FLASH Strategic Plan

December 04, 2010

Fisheries Local Action Strategy in Hawai‘i (FLASH):

Problem statement

Introduction

Coral reef fisheries are an integral part of life in Hawai‘i, providing resources such as food, recreation, commerce, and culture. However, there is evidence from both researchers and resource users that coral reef fisheries have been steadily declining over the past century, a trend that threatens both the health of our nearshore marine environment and the well-being of present and future generations of our people. Urgent action is needed to address the increasing pressures and impacts on coral reefs in order to ensure sustainability of our fisheries and our lifestyle in the Hawaiian Islands. One action taken by the U.S. Coral Reef Task Force, in collaboration with the State of Hawaii, was to create the Fisheries Local Action Strategy for Hawai‘i (FLASH). The purpose of the FLASH is to develop viable fisheries management solutions, enhance public understanding of Hawai‘i’s coral reefs and facilitate public involvement in coral reef stewardship and supports projects by promoting collaboration, outreach, and engagement amongst stakeholders, offering technical support, and identifying funding opportunities.

Effects of increased fishing pressure

Increased fishing pressure not only results in less fish, but also fewer types of fishes and smaller fish. Fishing pressure can also make it more difficult for fish stocks to recover. Coral reef species are particularly vulnerable to fishing pressure, and stocks can be rapidly depleted, potentially to the point of no recovery.[1] The preference for larger and older fish has a disproportionately higher impact on the growth and replenishment of fish populations, since these fish produce more eggs and healthier offspring.[2] If the abundance of a species drops too low, a fish population may lose its ability to rebuild itself.[3] As large, predatory fish species are targeted and depleted, fishers will “fish down marine food webs,” moving on to remaining smaller species which are then, in turn, depleted.[4]

Declining fish stocks on coral reefs in the Main Hawaiian Islands (MHI)

There is evidence of overall declines in abundance and size of fishes, as well as decreased numbers of key species in Hawai‘i. The combination of these signs is an indication of

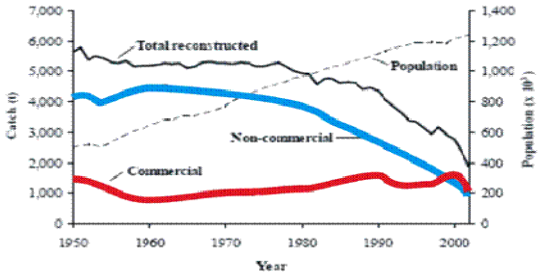

Figure 1: Total reconstructed catches of coral reef and reef-associated fisheries of Hawai‘i. Human population trend is also shown.

overfishing due to increased fishing pressure. There are two sources of evidence: quantitative (data from fisheries and research) and qualitative (surveys and interviews of resource users). The issue of overfishing can be presented in two ways: looking at changes in fisheries resources from past to present, and comparing data about resources in areas of high fishing pressure versus areas of low fishing pressure.

Quantitative evidence of declining fish stocks

A trend of declining catches despite increasing effort has been observed in several studies of time series data. A reconstruction of reef and bottomfish fisheries catches from 1950 to 2002 found that combined commercial and non-commercial catches for non-pelagic species peaked around the late 1980s at 10.09 million lbs, and declined by 2002 to 6.64 million lbs (see Figure 1).[5]

In a review of commercial landings data between 1980 and 1990, the Hawai‘i Division of Aquatic Resources (DAR) found that “while catch per unit effort (CPUE) was declining... an equivalent amount of landings was being shared among an increasing number of fishermen.”[6] This indicated the decline was due to decreasing fish stocks and not decreased fishing effort. Also, CPUE for species that are harvested by recreational and subsistence users has declined dramatically over time, despite new developments in fisheries technology. Moi are a highly prized species that have shown signs of overfishing. The average size of fish has declined since the 1960s with fewer females in the population. Over 40% of all the fish now harvested are below reproductive size (see figure 2).[7] Similar studies of omilu have shown that only 2% of the population had reached reproductive size before harvest.[8] In comparison, fisheries managers recommend at least 50% of the population reach reproductive size before removal.

