Identification and study of coral disease, 29th Symposium of American Association of Underwater Science, Honolulu, Hawaii, 24 March 2010 (INVITED).
56. **Work, T.M.** Coral disease and the scientific diver. 29th Symposium of American Association of Underwater Science, Honolulu, Hawaii, 24 March 2010 (INVITED).
57. **Work, T.M.**, G.H. Balazs. Health of sea turtles in the Pacific. 18th Annual Conference of the Wildlife Society, Kona, Hawaii, November 2011 (PRESENTED).
58. **Work, T.M.**, G. S. Aeby. Coral reef in the Pacific. 18th Annual Conference of the Wildlife Society, Kona, Hawaii, November 2011 (PRESENTED).
59. **Work, T.M.** Enfermedades de fauna silvestre en ecosistemas terrestres y marinos, Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Mexico, December 2011 (INVITED).

60. **Work, T.M.**, Disease investigations in corals, 44th Annual conference International Association of Aquatic Animal Medicine, Sausalito, California, April 2013 (INVITED).
61. **Work, T.M.**, Sick corals need good medicines, 44th Annual conference International Association of Aquatic Animal Medicine, Sausalito, California, April 2013 (INVITED).
62. **Work, T.M.**, Coral disease-Where the heck are the wildlife health experts? 62nd International Conference of the Wildlife Disease Association, Quebec, Canada, July 2013 (PRESENTED).
63. **Work, T.M.**, Enfermedades de fauna silvestre, oportunidades. Primera Conferencia de La Seccion LatinoAmericana de Wildlife Disease Association, Sao Paulo, Brazil, September 2013 (INVITED-KEYNOTE)
64. **Work, T.M.**, Bacteria are important to coral health (but not the way everybody thought), 63rd International Conference of the Wildlife Disease Association, Santa Fe, New Mexico, August 2014 (PRESENTED).
65. **Work, T.M.**, Investigating disease outbreaks in coral reef ecosystems. Challenges and opportunities, 7th International Symposium on Aquatic Animal Health, Portland, Oregon, September 2014 (INVITED-PLENARY).
66. **Work, T.M.** Diagnostic medicine helps promote ecosystem health in the tropical Pacific, World Association of Veterinary Laboratory Diagnosticians, Saskatoon, Canada, June 2015 (INVITED-PLENARY).

c. RENDERING SCIENTIFIC JUDGMENT

Peer reviewer for 56 articles from 18 journals including (n) Journal of Wildlife Diseases (28), Condor (5), Archives of Environmental Contamination and Toxicology (2), Canadian Journal of Zoology (2), Comparative Biochemistry and Physiology (2), Diseases of Aquatic Organisms (2), Elepaio (2), Journal of Field Ornithology (2), Marine Ecology Progress Series (2), American Journal of Veterinary Research (1), Biological Conservation (1), Caribbean Journal of Science (1), Copeia (1), Environmental Science & Technology (1), Harmful Algae (1), Journal of Zoo and Wildlife Medicine (1), Marine Mammal Science (1), Tissue & Cell (1). Also two book chapters

Reviewer for 2 proposals for UC Davis Oiled Wildlife Care Network, 1 proposal for NOAA, 1 proposal for ECOHAB, and 1 USGS study plan.

Expert consultant in NMFS-sponsored workshop on hooking mortality in sea turtles, Honolulu, Hawaii (June 1995)

Expert consultant to assist Florida Marine Research Institute on investigation of manatee die-off (April 1996)

Expert consultant on sea turtle fibropapillomatosis workshop in Honolulu, Hawaii (October 1999)

Expert consultant on sea turtle health assessment workshop in Charleston, South Carolina (September 2000)

Expert consultant for review of avian disease program for Galapagos Island at Princeton University (October 2000)

Reviewer of grant (Molecular and Functional Biology of Sea Turtle Hematological Systems) for National Science Foundation (April 2002).

Expert consultant for review of procedures for NOAA Coral Health and Disease Consortium in Oxford, Maryland (October 2002).

Reviewer of Grant "Disease ecology in Caribbean coral: anthropogenic environmental change and opportunistic pathogens." American Association for the Advancement of Science (June 2003).

-----Rendering scientific judgment since last promotion (5/4/2004)---

Peer reviewer for 108 articles from 44 journals including (n) Journal of Wildlife Diseases (15), Coral Reefs (12), Diseases of Aquatic Organisms (12), Marine Ecology Progress Series (8), PLOSOne (6), Ecohealth (4), Journal of Parasitology (4), Journal of Zoo & Wildlife Medicine (4), Harmful Algae (3), Journal of Zoo and Aquarium Research (3), Marine Biology (3), Journal of Invertebrate Pathology (2), African Journal of Microbiology Research (1), Aquatic Conservation (1), Auk (1), Bulletin of Marine Science (1), Chelonian Conservation Biology (1), Chemosphere (1), Comparative Biochemistry and Physiology (1), Condor (1), Conservation Biology (1), Conservation Physiology (1), Deep Sea Research (1), Endangered Species Research (1), Florida Sea Turtle Grant Program (1), ILAR Journal (1), Journal of Comparative Pathology (1), Journal of Experimental Marine Biology and Ecology (1), Journal of General Virology (1), Journal of Microscopy (1), Journal of the Royal Society of New Zealand (1), Journal of Veterinary Medicine and Animal Health (1), Limnology and Oceanography (1), Marine Mammal Science (1), Microbial Ecology (1), National Environmental Research Council (1), Pacific Science (1), PeerJ (1), Veterinarni Medicina (1), Veterinary Journal (1), Veterinary

Microbiology (1), Veterinary Pathology (1), Virus Research (1), Marine Biodiversity (1), and one book chapter.

