

# Prioritization of the Fisheries Issues and Research Needs of Hawai'i Island: Recommendations of the Hawai'i Island Fisheries Working Group

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**Introduction:** This white paper is intended to be a synthesis and summary of the discussions held by the Hawai'i Island Fisheries Working Group on 27 February 2017 in Kailua-Kona. The members of this working group represented federal agencies, state agencies, the University of Hawai'i campuses at Hilo and Mānoa, and NGOs (a full list of participants and their affiliations can be found in [Appendix I](#)). The purpose of the meeting on 27 February 2017 was to identify fishery research needs for Hawai'i Island and discuss avenues of collaboration. The re-establishment of the Hawai'i Cooperative Fishery Research Unit at the University of Hawai'i-Hilo in 2012 and its subsequent re-staffing in 2016 was catalyst behind forming the working group. The primary objectives of the meeting were to 1) identify current and emerging issues related to the management and conservation of the fisheries and marine, estuarine, and freshwater resources of Hawai'i Island and 2) prioritize the research needed to support effective management and conservation. We did not have time during the meeting to being the process of prioritizing the identified research needs. In addition to the primary objectives, the meeting served to reintroduce the Cooperative Fishery Research Unit and discuss how its roles in fulfilling these research needs directly, facilitating connections between the primary cooperators (U.S. Geological Survey, the University of Hawai'i System, the Hawai'i Department of Land and Natural Resources, and U.S. Fish and Wildlife Service) and other partners, and leveraging funds to support the research needs identified by the working group.

The working group focused on the following questions as part of their discussions:

- 1) What are the most pressing issues currently facing fishery resources on the Hawai'i Island?
  - a. Are these issues specific to Hawai'i Island or shared across the state?
  - b. What issues are likely to emerge or become more pressing going forward?
- 2) What are the uncertainties/unknowns that are limiting to or preventing effective conservation or management action to address these issues?
- 3) What resources are available to address these uncertainties/unknowns?
  - a. What are the strengths/assets that each agency/organization can contribute?
  - b. What are the areas that each agency/organization needs to look outside itself for expertise, resources, etc.?

**Research issues and priorities:** The following are the research issues and needs identified by the working group for Hawai'i Island. Most of the identified topics are not exclusive to Hawai'i Island and could form the basis of holding similar meetings for Maui Nui, O'ahu, and Kaua'i. Topics were prioritized by requesting that working group participants rank the topics in order of their perceived importance<sup>1</sup>.

- 1) ***Parrotfishes, parrotfishes, parrotfishes.*** Parrotfishes are important to the health of coral reef ecosystems, but are also an important component of the non-commercial catch in Hawai'i. Understanding the effectiveness of proposed regulations to protect parrotfishes, generating more information on the biology and life history of Hawaiian species beyond [O'ahu](#), evaluating parrotfish movement and behavior to assess the effectiveness of protected area design, evaluating the effects of loss of large individuals on coral reef health, and characterizing and quantifying legal and illegal harvest of parrotfishes were identified as areas in need of attention.
- 2) ***Evaluating the importance of trophic levels/guilds to the resiliency of coral reefs to disturbance, e.g., bleaching events.*** The group indicated that understanding the relationship between coral reef fisheries, which often focus on herbivorous species, such as parrotfishes and surgeonfishes, and coral reef recovery after bleaching events needed further research. A considerable amount of basic research has been conducted on this issue and the work is in the process of being synthesized (see [Ocean Tipping Points](#) for an example). While there are questions that remain, there is arguably a bigger need for applied research to support management decisions, such as assessing the efficacy of various management strategies.
- 3) ***Development of knowledge base of basic life-history information for priority species.*** The group repeatedly noted that basic life-history information was lacking for many exploited species. Information needed includes but is not limited to: length and age at maturity, fecundity, growth parameters ( $L_{\infty}$ ,  $k$ ,  $t_0$ ), spawning season and behavior, larval duration, diet, habitat requirements, ontogenetic shifts in habitat use, home range, length-weight relationship, length (and/or age)-fecundity relationship, maximum age, spawning periodicity, trophic level, etc. It was noted by the group that life-history studies tended to be difficult to publish, but could serve as an excellent source of projects for motivated undergraduate students looking for an introduction to science. There may also be potential to link to marine science and science high school teachers. Lists of priority species for [east Hawai'i](#) and [west Hawai'i](#) are included in [Appendix II](#) and [Appendix III](#), respectively. The Pacific Aquaculture and Coastal Resources Center (PACRC) at University of Hawai'i-Hilo is a good resource for developing some of these data as they will be or are capable of producing a steady supply of eggs and larva for many of the species of interest.

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<sup>1</sup>Only a small number of participants provided responses ( $n = 4$ ) and one of the responses was from the Kona office of the Hawai'i Department of Aquatic Resources (DAR) which represented the consensus ranking of seven biologists. Therefore, the final rankings were produced by partially-weighting the responses such that the DAR ranking was equivalent to the other three responses combined.

