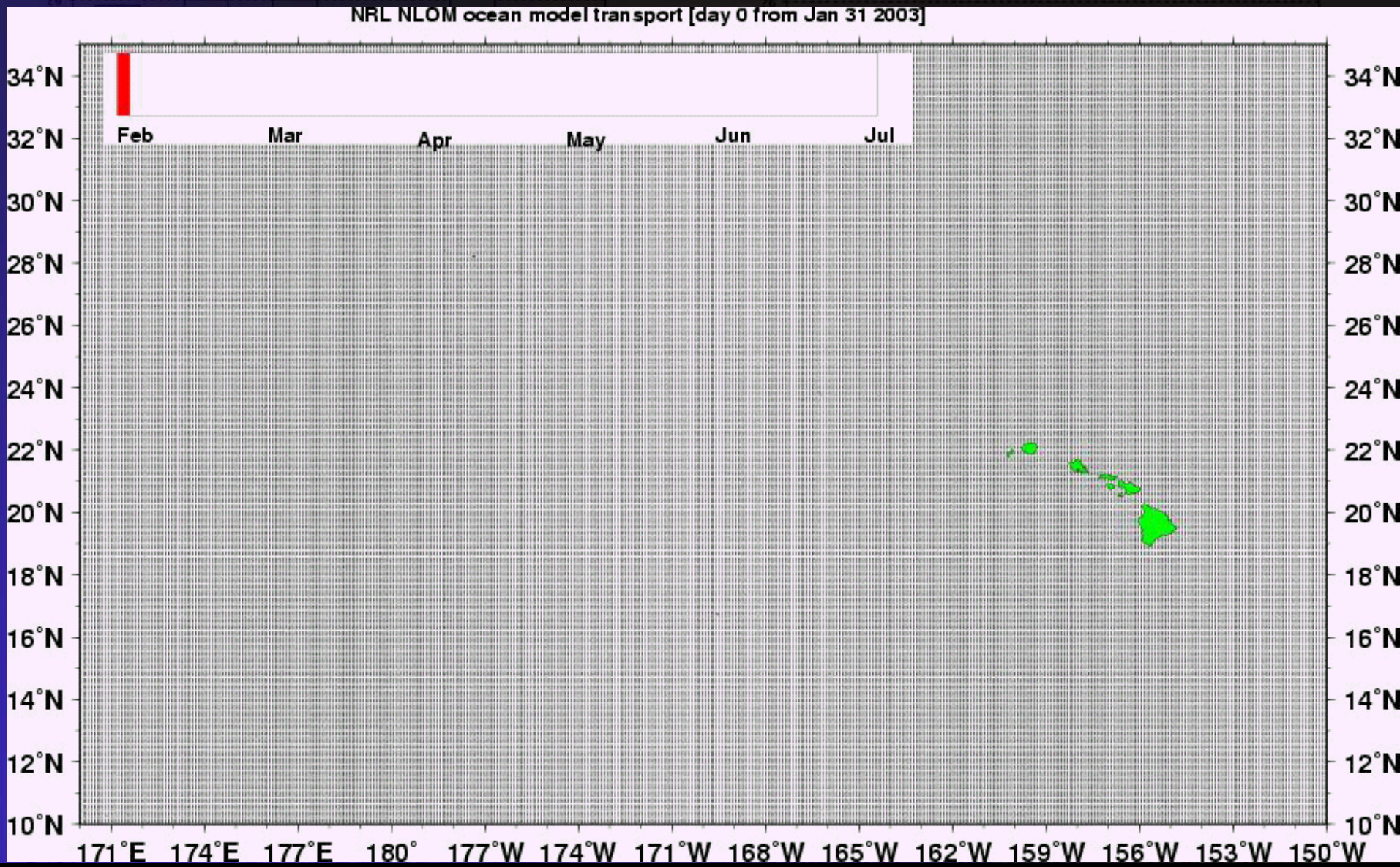