Assistant Editor, Journal of Wildlife Diseases, 131 articles reviewed (separate from those listed above).

NOAA Center for Sponsored Coastal Programs: SFP2006 Coral Reef Evaluation and Monitoring Project (CREMP) proposal (11/23/2005).

Microbiological and histopathological investigations of corals exhibiting signs consistent with white plague type II from geographically separated sanctuary reefs. NOAA Coral Reef Conservation Grant Program/General Coral Reef Conservation Grants CFDA Number: 11.463-Habitat Conservation (Nov. 2006).

Eighth National Conference on Science Policy and Environment, Washington DC, 17 January 2008 (INVITED PANELIST).

USGS RGE Review Panel, Sacramento, California 12 February 2009, (INVITED PANELIST).

NOAA sponsored workshop on contaminants and sea turtles, Washington DC, 4-6 May, 2010 (INVITED EXPERT).

NOAA sponsored workshop on effects of the Deepwater Horizon Oil spill on sea turtles, New Orleans, LA, 29 June -2 July, 2010 (INVITED EXPERT).

NOAA sponsored workshop on evaluating methods to monitor health of the endangered Caribbean coral *Acropora palmata*, Grand Cayman, Cayman Islands, 14-19 April, 2011 (INVITED EXPERT).

Member of Morris Animal Foundation Wildlife Research Proposals Review Panel, Boulder, Colorado, March 2013 (16 proposals reviewed).

Foreign Animal Disease joint USDA/USFWS/USGS workshop, National Conservation Training Center, Shepherdstown, West Virginia, August 2013 (INVITED EXPERT).

Member of Morris Animal Foundation Wildlife Research Proposals Review Panel, San Antonio, Texas, March 2014 (17 proposals reviewed)..

NOAA Workshop to evaluate mortality of endangered Kemp's Ridley turtles subsequent to the Deepwater Horizon oil spill, St. Petersburg, Florida, July 2014 (INVITED EXPERT).

USFWS-Sponsored workshop on avian botulism in Hanalei National Wildlife Refuge, December 2014 (INVITED EXPERT).

Joint USFWS/Defense Advanced Research Projects Agency vector control workshop, Honolulu, Hawaii, Feb 2015 (INVITED EXPERT)..

Member of Morris Animal Foundation Wildlife Research Proposals Review Panel, Kansas City, Missouri, March 2015 (17 proposals reviewed).

Long Now Foundation Genomic solutions for conservation problems, Sausalito, California, April 2015 (INVITED EXPERT).

Washington Sea Grant, grant review on sea star wasting disease, July 2015.

d. LECTURESHIPS AND OTHER ACADEMIC SERVICE

Guest lecturer- AHABS 548-Diseases of Wildlife. October 23, 1998. University of Wisconsin. Diseases of marine turtles.

Guest lecturer-Ecology of coral reefs. April 12, 2002; 2003. University of Hawaii. Diseases of coral reef organisms.

Guest Lecturer-Diseases of corals in the Pacific and histologic examination of corals . University of Hawaii, Pauley Summer Program, Coconut Island, June 13 2003.

Master's Committee: Amy Sloan: Assessing hematology of rehabilitated Hawaiian monk seals, University of Hawaii (1999-2000).

Master's Committee: Vanessa Pepi: Effects of fibropapillomatosis on nesting success of Hawaiian green turtles, University of Hawaii (2001-2003).

Investigating diseases of marine organisms. UH lecture course Biology 397 Biology of marine reptiles (November 2005, March 2006, November 2006)

Diseases in tropical marine ecosystems, lecture course, UH Coral Reef Biology (11 April 2002; 15 April 2003)

Invasive organisms in the Pacific Islands, Invited seminar to University of Hawaii Department of Zoology (29 April, 2010).

Proctor, PhD thesis defense, Gareth Williams, Victoria University, New Zealand.

Affiliate faculty Cornell University Department of Microbiology (2004-Present)

Affiliate faculty, University of Hawaii, Hawaii Institute of Marine Biology (2005-present)

Affiliate faculty, University of Hawaii, Marine Biology Graduate Group (2012-present)

Affiliate faculty, Wildlife Department, Texas A&M University (2014-present)

Masters Committee, Jenny Carolina Rodriguez, Centro de Investigacion Cientifica y de Educacion Superior de Ensenada 2011-2012.

Masters Committee, Shawn Murakawa, Department of Zoology, University of Hawaii, Manoa, 2012-2014.

Masters Committee, Katharine Cluckey, Department of Zoology, University of Hawaii, Manoa, 2014-Present.

PhD Committee, Elizabeth Fahsbender, College of Marine Science, University of South Florida, 2015-Present.

Work, T.M. Enfermedades de fauna silvestre en ecosistemas terrestres y marinos, Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, Mexico, December 2011 (INVITED SEMINAR)

Work, T.M. Enfermedades de fauna silvestre en ecosistemas terrestres y marinos, Facultad Agronomia de San Lis Potosi, Mexico, February 2012, (INVITED SEMINAR)

Work, T.M., G.S. Aeby. Coral diseases outbreak Kauai, Hawaii Institute of Marine Biology, Honolulu, Hawaii, January 2012 (INVITED SEMINAR)

Work, T. M. Discussion of research papers, Marine Biology Graduate Group, University of Hawaii, Honolulu, Hawaii, April 2015 (FACULTY-STUDENT DISCUSSION)

Work, T.M., Grim Reaper's a calling. Diseases of marine wildlife in the tropical Pacific, University of Southern Florida, St. Petersburg, Florida, May 2015 (INVITED SEMINAR)

Hosted students from Centro de Investigacion y Ciencias de Ensenada-Mexico (1), Hokkaido University-Japan (1), National Taiwan Ocean University-Taiwan (3), University of Hawaii (2), Universidad de Londrina-

Brazil (1), Universite de Toulouse-France (1), Universidad de Sao Paulo-Brazil (1), University of Illinois (2), University of Pennsylvania (2), National Taiwan Ocean University-Taiwan (1), North Carolina State University (1), University of Alaska (3), University of Hawaii (1), University of Pennsylvania (5), Western University (1), Colorado State University (2), Cornell University (1), Tufts University, University of California Davis (5), Universidad Autonoma de Mexico-Mexico (1), Universidad de Gran Canaria_Spain (1), University of Hawaii (5), University of Pennsylvania (1), University of Wisconsin (4).