- 4) ***Evaluation of fish movement and behavior, particularly as it relates to the design and implementation of conservation districts and special management areas.*** Understanding the movement and behavioral patterns of fishes is an important component of designing networks of MPAs that can rebuild the populations of priority species. The group indicated that additional research was needed on more species, similar to that reported by [Filous et al. \(2017\)](#).
  
- 5) ***Characterization and quantification of the non-commercial catch, i.e., subsistence and recreational fisheries.*** There was general consensus from the group that there were sufficient data regarding commercial landings to develop regulations and set sustainable catch limits. The group acknowledged that the self-reported data collected from commercial fishers in the state of Hawai'i has serious issues pertaining to its accuracy. However, it was repeatedly noted that there were no reliable data on the size of the non-commercial catch, despite it potentially being as large as, or even several times larger than, that of the commercial landings. It was further noted that the lack of a consistently applied, standardized method for collecting data on non-commercial landings is a serious impediment to fisheries management in the state of Hawai'i. Implementing research focused on accurately quantifying the non-commercial catch is an important component for monitoring the status of and developing effective management for nearshore fisheries. It would also be a critical component in the evaluation of the efficacy of a non-commercial fishing permit/license program if implemented. There were also several related issues identified as being important considerations:
  - a. The number of species that comprise the non-commercial catch of Hawai'i is considerably larger than that of the commercial fishery and data for these species is limited. There is a question as to whether the non-commercial fishery could be managed at the level of an "ecological stock," such as trophic guilds, or will each species need to be considered individually. While collecting more high-quality data through creel surveys was emphasized, it was also noted that there were statistical tools available to conduct data-limited stock assessments, such as those described by Nadon et al. (2015) available [here](#).
  - b. There is a question of how to place an economic valuation on the non-commercial catch, especially that landed for the subsistence fisheries. In particular, there is difficulty assigning a value to account for fish flow, or how the catch is distributed amongst the members of a community without an explicit or easily traceable exchange of goods, services, or money.
  - c. There is a pressing need to assess the current species composition of the non-commercial catch and understand how it is likely to shift with changing demographics in the state as well as how fishing gears and methods (and the impacts they have on sensitive habitats) might change. Though not specifically discussed during the meeting, understanding how a changing climate throughout the state is likely to impact the species composition of the catch should also be considered.

- d. Characterizing and quantifying illegal non-commercial fishing, particularly in protected areas, was identified as a priority for developing enforcement strategies and for assessing the effectiveness of protected areas.
- 6) ***Development of scientifically justified goals and benchmarks of success of conservation and management actions:*** The group identified the need for research to develop goals and benchmarks for conservation and management actions at the regional, state, island, and community scales that are based on the best available science. Research focused on developing ecological, socio-economic, and cultural benchmarks to determine the effectiveness of conservation and management actions are particularly critical, as such research would support an adaptive management/structured decision-making framework capable of being proactive to changing conditions. Specific examples discussed included, an evaluation of the sustainability of the marine ornamentals fishery, an evaluation of the degree to which existing and proposed MPAs around Hawai'i act as a network, elimination of changes to the network of bottomfish restricted areas (BFRAs) around Hawai'i Island, assessing the efficacy of community-based subsistence fishery management areas, and the various watershed initiatives on Hawai'i and Maui.
- 7) ***Assess changes in fish distribution and habitat use, e.g., loss of juvenile Hammerhead Sharks from Hilo Bay, and evaluate factors driving observed changes.*** Changing climatic conditions, degraded water quality, habitat degradation, coastal land development and other factors are likely to result in changes to the distribution of nearshore fishes around Hawai'i Island. Understanding these shifts in distribution and habitat use is important to ensure conservation and management strategies based on special management areas are successful. The example discussed by the group involved the unexplained absence of juvenile and pupping female Scalloped Hammerhead Sharks from Hilo Bay in recent years.
- 8) ***Assessment and monitoring of the health of coral reefs on the east side of Hawai'i Island.*** While coral reefs on the west side of Hawai'i Island are consistently monitored, coverage on the east side of the island is incomplete. In addition to implementing a standardized monitoring program, the group identified understanding connectivity among east Hawai'i reefs and between reefs in east and west Hawai'i as a high priority. Furthermore, understanding any functional differences between reefs in the two regions was also considered important. For example, there is anecdotal evidence to suggest that corals in east Hawai'i did not experience as severe a bleaching event as those in west Hawai'i during 2014-2015.
- 9) ***Developing methodologies to formalize the integration of local knowledge into research and management activities.*** The group identified the need to better incorporate local knowledge into science and management. In particular, the group emphasized the need for greater participation and input from local communities in developing research agendas, as well as more effort from researchers to disseminate their findings to members of local communities. The effort should be perceived as mutually beneficial as it is both a means of community engagement and a valuable source of information.