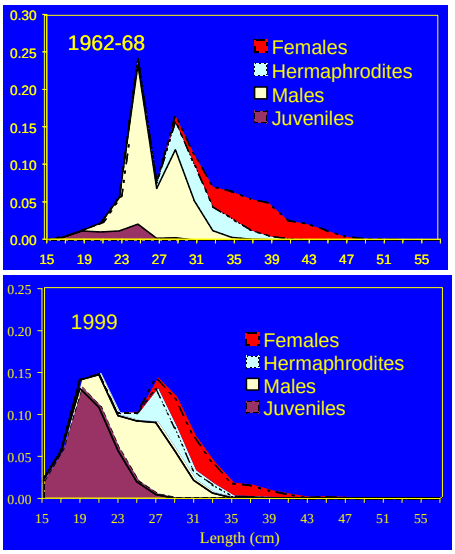

Figure 2: Comparisons of moi size and sex between the 1960s and 1999

Further evidence of overfishing impacts can be seen by comparing conditions in the MHI with the Northwestern Hawaiian Islands (NWHI). Due to relatively low levels of fishing pressure and other human impacts, conditions in the NWHI can serve as a baseline for “pristine” coral reefs. A comparative study in 2002 revealed “dramatic differences” in abundance, size, and species composition (see Figure 3):[9]

1. Standing fish stock in the NWHI was more than 260% greater than in the MHI.
2. More than 54% of the total fish biomass in the NWHI consisted of apex predators, compared to less than 3% in the MHI.
3. Most of the dominant species by weight in the NWHI were either rare or absent in the MHI, and the target species that were present, regardless of trophic level, were nearly always larger in the NWHI.

This study concluded that “the differences in fish assemblage structure in this study are evidence of the high level of exploitation in the MHI.” These results are also mirrored in many archipelagos in the Pacific (see CRED 2007 report).

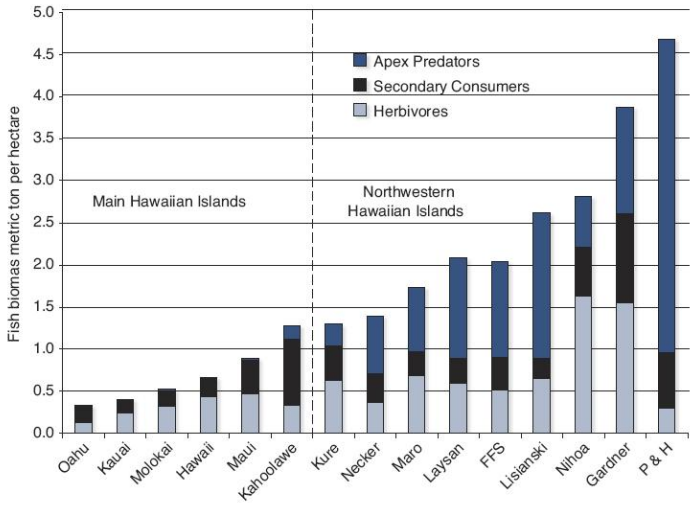

Figure 3: Comparison of coral reef fish biomass in MHI and NWHI

Qualitative evidence of declining fish stocks

The quantitative evidence of declining reef fisheries is corroborated by qualitative information from public surveys, oral histories, and interviews with members of fishing communities. In 1997, DAR surveyed 863

fishermen and found reports of “a decline in the amount of fish that they’re able to catch now compared with what they were able to catch 20 or 30 years ago.” Consequently, more than half of the respondents rated nearshore fisheries as “poor” or “terrible.”[10] These comments echoed an earlier DAR survey in 1988, in which respondents agreed that nearshore resources were in decline due to overfishing.[11]

In a compilation of over 130 oral history interviews with *kupuna* (“elders”) and *kama‘aina* (Hawaiian residents; literally “those who are of the land”), the majority of interviewees reported changes in the quality of the fisheries as well as a significant decline in fish abundance, and they attributed these trends to overfishing.[12] One interviewee described the impact of intensively fishing a single spot, demonstrating how bigger fish are targeted first, followed by a decline in size:

> *“At first, I was catching like a twelve, fourteen pound fish [‘opakapaka]... and then started going down and then I started catching the seven, eight pounders. And then after about maybe a six to nine month period it was going down to like two or three pound fish. Just wiped the whole chain down, down to the bottom already.”*

Another interviewee observed the effects of the fisheries closure during and after World War II, an example of how quickly fish populations can respond to the absence and presence of fishing effort:

> *“I went back fishing [around 1946] and it was unbelievable. Those years that the fish had reprieve... it was overwhelming in numbers... The [fish] population just exploded! ...it took about three to four years to begin to see the decline occurring again... the closure enforced in this case, was very, very obvious that human beings can really wreck havoc.”*

There were also observations that the availability of desirable fish was diminishing, which illustrates how fishing down marine food webs forces economic preferences to shift: “*We just threw that stuff away, I see people selling that stuff now.”*

In 2005, the Fisherman Outreach Program (FOP) collected and analyzed interviews with 55 fishermen on Maui and the island of Hawai‘i.[13] Fishermen's responses revolved around three main themes:

1. declines in the numbers of fish or schools of fish;
2. changes in how readily fishers were able to find fish ; and
3. changes in the quality of fish fishers saw and caught.

These themes echo the quantitative evidence of decreasing abundance yet increasing effort, smaller fish, and loss of species. Many fishermen interpret these trends as less fish for the future: “*What about my grandchildren? Not going be able to catch fish. Going be all gone*.”

Conclusions

Both quantitative data from fisheries and research as well as qualitative information from surveys and interviews of resource users show clear evidence of overfishing of MHI coral reefs. Overfishing has contributed to trends of decreasing fish abundance, smaller sizes of fish, decreased capacity for replenishment of fish stocks, and loss of commercially valuable and ecologically important species. The impacts of overfishing not only endanger fisheries, but also threaten many aspects of daily life such as subsistence, health, recreation, tourism, and culture. Coral reef resources are an integral part of life in Hawai‘i. The Fisheries Local Action Strategy was developed to address this concern and assist the State to ensure a sustainable coral reef fishery.

Vision Statement:

Developing a shared vision is one of the most important steps in developing a strategic plan. This vision is a statement of the preferred future for the coral reef fisheries in Hawaii and what we are striving to accomplish. We hope this vision will also help motivate and inspire the greater stakeholder community.

The Fisheries Local Action Strategy's Steering Committee envisions a Hawaiian Islands with a healthy nearshore marine environment that is maintained through effective management* for the benefit and appreciation of all generations.*

* Healthy nearshore marine environment and effective management are defined in Appendix 1.

Mission Statement:

Our mission statement sums up the FLASH steering committee's 'reason for being'. It defines our intentions, priorities, assumptions and values. This statement also helps explain to our stakeholder community what we do and why we are doing it. It will help determine what projects fall within the scope of the steering committee.

We believe the island way of life is important to defining who we are, that most people care about the environment, and that informed decision making and proactive stewardship will lead to improved and sustainable coral reef fisheries. By promoting collaboration, outreach, and engagement amongst stakeholders, offering technical support, and identifying funding opportunities, we will help create viable fisheries management solutions, enhance public understanding of Hawaii's coral reefs and facilitate public involvement in coral reef stewardship.

Prioritized threats:

To prioritize threats to coastal marine resources, we rated each identified threat under three category headings: area (the amount of area that could possibly be impacted by the threat); intensity (the strength of the impact); and urgency (the immediate necessity to address the threat). Each threat was rated on a scale of 1 to 3 for each category, with 3 the highest rating.

Direct Threat	***Area***	***Intensity***	***Urgency***	***TOTAL***
1. Increased fishing pressure	**2.8**	**2.8**	**2.7**	**8.17**
2. Overly efficient fishing gear	**2.3**	**2.4**	**2.7**	**7.38**
3. Shoreline development	**2.4**	**2.3**	**2.5**	**7.21**
4. Alien invasive species	**2.4**	**2.3**	**2.4**	**7.08**
5. Pollution	**2.4**	**2.2**	**2.2**	**6.73**
6. Destructive fishing practices	**1.5**	**1.8**	**2.2**	**5.55**
7. Recreation user impacts	**1.8**	**1.7**	**1.8**	**5.25**
8. Natural disturbance	**1.8**	**1.6**	**1.1**	**4.42**

Several indirect threats were also identified:

Indirect Threats:

1. Lack of information
2. Poorly informed legislature
3. Poor management
4. Lack of management capacity
5. Population increase
6. Lack of Enforcement
7. Coastal development/urban expansion
8. Contentious relationships between users and managers
9. Economic challenges of living in Hawaii
10. Lack of clear definition of sustainable
11. Diversion of freshwater stream flow into ocean
12. Scape-goating
13. Lack of empowerment
14. Lack of coordination and collaboration
15. Economic incentives
16. Conflicting perspectives
17. Language barriers
18. Lack of community
19. Lack of political will
20. Tourism
21. Poorly informed judiciary
22. Corruption
23. Lack of conservation ethic
24. Lack of awareness
25. Attitudes: right vs. privilege
26. Attitudes: desperation, hopelessness, pessimism
27. Lack of refugia
28. Disinformation


INDIRECT
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TARGET CONDITION
Economic incentives
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Lack of conservation ethic
Lack of refugia
Lack of enforcement
Population
Tourism
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Lack of coordination/ collaboration
Lack of information
Disinformation
Poorly informed legislature
Poorly informed judiciary
Corruption
Poor management
Coastal development/ urban expansion
Contentious relationships between users and managers
Economic challenges of living in Hawaii
Lack of clear definition of sustainable
Diversion of freshwater stream flow into ocean
Scape-goating
Lack of management capacity
Natural disturbance
Fishing pressure
Destructive fishing
Over-efficient fishing gear
Recreational impacts
Shoreline development
Pollution
Aquatic invasive species
Degradation & loss of habitat
Nearshore marine environment in Hawaii

Causes and Effects of Fisheries Resource Decline in Hawaii

A sub-committee of the Fisheries Local Action Strategy steering committee members was asked to identify the various causes and effects of nearshore fisheries decline. They produced the following output:

Causes:

1. Lack of responsibility/stewardship
    a. Detached from the resource
    b. Lack of will
    c. “every man for themselves” mentality
    d. “tragedy of the commons”; take before someone takes it from you
2. Sliding/shifting baselines
    a. Lack of awareness of what is happening to the resource
3. Lack of enforcement
    a. Some regulations may be too hard to enforce
4. Development of a commercial market
    a. Technology – refrigerator/ice
5. Overly efficient fishing gear
6. Lack of knowledge of the regulations
    a. “too many rules”
7. Lack of communication between managers and fishermen
    a. Lack of mechanism for communication
8. Right vs. privilege to fish
9. Desire for bigger fish
    a. Trophy fish, 100lb Ulua
10. lack of information
    a. Language barrier
11. Legislature lacks knowledge of problem
12. Increased fishing pressure
    a. Immigration - Different fishing values
    b. Increased population
    c. More concentrated population
13. Lack of refuge
    a. Temporal
    b. Spatial
14. Limited rules
    a. Not stringent
    b. Not based on science, based on public opinion
15. Bad information
    a. Pushing culture of excess
    b. Scientists pushing their own agenda
16. Scientists out of touch with the fishing community

Other possible causes of fisheries resource decline –

1. Recreational activities
    a. Tourism
    b. increased use
    c. sunscreen
2. Habitat degradation
3. Invasive species

Effects of Overfishing:

1. Loss of Habitat
2. Too few fish
3. Fish are too small/ removal of big fish
4. Resource species depleted
5. Undesirable fish dominant
6. Change in trophic dynamics
7. Ecosystem function disrupted
    a. Proliferation of invasive algae
8. Ecosystem services
    a. Economic impact
    b. Loss of income
9. Loss of resiliency
    a. Exacerbated by global climate change
10. Fish evolving smaller
11. Removal of dominant contributing reproductive fish
    a. Big fat fecund females
12. Loss of food resources
    a. Public health (diabetes)
13. Reduced quality of life

Goals:

Goal 1: To restore and maintain healthy coral reef ecosystems by supporting effective fishery management approaches based on sound science, responsible practice, and stewardship.

Goal 2: To improve information exchange and communication amongst stakeholders to enhance collaboration and compliance.

Priority Objectives:

Objective 1:
For DAR/DLNR and resource users to have an understanding of the applicability of an MPA network in Hawaii, including data on its potential biological, social and economic effects by 2010.

Objective 2:
To have statistically valid and useful knowledge for management on all catch and effort for Hawaii's CR fisheries by 2012.

Objective 3:
3 communities are implementing pono practices and eliminating non-pono practices on each island by end of 2010.

Objective 4:
To have effective enforcement of marine resource rules by 2010.

Objective 5:
To have a process that more effectively collects and disseminates information between managers and resource users by December 2008.