Hosted visiting faculty from Wildlife Conservation Society (1) and University of Zurich-Switzerland (1).

e. TECHNICAL TRAINING PROVIDED

Diseases of wildlife in Hawaii. Course given to biologists of Hawaii Department of Land and Natural Resources, U.S. Fish and Wildlife Service, National Park Service, National Marine Fisheries Service, Kauai, Hawaii, Maui, Oahu (August 1995).

Capture methods for free-ranging wildlife. Course given to Hawaii DLNR biologists, Maui (August 1998).

Diseases of marine mammals, capture methods for free-ranging wildlife. Course given to veterinarians and biologists (slides in Russian), Moscow, Russia (November 1999).

Lecture series: Marine mammal diseases, diseases of sea turtles, diseases of seabirds, use of GIS in wildlife biology, capture methods in free-ranging wildlife. Courses given to Wildlife Institute of India, Dehra Dun, India (December 2000).

Importance of wildlife diseases; How we investigate wildlife diseases; Details of tools used to investigate wildlife diseases and their limitations; Examples with marine turtles in Hawaii; Methods to do sea turtle necropsies. Course (in Spanish) given to biologists from Mexico and Costa Rica, Mexico City, (October 2001) and (in English) to biologists from Papua New Guinea and Solomon Islands, Port Moresby PNG, (November 2001).

Tools used to investigate wildlife diseases: Diseases of seabirds: Diseases of waterfowl. Course (in Spanish) given to biologists and veterinarians from Ecuador at the Charles Darwin Research Station, Galapagos Islands, Ecuador (July 2002).

How to do a sea turtle necropsy: Tools used to investigate diseases of wildlife: Overview of wildlife diseases. Lectures (in Spanish) given to biologists, veterinary students, veterinarians, and administrators of the Ministry of Environment and Natural Resources, Caracas, Venezuela (October 2002).

-----**Technical training since last promotion (5/4/2004)**-----

Hawaii Institute of Marine Biology Pauley Workshop 5 April 2004. Coral Health in American Samoa.

Hawaii Pacific University demonstration on turtle necropsies, Honolulu, Hawaii 23 Nov 2003; Aug 2004 (PRESENTED)

Workshop on coral disease investigations, NOAA Hollings Marine Laboratory, Coral Disease & Health Consortium, Charleston, SC. 2/14/-2/17/2005

Western Pacific Sea Turtle Cooperative Research & Management Workshop (WESPAC) Exploring the aetiology of fibropapillomatosis using Bayesian Belief Networks, Honolulu, HI (2/28-3/1/2005)

CDHC workshop. Coral histopathology II. Medical University of South Carolina, Charleston, SC. 12-14 July 2005

Principals of Wildlife Disease Investigations; Demonstration on how to necropsy sea turtles. International Workshop for Sea Turtle Stranding and Necropsy in Taiwan April 30 to 5 May 2006 (Penghu, Taiwan)

Avian Influenza Surveillance in Hawaii and the Pacific. Pacific Emergency Management Preparedness and Response Information Network and Training Services, Honolulu, HI. 4 August 2006.

Avian Influenza Surveillance in Hawaii and the Pacific. Workshop given to US Fish & Wildlife Service, Honolulu, HI. 25 July 2006.

Avian Influenza Surveillance in Hawaii and the Pacific. Workshop given to USDA, US Army, US Fish & Wildlife Service, Honolulu, HI. 6 September 2006.

Avian Influenza Surveillance in Hawaii and the Pacific. Workshop given to American Samoa Department Marine Wildlife Resources, Pago Pago, American Samoa 14 August 2006.

Avian Influenza Surveillance in Hawaii and the Pacific. Workshop given to Bureau of Public Safety, Bureau of Public Health, Palau Conservation Society, Koror, Palau 18 October 2006

Avian Influenza Surveillance in Hawaii and the Pacific. Workshop given to National Park Service, Hilo, HI. 6 October 2006.

Zoonotic Diseases in Hawaii. Workshop given to National Park Service, Haleakala National Park, HI, 23 October 2006.

Updates on avian influenza in American Samoa and Pacific Islands,. Workshop given to American Samoa Department of Marine and Wildlife, Pago Pago, American Samoa, 27-30 October 2008.

Updates on avian influenza in American Samoa and Pacific Islands,. Workshop given to Palau Conservation Society, Koror, Palau, 15-21 November, 2008

Workshop on coral reef ecosystem health, Xcaret Park, Yucatan, Mexico. 15 May 2009. The following lectures were given in Spanish: Examples of disease in marine organisms; Introduction to coral disease globally; describing lesions in corals; methods used to investigate coral disease; monitoring impact of disease in corals

Climate change and marine disease Local Action Strategy Workshop- Rapid response team training for state of Hawaii Department of Aquatic Resources, Kaneohe, Hawaii, 2 June, 2009.

Sea turtle necropsy demonstration for Hawaii Pacific University, Honolulu, Hawaii, 1 December, 2009.