- 10) ***Assessing the influence of fishponds, both active and abandoned/inactive, on the productivity of nearshore fisheries.*** Prior to European contact, native Hawaiians constructed and maintained a large number of fishponds along the coastlines of the main Hawaiian Islands. These ponds were usually sited to take advantage of nutrient-rich freshwater inflows and potentially represented a significant portion of available estuarine habitat. While the majority of these fishponds today are inactive and in various states of disrepair, they still might represent important nursery habitat for nearshore fishery resources or serve as reservoirs for invasive species. The group identified evaluating the functional equivalency of active and inactive fishponds to natural estuaries and assessing their contribution to the productivity of nearshore fisheries as research priorities.
- 11) ***Evaluating the dynamics and impacts of invasive species in estuarine habitats, anchialine pools, and fish ponds.*** The impacts of invasive species in coral reef habitats have been examined on Hawai'i Island, little attention has been focused on estuarine habitats, anchialine pools, or fish ponds. Specific needs discussed included invasive plants, such as the impacts of California grass *Buddleja asiatica* and red mangrove *Rhizophora mangle*, in Hawaiian estuaries, potential impacts of Kanda *Moolgarda engeli* on native mullets, and upside-down jellyfish *Cassiopeia andromeda* on fish pond productivity.
- 12) ***Development of indices for monitoring the health of estuaries.*** Hawaiian estuaries and their role in maintaining sustainable and productive nearshore fisheries are poorly understood. However, estuaries are facing numerous threats from coastal development, changing freshwater inflows, degraded water quality, and invasive species. A better understanding of the relative impacts of these threats on estuarine productivity is needed to develop/improve monitoring methods for these habitats.
- 13) ***Assessment of the effects of loss of connectivity and altered flow regimes in watersheds on water quality, the abundance and distribution of freshwater species, and the productivity and functionality of estuarine systems.*** Increased demands for freshwater resulting in increased water withdrawals and diversions and changing precipitation patterns have altered flow regimes and reduced the connectivity of Hawaiian watersheds. Research is needed on how these changes influence habitat at a landscape scale, particularly how changes in connectivity and water quality associated with altered flow regimes impacts imperiled freshwater fishes and invertebrates. The effects of changes in the quality and quantity of freshwater entering Hawaiian estuaries on the productivity and functionality of these systems is also not well understood.

**Appendix I.** A list of participants in the Hawai'i Island Fisheries Working Group with their affiliations and e-mail addresses.

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\*not present at 27 February 2017 meeting.

**Appendix II.** List of priority species from east Hawai'i Island for which the absence of life history information is currently viewed as limiting or otherwise impeding effective management. Species are listed in phylogenetic order as per Nelson (2016). Common and Hawaiian names are taken from Randall (2007).

<b>Family</b>	<b>Species</b>	<b>Common name</b>	<b>Hawaiian name</b>
Albulidae	<i>Albula virgata</i>	Longjaw Bonefish	‘Ō‘iō
Clupeidae	<i>Herklotsichthys quadrimaculatus</i>	Goldspot Sardine	n/a
Engraulidae	<i>Encrasicholina purpurea</i>	Hawaiian Anchovy	Nehu
Chanidae	<i>Chanos chanos</i>	Milkfish	Awa
Mugilidae	<i>Moolgarda engeli</i>	Kanda	n/a
Atherinidae	<i>Atherinomorus insularum</i>	Hawaiian Silverside	‘Iao
Kuhliidae	<i>Kuhlia sandvicensis</i>	Hawaiian Flagtail	Āholehole
	<i>Kuhlia xenura</i>	Reticulated Flagtail	Āholehole
Carangidae	<i>Caranx ignobilis</i>	Giant Trevally	Ulua aukea
	<i>Caranx sexfasciatus</i>	Bigeye Trevally	Pake ulua
	<i>Scomberoides lysan</i>	Leatherback	Lai
	<i>Selar crumenophthalmus</i>	Bigeye Scad	Akule
Lutjanidae	<i>Lutjanus fulvus</i>	Blacktail Snapper	To‘au
Mullidae	<i>Mulloidichthys flavolineatus</i>	Yellowstripe Goatfish	Weke‘ā

**Appendix III.** List of priority species from west Hawai'i Island for which the absence of life history information is currently viewed as limiting or otherwise impeding effective management. Species are listed in phylogenetic order as per Nelson (2016). Common and Hawaiian names are taken from Randall (2007).

<b>Family</b>	<b>Species</b>	<b>Common name</b>	<b>Hawaiian name</b>
Labridae	<i>Labroides phthirophagus</i>	Hawaiian Cleaner Wrasse	n/a
	<i>Thalassoma duperrey</i>	Saddle Wrasse	Hinālea lau-wili
Scaridae	<i>Calotomus carolinus</i>	Stareye Parrotfish	Pōnuhunuhu
	<i>Calotomus zonarchus</i>	Yellowbar Parrotfish	Uhu
	<i>Scarus dubius</i>	Regal Parrotfish	Lauia
	<i>Scarus psittacus</i>	Palenose Parrotfish	Uhu
Acanthuridae	<i>Acanthurus achilles</i>	Achilles Tang	Pāku'iku'i
	<i>Acanthurus blochii</i>	Ringtail Surgeonfish	Pualu
	<i>Acanthurus dussumieri</i>	Eyestripe Surgeonfish	Palani
	<i>Acanthurus xanthopterus</i>	Yellowfin Surgeonfish	Pualu