Fisheries Local Action Strategy Activities:

A list of potential activities was developed to achieve the priority objectives that are identified above. These activities are inventoried on worksheet one provided by the Coral Reef Task Force and include management tool categories.

Threat / Focus Area:
Coral Reef Fishery Management

GOAL:

To restore and maintain healthy coral reef ecosystems by supporting effective fishery management approaches based on sound science, responsible practice, and stewardship.

Indicator:

Objective 1:

For DAR/DLNR and resource users to have an understanding of the applicability of an MPA network in Hawaii, including data on its potential biological, social and economic effects by 2010.

Indicator:

Proposed Activities / Projects	Management Tools							Current Status	
	Developing policies/laws	Enforcement	Monitor/survey	Marine managed areas	Outreach/education	Research	Other	Unfunded	Funded (f), partial (p)
Quantifying the benefits of MPAs in terms of population fecundity and reproductive output				x		x			
Conduct a socio-economic assessment on value and potential impacts of a range of MPA Networks in Hawaii				x		x			
Conduct benefits/costs analysis of area management vs species specific management				x		x			
Classify habitat types and identify areas			x	x		x			

socially, economically, and culturally appropriate for area management; Prioritize sites based on output									
Quantify and characterize public opinion on MPA's in Hawaii				x		x			
Develop a comprehensive marine zoning plan for West Hawaii.				x		x			
Assessment of biological, social, and economic (BSE) effectiveness of community based marine co-management / ahu-moku council (select pilot area);				x		x			
Develop a roadmap to establish ecologically integrated coastal management in Hawaii (upland SMA adjacent to MPA)?				x		x			
Assess the recovery process of MPAs impacted by natural and anthropogenic disturbance? Is it possible to compare to a non-protected area?				x		x			
Assess the scope of marine managed areas to restore herbivore stocks and effect on ecological processes.				x		x			
Assess the ecosystem services of marine protected areas				x		x			
Assess the effects of de-establishing a MPA – West Hawaii and Waikiki				x		x			

Threat / Focus Area: Coral Reef Fishery Management

GOAL:

To restore and maintain healthy coral reef ecosystems by supporting effective fishery management approaches based on sound science, responsible practice, and stewardship.

Indicator:

Objective 2:

To have statistically valid and useful knowledge for management on all catch and effort for Hawaii's CR fisheries by 2012.

Indicator:

Proposed Activities / Projects	Management Tools							Current Status	
	Developing policies/laws	Enforcement	Monitor/survey	Marine managed areas	Outreach/education	Research	Other	Unfunded	Funded (f), partial (p)
Analyze and validate the existing commercial coral reef fisheries data and produce a report detailing coral reef fisheries catch, effort and economic information either by island or for the state as a whole. 2009-2011						x			
Conduct cost/benefit analysis of fishing license in Hawaii, comparison among states	x					x			
Revamp HMRFS Analysis of HMRFS data, descriptive reports			x						

Data on effort and catch broken down by location How do other countries (Australia) conduct and deal with creel surveys?									
Revising commercial catch reports to be more spatially explicit			**x**						
Collect information on the catch and bycatch of certain gears and CPUE (recreational)			**x**			**x**			
Collect information on the commercial export of near-shore fishes from Hawaii			**x**			**x**			
Develop simplified and/or online reporting system			**x**						

Threat / Focus Area: Coral Reef Fishery Management

GOAL:

To restore and maintain healthy coral reef ecosystems by supporting effective fishery management approaches based on sound science, responsible practice, and stewardship

Indicator:

Objective 3:

3 communities are implementing pono practices and eliminating non-pono practices on each island by end of 2010.

Indicator:

	Management Tools							Current Status	
Proposed Activities / Projects	**Developing policies/laws**	**Enforcement**	**Monitor/survey**	**Marine managed areas**	**Outreach/education**	**Research**	**Other**	**Unfunded**	**Funded (f), partial (p)**
Identify five *pono and 5* non-*pono* fishery management practices for each island based on guidance from cultural experts, kupuna and other culturally recognized sources of information	**x**				**x**	**x**			
Assess the (BSE) impacts and benefits of implementing these practices						**x**			

Threat / Focus Area: Coral Reef Fishery Management

GOAL:

To restore and maintain healthy coral reef ecosystems by supporting effective fishery management approaches based on sound science, responsible practice, and stewardship

Indicator:

Objective 4:

To have effective enforcement of marine resource rules by 2010.