Sampling workshop for avian influenza surveillance, Palau Conservation Society, Koror, Palau, 10 December, 2009.

Avian botulism workshop, Kilauea Point National Wildlife Refuge, Kilauea, Hawaii, 24 February, 2010.

Quick course on wildlife health, Hawaii Pacific University, December 2011

Methods that we used to investigate wildlife diseases, America Samoa Department of Marine & Wildlife Resources, April 2012

Zoonotic diseases in American Samoa, America Samoa Department of Marine & Wildlife Resources, April 2012

La Importancia de Enfermedades de fauna silvestre en ecosistemas terrestres y marinos, Taller de Salud de Tortugas Marinas, Antigua, Guatemala, June 2014.

Métodos que utilizamos para investigar enfermedades de fauna silvestre. Taller de Salud de Tortugas Marinas, Antigua, Guatemala, June 2014.

Enfermedades de tortugas marianas. Taller de Salud de Tortugas Marinas, Antigua, Guatemala, June 2014.

Como hacer una necropsia de una tortuga marina. Taller de Salud de Tortugas Marinas, Antigua, Guatemala, June 2014.

Co-host of 1 week USGS/NOAA sponsored US-China workshop on sea turtle health attended by 16 scientists 11 of whom originated from mainland China, Hong Kong, and Taiwan with the remainder from US, Honolulu, Hawaii, August 2014.

Mini Workshop on Coral histopathology, University of Florida, Gainesville, December 2014.

Co-host of 4 day international NOAA/USGS workshop on population effects of marine turtle fibropapillomatosis attended by 10 scientists from Australia, Brazil, Congo, Puerto Rico, Hawaii, Wisconsin, and Florida, Honolulu, Hawaii, June 12-14, 2015.

Workshop on diseases of coral reefs and associated organisms (7 lectures on corals, fish, disease, shipping, inverts, turtles), American Samoa Department of Marine and Wildlife & National Park Service, Pago Pago, American Samoa, July 1-3 2015.

f. SPECIAL ASSIGNMENTS

None.

g. OTHER TECHNICAL ACTIVITIES

Diagnostic assistance:

Scientist filed necropsy reports for 6257 cases comprising 977 endangered, 1178 threatened, and 4102 unlisted animals composing 3561 birds, 698 fish, 693 invertebrates, 102 mammals, and 1203 reptiles/amphibians originating from 6 countries to the following organizations: Agriculture-Fisheries and Conservation, Bishop Museum, North Carolina Wildlife Resources Commission, US Army, Waste Management, Ducks Unlimited, Florida Department of Environmental

Protection, Hilton Hawaiian Village, Nene O Molokai, American Samoa Division of Marine and Wildlife Resources, Kona Veterinary Service, The Nature Conservancy, Cyanotech Corporation, Hawaii Department of Agriculture, Waikiki Aquarium, Point Reyes Bird Observatory, US Department of Agriculture, Guam Department of Agriculture, Hawaii Department of Health, Rana Biological, Kailua Animal Clinic, Honolulu Zoo, The Peregrine Fund, Aloha Animal Hospital, Maui Bird Conservation Center, Costa Rica National Parks, University of Hawaii, Kauai Humane Society, Private Individual, University of California Davis, US Marine Corps, National Park Service, Hawaii Department of Land and Natural Resources, Sea Life Park, Board of Water Supply City and County of Honolulu, US Geological Survey, National Oceanic and Atmospheric Administration, US Fish and Wildlife Service.

Led coral reef health surveys in Johnston Atoll, French Frigate Shoals, Hawaiian Islands, and American Samoa. Reef health assessment report for American Samoa was recently highlighted by Judge Manson at the latest US Coral Reef Task force as an example of ongoing DOI efforts on coral reef health.

Elucidated extent of lead poisoning in Laysan albatross on Midway Atoll. Data from this study provided critical guidance to USFWS for cleanup measures during base closure operations and transfer of the air station from the U.S. Navy to the USFWS.

Led multiple field investigations to assist USFWS and State of Hawaii on Kauai, Maui and Oahu to identify and mitigate endangered waterfowl mortalities due to avian botulism. In several instances, prompt assistance mitigated large mortalities of endangered waterfowl.

Determined the cause of a massive sea urchin mortality event on Johnston Atoll NWR, Central Pacific.

Technical Assistance:

Provided assistance to biologist at Oahu NWR on operation of GPS equipment, mapping of refuge resources, and incorporation of data into USFWS GIS database for use in refuge management. Maps generated from these activities have been used by the USFWS to formulate burn plans and to assess waterfowl habitat management.

Led efforts to establish laboratory capacity to implement wild birds surveillance for West Nile Virus in Hawaii. Provided guidance to USFWS and State of Hawaii Department of Health on measures to prevent ingress of West Nile Virus into Hawaii. Specifically, advising above agencies on measures for surveillance of birds and mosquitoes for virus activity and

providing assistance on modifying state import regulations for birds into Hawaii.