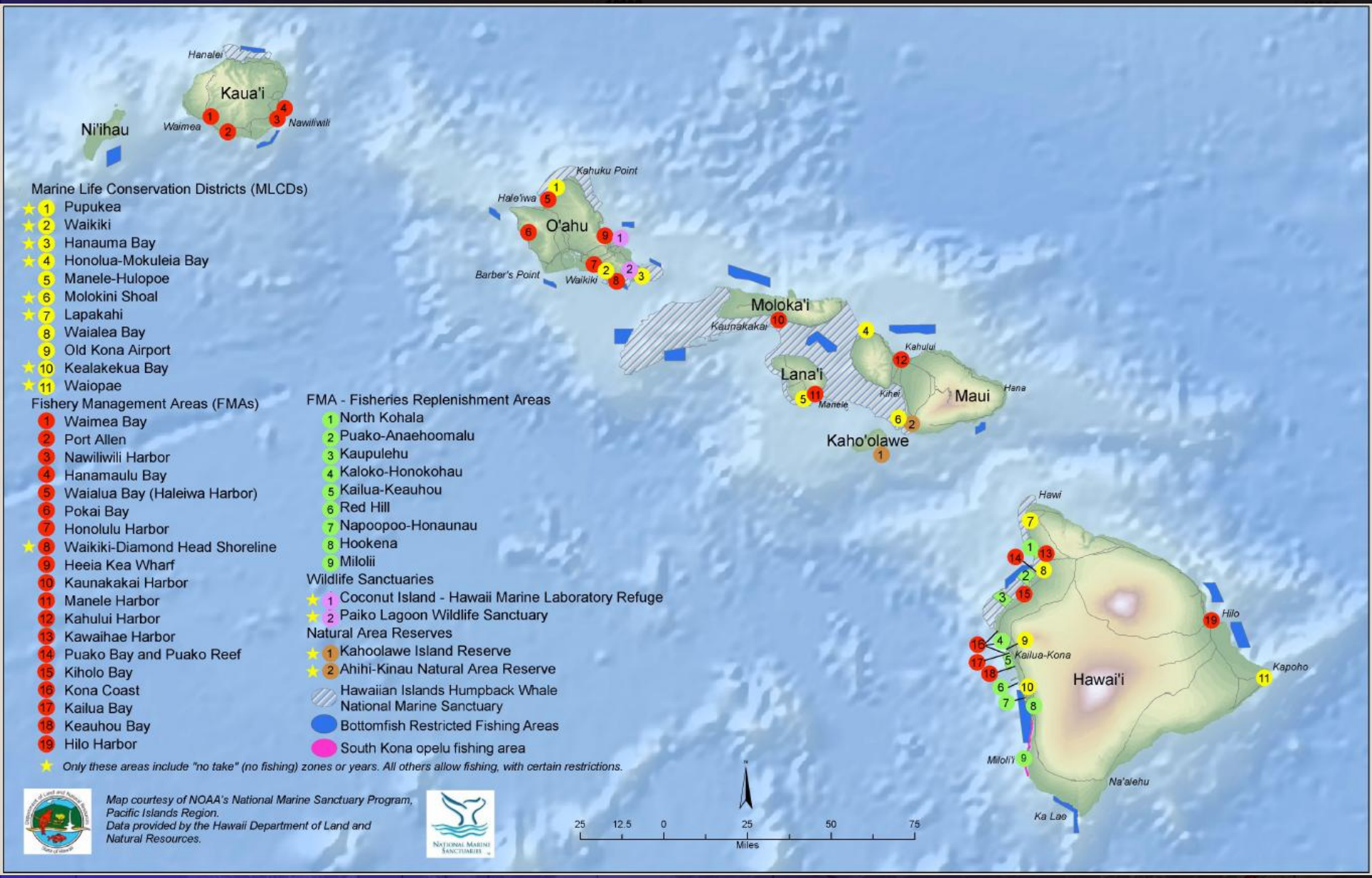
Supplementary material 1.