Indicator:

Proposed Activities / Projects	Management Tools							Current Status	
	Developing policies/laws	Enforcement	Monitor/survey	Marine managed areas	Outreach/education	Research	Other	Unfunded	Funded (f), partial (p)
Quantify resource violations in representative areas		x			x				
Develop enforcement plan	x	x							
Summarize of what has been done already on public trust and respect for DOCARE		x			x				
Evaluation of DOCARE's compliance with legislative audit		x				x			
Quantify and qualify presence of DOCARE officers at key sites.		x				x			

Analyze DOCARE's volunteer program, what were the pitfalls, what happened to the program, are there volunteer programs in other states, are they successful?		x				x			
Look into DAR being able to issue violations like in Alaska, deputize volunteers/citizens.	x	x							
Develop consultation process between DAR, DOCARE, and judicial system on rules and all things enforcement	x	x							
Establish a natural resource court (land board) – administrative fines, no DOCARE involvement	x	x							
Translate rules into more than one language – priority Pacific Island languages, Filipino, Samoan, etc.		x			x				
Develop an education and outreach program on what the public can do. What are the rules? Who can they call? What can they expect? Etc		x			x				

Threat / Focus Area: Coral Reef Fishery Management

GOAL:

To improve information exchange and communication amongst stakeholders to enhance collaboration and compliance.

Indicator:

Objective 5:

To have a process that more effectively collects and disseminates information between managers and resource users by December 2008.

Indicator:

Proposed Activities / Projects	Management Tools							Current Status	
	Developing policies/laws	Enforcement	Monitor/survey	Marine managed areas	Outreach/education	Research	Other	Unfunded	Funded (f), partial (p)
Increase # of extension/outreach officers (possible volunteer program)		x			x				
Determine the most effective and appreciated ways to contact or communicate with fishermen					x				
Develop and implement a decentralized and consistent communication process/plan					x				
Determine top subjects/issues that fishermen/stakeholders are interested in and develop outreach information and					x				

materials.									
Set up kiosk at different fishing tournaments (information can be provided and collected)					x				
Pre-introduction consultative process between DAR and legislature for potential bills on marine resource related topics.					x				
Identify and support a place/agency for resource users to obtain reliable, credible, and unbiased information on fisheries related issues within Hawaii by 2009.					x				
Support translation (from scientific jargon) and synthesis of information of key topics related to the fisheries LAS, production of master document.					x				
Semiannual fishers forum for consistent reliable information exchange					x				

Appendix 1: Definitions

Healthy nearshore marine environment – an environment where ecological and genetic diversity is maintained, reef fish populations are at levels that can be sustainably harvested for recreational, commercial, subsistence, and cultural use. All trophic groups and size classes are adequately represented, and the impacts to the habitat are minimized allowing for an increase in standing stock and recruitment.

Effective Management – Effective management balances stakeholder use, including extractive activities, cultural practices, economics (tourism, ecosystem services, etc.), and conservation, and prohibits destructive and indiscriminate fishing methods. Resource management decisions are supported by the public (including fishermen), considerate of traditional values and based on science, enforceability, and results. It also allows for and/or encourages community-based stewardship and managed areas. Effective management requires considering an entire ahupua'a when addressing cause and effects on a coastal marine ecosystem.

Appendix 2: Draft SMART objectives suggested by FLASH steering committee

FLASH Objectives for Goal 1:

O_1: To have useful life history data on a majority (15 out of top 30) of primary target species by 2013.

O_2: To have DOCARE in compliance with Act 226 by 2009. (Prioritize environmental enforcement activities)

O_3: (Zoning) To have 100% of W. Hawaii coastline in a pilot comprehensive zoning plan, including x, y, z, by 2012.

X,y,z, etc. are example of different kinds of zones.

O_4: Have protected 20% of critical/sensitive habitats by 2020.

O_5: (Recreational fisheries) To have statistically valid and useful knowledge for management on all catch and effort for Hawaii's CR fisheries by 2012.

O_6: (Rules and regulations) To have rules and regulations on bag and size limits that are based on DLNR's priorities (in order of priority) and consider human sustenance needs, species (vulnerability, abundance, ecological service, and reproductive contribution), and sound science for a majority of primary resource species by 2012.