-----Other technical activities since last promotion (5/4/2004)-----

Scientist filed necropsy reports for 16,732 cases comprising 2930 endangered, 1532 threatened, and 12270 unlisted animals comprising 2065 birds, 2416 fish, 2965 invertebrates, 77 mammals, and 843 Reptile/Amphibian originating from 14 countries to the following organizations: Advanced Technology Solar Telescope, Alaska Department of Fish and Game, Aloha Animal Hospital, American Samoa Division of Marine and Wildlife Resources, Aquarium des Lagons, Association Caouanne, Australia Institute of Marine Science, Bishop Museum, Board of Water Supply City and County of Honolulu, Brigham Young University, Cascadia Research Collective, CNMI Department of Land and Natural Resources, CNMI Division of Fish & Wildlife, Coordinating Group on Alien Pest Species, Coral Reef Research Foundation, Direction de l'environnement, First Wind, Fundacion Zoologica de El Salvador, Guam Department of Agriculture, Guam Zoological Botanical Garden, Guatemala Rescue and Wildlife Conservation Association, Hawaii Department of Agriculture, Hawaii Department of Health, Hawaii Department of Land and Natural Resources, Hawaii Wildlife Center, Honolulu Zoo, Interstate School of Veterinary Science and Medicine of Dakar, Kauai Humane Society, Kindred Spirit Kindred Care, Lanai Native Species Recovery Program, Le Meridien Bora Bora, Makai Animal Clinic, Manta Pacific Research Foundation, Maui Ocean Center, National Oceanic and Atmospheric Administration, National Park Service, National Taiwan Ocean University, Nene O Molokai, Oahu Army Natural Resource Program, Oahu Invasive Species Committee, Pacific Rim Conservation, Palau Conservation Society, Private Individual, Rana Biological, Sea Life Park, The Hawaii Association for Marine Education and Research Inc., Three Ring Ranch, University of California Davis, University of California Santa Cruz, University of Guam, University of Hawaii, University of Rome, University of Washington, US Army, US Department of Agriculture, US Fish and Wildlife Service, US Geological Survey, US Marine Corps, US Navy, Waikiki Aquarium, Waimea Valley Audubon Center, Waimea Valley Hiipaka LLC.

Worked with Hotel Meridien and Government of Tahiti to investigate sea turtle mortalities at the hotel lagoons (Nov. 2004, April 2005)

Co-PI with Universidad Autonoma De Mexico on field investigations of fibropapillomatosis (October 2005, April, 2007) in sea turtles from Yucatan.

Spearheaded all veterinary care during and after the translocation of Laysan ducks from Laysan Island to Midway Atoll NWR. This included ensuring that ducks received safe doses of anthelmintics in attempts to reduce the probability of translocating *Echinuria* (a parasite that can cause significant mortality in ducks) to Midway, ensuring that ducks were properly and safely supplemented with foods and fluid during the 2-day ship transport from Laysan to Midway, calculating necessary nutritional requirements for ducks while they were held in release pens on Midway, and monitoring clinical status of ducks while in captivity. A total of 42 ducks were safely translocated from Laysan to Midway in 2004 and 2005. Since then, populations on Midway have increased to >300 individuals indicating a second viable population now well established.

Led efforts to help Kauai NWR determine the causes of failure of sham translocation of Laysan albatross (we determined birds were dying from disseminated bacterial infections) (October 2007)

Investigated prevalence of green turtle fibropapillomatosis in the Yucatan Peninsula (Mexico) (May 2008).

Co-led coral disease and microbiota surveys in a joint project between Hawaii Institute of Marine Biology, Australian Institute of Marine Science, and USGS. The scientist's role was to collect and analyze corals for disease using microscopy and collection of samples in the field (June 2008)

Led a field investigation of a botulism outbreak in endangered Laysan ducks on Midway Atoll NWR (August-September, 2008)

Led a joint University of Hawaii and USGS coral and fish disease surveys in Kauai, Molokai, and Maui (May 2009).

Co-led an international expedition between University of Hawaii, Institut de Recherche pour le Development, and USGS to conduct an island-wide coral disease survey in New Caledonia (January 2009).

Led clinical team for Hawaii Department of Fish and Wildlife to translocate endangered nene geese from Kauai to Maui (April, 2011).

Assist USFWS in health assessment of captive green turtles in Kwajalein (November 2011)

Led veterinary care efforts for Nihoa miller bird translocation, USFWS, (September 2011, 2012)

Assist Smithsonian Museum in turtle captures, Palmyra (July 2011)
Palmyra corallimorph survey (May-June 2011)

Led coral disease outbreak investigation, North Kauai (September-October 2012)

Co-PI for joint Woods Hole Oceanographic Institute, University of Hawaii, USGS survey of coral reefs in Micronesia survey (October-November 2012)

Co-PI for Joint Institut pour la Recherche et Development, University of Hawaii, USGS coral disease survey, New Caledonia (February 2013)

Led Sea urchin disease investigation, Oahu, Hawaii (March 2014)

Led Kaneohe Bay coral disease investigation, Oahu, Hawaii (March 2015)

15. OUTREACH AND INFORMATION TRANSFER

Co-taught annual workshop on sea turtle management techniques (necropsy, health investigation) with NMFS for sea turtle biologists from State and Federal agencies and foreign agencies including Ecuador, Peru, Chile, Indonesia, Malaysia, Hong Kong, Palau, Taiwan, and Solomon Islands (November 2000).

Necropsy manuals for sea turtle and seabirds in Spanish, English, Japanese, Italian available on the web as PDF file at following URL:
www.nwhc.usgs.gov/hfs/Products.htm.

Printed and distributed wildlife disease manual for diseases of wildlife in Hawaii for biologists.

Presented update on coral disease research for Marine Ecosystem GIS group, Honolulu, HI (September 2001)

Poster: Invasion of the Reef Snatchers put on by Hawaii Coral Reef Initiative 20 August Waikiki Aquarium. 2004

-----Outreach since last promotion (5/4/2004)-----

Work, T. Diseases in tropical marine ecosystems, Maui Ocean Center, 22 Feb 2005.

Work, T. Sea turtle fibropapillomatosis. Hanauma Bay Nature Preserve, Honolulu, HI 23 July 2005.

Mauna Lani Bay Resort Turtle Independence Day, Kona, Hawaii. Participated in joint NOAA-USGS booth providing children with opportunities to interact with sea turtles. July 4, 2007.