- Redo NLOM animation
- Additional MHI closures map
- Fishery Council FMP URLs and documents
- Lobster CPUE time series other locations


NRL NLOM ocean model transport [day 0 from Jan 31 2003]
Feb
Mar
Apr
May
Jun
Jul
34°N
32°N
30°N
28°N
26°N
24°N
22°N
20°N
18°N
16°N
14°N
12°N
10°N
171°E
174°E
177°E
180°
177°W
174°W
171°W
168°W
165°W
162°W
159°W
156°W
153°W
150°W


Hanalei
Kaua'i
Ni'ihau
Waimea
Nawiliwili
Kahuku Point
Hale'iwa
O'ahu
Barber's Point
Waikiki
Moloka'i
Kaunakakai
Kahului
Lana'i
Maui
Hana
Maneie
Kihei
Kaho'olawe
Hawi
Hilo
Kailua-Kona
Hawai'i
Kapoho
Miloli'i
Na'alehu
Ka Lae
Marine Life Conservation Districts (MLCDs)
1 Pupukea
2 Waikiki
3 Hanauma Bay
4 Honolua-Mokuleia Bay
5 Manele-Hulopoe
6 Molokini Shoal
7 Lapakahi
8 Waialea Bay
9 Old Kona Airport
10 Kealakekua Bay
11 Waiopae
Fishery Management Areas (FMAs)
1 Waimea Bay
2 Port Allen
3 Nawiliwili Harbor
4 Hanamaulu Bay
5 Waialua Bay (Haleiwa Harbor)
6 Pokai Bay
7 Honolulu Harbor
8 Waikiki-Diamond Head Shoreline
9 Heeia Kea Wharf
10 Kaunakakai Harbor
11 Manele Harbor
12 Kahului Harbor
13 Kawaihae Harbor
14 Puako Bay and Puako Reef
15 Kiholo Bay
16 Kona Coast
17 Kailua Bay
18 Keauhou Bay
19 Hilo Harbor
FMA - Fisheries Replenishment Areas
1 North Kohala
2 Puako-Anaehoomalu
3 Kaupulehu
4 Kaloko-Honokohau
5 Kailua-Keauhou
6 Red Hill
7 Napoopoo-Honaunau
8 Hookena
9 Milolii
Wildlife Sanctuaries
1 Coconut Island - Hawaii Marine Laboratory Refuge
2 Paiko Lagoon Wildlife Sanctuary
Natural Area Reserves
1 Kahoolawe Island Reserve
2 Ahihi-Kinau Natural Area Reserve
Hawaiian Islands Humpback Whale National Marine Sanctuary
Bottomfish Restricted Fishing Areas
South Kona opelu fishing area
Only these areas include "no take" (no fishing) zones or years. All others allow fishing, with certain restrictions.
Map courtesy of NOAA's National Marine Sanctuary Program, Pacific Islands Region.
Data provided by the Hawaii Department of Land and Natural Resources.
25 12.5 0 25 50 75
Miles

Relevant Fishery Council documents

http://www.wpcouncil.org/index.html
http://www.wpcouncil.org/hawaii/bottomfish.htm#BFish_FMP
http://www.wpcouncil.org/hawaii/coralreef.htm#Coral_FMP
http://www.wpcouncil.org/hawaii/crustaceans.htm#Crust_FMP
http://www.wpcouncil.org/hawaii/PreciousCorals.htm#Precious_FMP

http://www.wpcouncil.org/Bottomfish/BSAW2004/Documents/PanelReport.pdf
http://www.wpcouncil.org/bottomfish/Documents/BottomfishOverfishingFSEIS-December2007.pdf
http://www.wpcouncil.org/coralreef/InterimFinalPanelReport/index.html

BottomfishOverfishingFSEIS-December2007.pdf (SECURED) - Adobe Acrobat Professional

Relatively little is known about the reproduction and early life history of deepwater bottomfish in the region. Spawning occurs over a protracted period with peaks from July to September (Haight et al. 1993b). The eggs are released directly into the water column and hatch in three to four days. The planktonic larval phase is thought to last at least 25 days (Leis 1987) and for some species this phase may be considerably longer. For example, the pelagic stage for ʻōpakapaka is believed to last as long as six months (Moffitt and Parrish 1996). Experimental work at the Hawaii Institute of Marine Biology found that ʻōpakapaka eggs incubated at temperatures characteristic of adult habitat did not hatch, but those incubated in water at surface temperatures hatched and were reared for up to four months (C. Kelly, HURL, personal communication). This indicates that surface currents or eddies could play an integral role in the dispersal of some bottomfish larvae.

Larval advection simulation research indicates that larval exchange may occur throughout the Hawaiian Archipelago and that the amount of larval exchange between the NWHI and the MHI is correlated with the duration of the larval phase, with the highest larval exchange occurring with the longest larval phase durations (Kobayashi 1998). The direction of larval exchange is subject to oceanographic circulation patterns as well as large-scale temperature or climate variation, leading to oceanographic regime shifts of different scales (e.g., El Niño, the Pacific Decadal Oscillation). Many such oceanographic events and their resultant impacts to marine ecosystems have been described, including impacts to Pacific pelagic species (Polovina et al. 2001) and other Pacific fisheries including the Hawaiian lobster fishery (Polovina 2005). Data on actual larval exchange rates between the MHI and NWHI are lacking. Preliminary research indicates that genetic connectivity does exist between MHI and NWHI bottomfish species.