Suggested:

By 2012, to have sufficient understanding for management to be able to draft appropriate rules, of the significance and nature of cascading impacts of fishery depletion on other components of reef ecosystems.

To have useful data on status and trends of stocks of a majority (15 out of top 30) of 'resource' species, including food, sport, and aquarium species by 2013.

Implement an effective fishery monitoring regime that captures both the recreational and commercial landings by the end of 2009

Establish and implement within three years, a scientifically acceptable methodology for collecting non-commerical fisheries information appropriate for each island area.

DLNR will have dedicated marine enforcement agents (variable number per island) by the end of 2009.

Determine every three years, the status of two key reef fish species utilizing nationally accepted stock assessment methodologies.

Need to determine what we will define as "healthy" vs. unhealthy ecosystem. For fish, this means determining what population is a sustainable population. We should focus on the top 10 harvested coral reef fish species.

Identify within two years, five *pono* fishery management practices for each island based on guidance from cultural experts, kupuna and other culturally recognized sources of information

SMART objectives for Goal 2:

Suggested:
Improved capacity for local management and enforcement of fisheries regulations.

By March 2009, a council of Oahu? fishermen that represent the various in-shore fishing groups (spear, aquarium, pole & line, gillnet), and government managers & scientist is established and meets quarterly to exchange information and discuss pressing issues.

By January 2009, a 3 year communications plan is developed that outlines a plan on how to collect and disseminate the most up to date scientific (biological & social) information.

By August 2009, an enforcement plan is developed that guides DOCARE officer's activities (i.e. enforcement, outreach, community support) and includes a capacity assessment.

Appendix 3: References

[1] Birkeland, C. 2001. Can ecosystem management of coral reefs be achieved? Pp. 15-18 In B. Best and A. Bornbusch (eds.) *Global trade and consumer choices: coral reefs in crisis*. AAAS, Washington, DC.

[2] Palumbi, S.R. 2004. Fisheries science: Why mothers matter. *Nature* 430: 621-622.

Berkeley, S.A., Chapman, C., and Sogard, S. 2004. Maternal age as a determinant of larval growth and survival in a marine fish, Sebastes melanops. *Ecology* 85(5):1258-1264.

[3] Birkeland, C. 2004. Ratcheting down the coral reefs. *BioScience* 54(11): 1021-1027.

[4] Pauly, D. 2003. Ecosystem impacts of the world's marine fisheries. Global Change Newsletter 55: 21.

[5] Zeller, D., Booth, S., and Pauly, D. 2005. Reconstruction of coral reef and bottom fisheries catches for U.S. flag island areas in the western Pacific, 1950-2002. Final Report. Honolulu: Western Pacific Regional Fishery Management Council.

[6] Smith, M.K. 1993. An ecological perspective on inshore fisheries in the Main Hawaiian Islands. *Marine Fisheries Review*, 55(2): 34-49.

[7] Friedlander, A.M. and Ziemann, D.A. 2003. Impact of hatchery releases on the recreational fishery for Pacific threadfin in Hawaii. *Fishery Bulletin* 101:32-43.

[8] Friedlander, A.M. and Parrish, J.D. 1997. Fisheries harvest and standing stock in a Hawaiian Bay. *Fish. Res.* 32(1):33-50.

[9] Friedlander, A.M. and DeMartini, E.E. 2002. Contrasts in density, size, and biomass of reef fishes between the northwestern and main Hawaiian islands: The effects of fishing down apex predators. *Marine Ecology Progress* 230: 253-264.

[10] Hawaii Division of Aquatic Resources 1998. Current line: Fishing survey summary. Online document <http://www.hawaii.gov/dlnr/dar/pubs/survey98_02.pdf>

[11] Hawaii Division of Aquatic Resources 1988. Main Hawaiian Islands marine resources investigation: 1988 survey (DAR, Honolulu, HI).

[12] Maly, K. and Maly, O. 2003. *A history of fishing practices and marine fisheries of the Hawaiian Islands.* Kumu Pono Associates LLC: Hilo, HI.

[13] Gowensmith, D. 2005. Fishermen outreach program: Hearing from Big Island and Maui fishers about nearshore marine resources on their islands. Fishermen Outreach Program, Community Conservation Network, Honolulu, Hawaii (unpublished).