HFS web site has been updated to provide fact sheets to the public on the following topics: Avian botulism, avian pox, toxoplasmosis, avian malaria, lead poisoning, avian translocations, coral diseases, sea turtle diseases, fish diseases, and avian influenza in the pacific islands. The web site also has following downloadable PDFs: All peer-reviewed publications produced by HFS. URL: www.nwhc.usgs.gov/hfs/Products.htm.

Causes of mortality in wildlife from American Samoa, Pago Pago, American Samoa Community College, Pago Pago, American Samoa, 29 March to 1 April, 2010.

TM Work. The struggle to save the Laysan duck. The wildlife Professional. Spring, 2009.

TM Work. Wildlife health is "One Health" and more. One Health Newsletter, Spring 2010.

Development of underwater coral disease cards for Hawaii, American Samoa, and New Caledonia (French and English versions for latter). These are available on the web at: <http://www.nwhc.usgs.gov/hfs>.

Diseases in marine ecosystems (Presented at American Samoa National Park, Pago Pago, American Samoa, April 2012)

So what's killing wildlife in the Marianas? (Presented at Guam Department of Agriculture, Commonwealth of the Northern Marianas Department of Fish & Wildlife, Saipan and Rota October 2012)

Causes of bat mortality in Hawaii and the Pacific (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Avian Botulism (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Coral Disease (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May

2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Phase shift from coral to corallimorph-dominated reef associated with a shipwreck at Palmyra Atoll NWR. (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Methods used to investigate diseases of wildlife (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Fish disease in Hawaii (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Overview of avian influenza in the Pacific (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Monitoring seabird health (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Shipping samples to HFS (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Diseases of terrestrial birds (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Diseases of sea turtles (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

West Nile Virus and Hawaii (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui,

May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Zoonotic diseases in Hawaii (Presented at Maui Department of Land & Natural Resources, Haleakala National Park, USDA-Maui, Kahului, Maui, May 2011 and separate workshop for Kauai Department of Land & Natural Resources, Lihue, Kauai, May 2013)

Update on coral disease in Kauai (Presented at Hawaii Department of Land & Natural Resources, Oahu, Hawaii June 2013)

Sick Corals need good medicine (Presented at National Wildlife Health Center, Madison, WI, July 2013)

Terrestrial and marine ecosystem health in the pacific (Presented to US Congressionals, Oahu, Hawaii, July 2013)

Sea Urchin Mortality, Hawaii (Presented at Hawaii Department of Land & Natural Resources, Oahu, Hawaii, May 2014).

Something is awry with Kauai's marine ecosystems (Presented to Department of Defense, Oahu, Hawaii, February, 2014 and Maui Community College, Kahului, Maui, June 2014)

Hanalei Bay Coral Mortality (Presented to Kilauea Point National Wildlife Refuge, December 2014)

U.S. Geological Survey National Wildlife Health Center. Advancing Wildlife and Ecosystem Health through Science (Presentation to US Army Tripler Army Medical Center, Oahu, January 2015)

Update on coral disease in Kauai (Presentation to Hawaii Department of Land & Natural Resources, Oahu, March 2015)

Diseases in marine organisms in the Pacific (Presentation to USFWS, Department of State, Department of Defense, Oahu, March 2015)

Sea turtle necropsy manual in traditional and simplified Chinese available at <http://www.nwhc.usgs.gov/hfs/Products.jsp>

Seabird necropsy manual in English, French, Spanish available at <http://www.nwhc.usgs.gov/hfs/Products.jsp>

Collecting corals for histopathology, a practical guide in English and Spanish available at <http://www.nwhc.usgs.gov/hfs/Products.jsp>

Coral disease cards in French, English, and Samoan available at <http://www.nwhc.usgs.gov/hfs/CoralDiseaseCards.jsp>

Press interviews for various organizations including Hawaii Public Radio, National Geographic, Honolulu Advertiser, Los Angeles Times, Nature, Australian Broadcasting Corporation, 93 KHJ American Samoa, ABC news.

16. INVENTIONS AND PATENTS

None

17. HONORS, AWARDS, RECOGNITION, ELECTED MEMBERSHIP

U.S. Fish and Wildlife Service Endangered Species Recovery Champion for helping recover endangered Nihoa Millerbird (2012).

National Wildlife Health Center STAR award (2010).

U.S. Fish and Wildlife Service Recovery Leader Award for efforts leading to recovery of the endangered Laysan duck (2007).

U.S.G.S Sustained Superior Performance Award (2/2006; 11/2006; 12/2007).

USGS Time Off Award (2005).

National Biological Service STAR award (1996).

National Biological Survey Quality Performance Award (1994;1995).

U.S. Fish and Wildlife Service Special Achievement Award (1993).

Phi Kappa Phi (1983).

Phi Sigma (1983).

Distinguished Student (honor roll). Texas A&M University (1981-1983).

18. BIBLIOGRAPHY

a. PUBLISHED REPORTS

Summary: 114 Peer reviewed publications, Google Scholar citations: 3049; Google h-index: 29.

1) Beale AM, Higgins RJ, **Work TM**, Bailey CS, Smith MO, Shinka T, Hammock BD (1989) MPTP-induced parkinson-like disease in sheep: Clinical and pathologic findings. *Journal of Environmental Pathology and Toxicology* 9:417-428. Concept: 41%, Data: 74%, Interpretation: 55%, Paper: 80%.

2) Hammock BD, Beale AM, **Work TM**, Gee SJ, Gunther R, Higgins RJ, Shinka T, Castagnoli N (1989) A sheep model for MPTP induced parkinson-like symptoms. *Life Sciences* 45:1601-1608. Concept: 74%, Data: 42%, Interpretation: 75%, Paper: 59%.

- 3) Jessup DA, **Work TM**, Bushnell R, Sawyer MM, Osburn BI (1990) An outbreak of bluetongue in captive deer and adjacent livestock in Kern county, California. *California Fish and Game* 76:83-90. Concept: 54%, Data: 71%, Interpretation: 60%, Paper: 65%.
- 4) **Work TM**, Jessup DA (1990) Epidemiology and pathology of hemorrhagic disease in free-ranging black-tailed deer in California: 1986-1987. *Transactions of the Western Section of the Wildlife Society* 26:72-76. Concept: 98%, Data: 83%, Interpretation: 88%, Paper: 99%.
- 5) **Work TM**, Sawyer MM, Jessup DA, Washino RK, Osburn BI (1990) Effects of anaesthetization and storage temperature on bluetongue virus recovery from *Culicoides variipennis* (Diptera: Ceratopogonidae) and sheep blood. *Journal of Medical Entomology* 27:331-333. Concept: 92%, Data: 88%, Interpretation: 80%, Paper: 96%.
- 6) **Work TM**, Washino RK, Van Riper III, C (1990) Comparative susceptibility of *Culex tarsalis*, *Anopheles franciscanus* and *Culiseta inornata* (Diptera: Culicidae) to *Plasmodium relictum* (Haemosporidia: Plasmodiidae). *Journal of Medical Entomology* 27:68-71. Concept: 97%, Data: 100%, Interpretation: 85%, Paper: 92%.
- 7) **Work TM**, Mullens BA, Jessup DA (1991) Estimation of survival and gonotrophic cycle length of *Culicoides variipennis* (Diptera; Ceratopogonidae) in California. *Journal of the American Mosquito Control Association* 7:242-249. Concept: 96%, Data: 96%, Interpretation: 98%, Paper: 94%.
- 8) Fritz L, Quilliam MA, Wright JLC, Beale AM, **Work TM** (1992) An outbreak of domoic acid poisoning attributed to the pennate diatom *Pseudonitzschia australis*. *J Phycol* 28:439-442. Concept: 80%, Data: 67%, Interpretation: 59%, Paper: 49%.
- 9) **Work TM**, Jessup DA, Sawyer MM (1992) Experimental bluetongue and epizootic hemorrhagic disease virus infection in black-tailed deer. *J Wildl Dis* 28:623-628. Concept: 94%, Data: 85%, Interpretation: 91%, Paper: 99%.
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- 12) **Work TM**, DeLong RL, Spraker TR, Melin SR (1993) Halothane anesthesia as a method of immobilizing free-ranging California sea lions (*Zalophus californianus*). *J Zoo Wildl Med* 24:482-487. Concept: 96%, Data: 93%, Interpretation: 81%, Paper: 98%.
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- 21) Graczyk TK, Balazs GH, **Work TM**, Aguirre AA, Ellise DM, Murakawa SKK, Morris R (1997) *Cryptosporidium* sp. infections in green turtles, *Chelonia mydas*, as a potential source of marine waterborne oocysts in the Hawaiian islands. *Appl Env Microbiol* 63:2925-2927. Concept: 74%, Data: 58%, Interpretation: 41%, Paper: 78%.
- 22) Moore MK, **Work TM**, Balazs GH, Docherty DE (1997) Preparation, cryopreservation, and growth of cells prepared from the green turtle (*Chelonia mydas*). *Methods in Cell Science* 19:161-168. Concept: 67%, Data: 58%, Interpretation: 66%, Paper: 78%.
- 23) **Work TM**, Rameyer RA (1997) Description and epizootiology of *Babesia poeala* n. sp. in brown boobies (*Sula leucogaster* (Boddaert)) on Sand Island, Johnston Atoll, Central Pacific. *J Parasitol* 83:734-738. Concept: 91%, Data: 89%, Interpretation: 84%, Paper: 91%.
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41) **Work TM**, Balazs GH, Wolcott M, Morris RM (2003) Bacteraemia in Hawaiian green turtles, *Chelonia mydas*, with fibropapillomatosis. *Dis Aquat Org* 53:41-46. Concept: 100%, Data: 86%, Interpretation: 99%, Paper: 98%.

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44) **Work TM**, Balazs GH, Rameyer RA, Morris R (2004) Retrospective pathology survey of green turtles (*Chelonia mydas*) with fibropapillomatosis from the Hawaiian Islands, 1993-2003. *Dis Aquat Org* 62:163-176. Concept: 94%, Data: 81%, Interpretation: 82%, Paper: 98%.

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- 46) Greenblatt R, Quackenbush SL, Casey R, Rovnak J, Balazs G, **Work T**, Casey J, Sutton C (2005) Genomic variation of the fibropapilloma-associated marine turtle herpesvirus across seven geographic areas and three host species. *Journal of Virology* 79:1125-1132. Concept: 68%, Data: 50%, Interpretation: 68%, Paper: 40%.
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- 50) **Work TM** (2005) Cancer in sea turtles. *Hawaii Medical Journal* 64:23-24. Concept: 91%, Data: 92%, Interpretation: 87%, Paper: 93%.
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- 55) Yabsley MJ, **Work TM**, Rameyer RA (2006) Molecular phylogeny of *Babesia poelea* from brown boobies (*Sula leucogaster*) from Johnston Atoll, Central Pacific. *J Parasitol* 92:423-425. Concept: 98%, Data: 88%, Interpretation: 98%, Paper: 99%.

- 56) Reynolds MH, **Work.T.M.** (2007) Translocation and disease monitoring of wild Laysan ducks. *Endangered Species Bulletin* 32:52-53. Concept: 63%, Data: 56%, Interpretation: 53%, Paper: 60%.
- 57) Aeby G, **Work T**, Fenner D, Didonato E (2008) Coral and crustose coralline algae disease on the reefs of American Samoa. 11th International Coral Reef Symposium:197-201. Concept: 42%, Data: 44%, Interpretation: 69%, Paper: 62%.
- 58) Chaloupka M, **Work TM**, Balazs GH, Murakawa SKK, Morris RM (2008) Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982-2003). *Mar Biol* 154:887-898. Concept: 75%, Data: 60%, Interpretation: 64%, Paper: 76%.
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- 65) **Work TM**, Woodley C, Raymundo L (2008) Confirming field assessments and measuring disease impacts. In: Raymundo L, Couch CH, CD (eds) A coral disease handbook: Guidelines for assessment, monitoring, and management. Coral Reef Targeted Research and Capacity Building for Management, St. Lucia, pp33-46. Concept: 90%, Data: 88%, Interpretation: 81%, Paper: 93%.
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- 71) **Work TM**, Dagenais J, Balazs GH, Schumacher J, Lewis TD, Leong JC, Casey RN, Casey JW (2009) In vitro biology of fibropapilloma-associated turtle herpesvirus and host cells in Hawaiian green turtles (*Chelonia mydas*). *Journal of General Virology* 90:1943-1950. Concept: 92%, Data: 88%, Interpretation: 88%, Paper: 91%.
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19. PUBLICATIONS (enclosed publications on following)

Work, T, C Meteyer. 2014. To understand coral disease, look at coral cells. EcoHealth 11: 610-618. Concept: 93%, Data: 94%, Interpretation: 82%, Paper: 92%.

Background: Over the last 40 years, progress on determining exactly why corals and associated organisms are declining has been slow to non-existent.

Role: I conceived the study, did the literature search, analyzed the data and wrote the paper.

Results: This paper reviewed 429 published coral disease papers spanning 1965 to 2013 in attempts to understand why we have made so little progress in understanding causes of declines in coral reefs globally. It concluded that the most likely reason for this is that most studies to understand causes of death in corals have focused on molecular studies or field surveys with little to no attention placed on examining what happens to animal at cellular level. The paper closes by suggesting that closer collaborations between coral ecologists and veterinarians might be a more productive way forward, and that diseases of epithelial surfaces such as the skin or gut might serve as a useful model to understand pathology and pathogenesis of coral disease.

Impact: The lack of a systematic biomedical approach to coral disease investigations has resulted in numerous studies incriminating various pathogens as a cause of coral disease with little to no supportive biomedical evidence to back up those claims. All studies categorically incriminating particular pathogens as cause of coral disease are not supported by biomedical evidence.

Work, TM, GS Aeby. 2014. Microbial aggregates within tissues infect a diversity of corals throughout the Indo-Pacific. Marine Ecology Progress Series 500: Concept: 90%, Data: 99%, Interpretation: 83%, Paper: 98%.

Background: We have known about algal-coral symbioses for years. There is also much published research on mucus-associated bacteria in corals and their potential in disease, but interpreting this research is problematic, because corals tissues are inherently non-sterile. Tissue associated bacteria have been seen in corals but little is known of their role in coral biology or ecology.

Role: I conceived the study, collected and processed the samples, analyzed the data, wrote the paper.

Results: This “Feature Paper” in Marine Ecology Progress Series shows that tissue associated bacterial aggregates are widespread in corals from the Indo-Pacific and that they are most often seen in coral genera that are dominant on reefs such as *Acropora*, *Porites*, and *Pocillopora*. We further show that these aggregates are upregulated in diseased corals suggesting they play a role in immunity. Spatial distribution of infected corals suggests that these aggregates probably originated in the western Pacific and radiated through to the central Pacific. Intriguingly, the presence of these aggregates in certain coral genera may give them a competitive advantage and could explain, in part, why these coral genera are dominant on coral reefs.

Impact: The paper also opens an entirely new area of symbioses in corals that have heretofore been overlooked. Most studies of symbioses focus on algae in corals, but it is clear that important genera have high prevalence of bacterial symbionts that could not only explain community assemblages, but also coral evolution and immunity.

2) Work, T. M., J. Dagenais, G. H. Balazs, N. Schettle, and M. Ackermann. 2014. Dynamics of virus shedding and in-situ confirmation of chelonid herpesvirus 5 in Hawaiian green turtles with fibropapillomatosis. *Veterinary Pathology*. Concept: 91%, Data: 88%, Interpretation: 85%, Paper: 95%.

Background: Virus-induced tumor diseases in animals and humans are well known. How these viruses are transmitted is less clear, particularly for wildlife species where tools to understand virus shedding and transmission are rudimentary. Furthermore, tumors are thought to be a poor source of virus for most virus-induced tumor diseases. We set out to examine virus shedding in the herpesvirus-associated tumor disease, fibropapillomatosis (FP), in sea turtles.

Role: I conceived the study, collected and processed the samples, analyzed the data, wrote the paper.

Results: This paper, featured as “Editor’s Choice-Wildlife Series” in *Veterinary Pathology* showed that contrary to accepted wisdom, this paper showed that tumors play an important role in transmission of herpesvirus in turtles afflicted with FP, and that smaller tumors are more likely to shed

virus than larger tumors, and revealed the existence of superspreaders (a few animals accounting for majority of transmission)

Impact: This is the first report showing the potential role of superspreaders in epidemiology of virus-induced cancers in any animal. The paper has management implications, because by knowing that smaller tumors are more likely to shed virus allows for more targeted attempts at virus isolation.

REFERENCES

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20. POSITION DESCRIPTION (see attached)