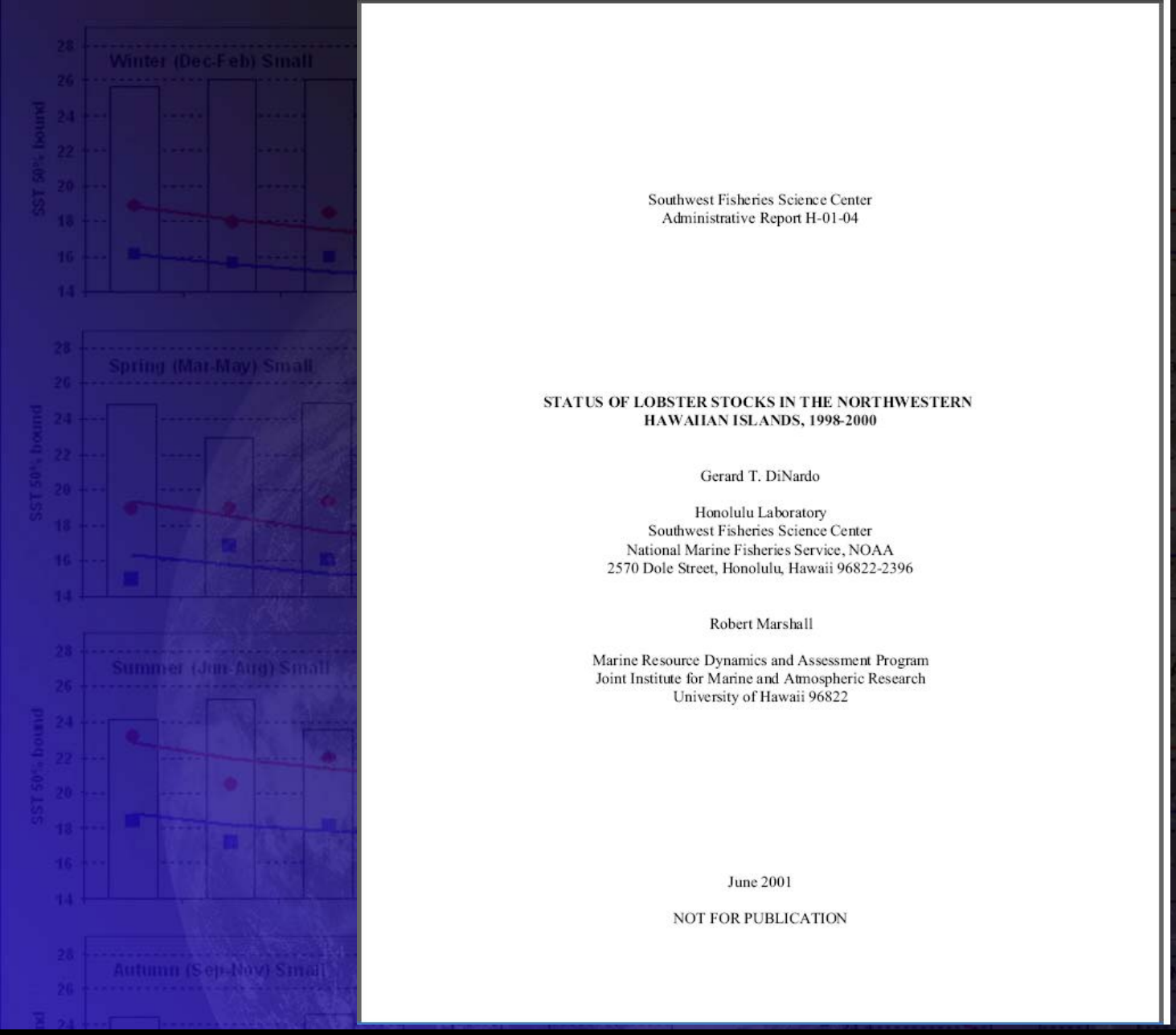
Little is known of the life history of the juvenile fish after settling out of the plankton, but research on ʻōpakapaka (*P. filamentosus)* indicates the juveniles utilize nursery grounds well away from the adult habitat (Parrish 1989). Most of the target species have a relatively high age at maturity, long life span, and slow growth rate. These factors, combined with considerable variation in larval recruitment, make these species more susceptible to overfishing (Haight et al. 1993a).

4.3. Specification of Management Units

Recommendation 4.3: *The Panel recommends the clear articulation of the expected management units for the fishery to guide the refinement of monitoring and sampling strategies, but emphasizes also the importance of seeking maximum coherence of such strategies among management units.*

The degree to which consistency of data collection can be relaxed among the U.S. Western Pacific States and Territories with negligible impact on the assessment outcomes will depend substantially on the domain over which data are to be aggregated and applied for assessments. Thus, the clear definition of the geo-political or administrative units of management will be central to the formulation of data collection guidelines. It also may be appropriate to treat specific areas within State or Territorial jurisdictions as separate management units for primarily administrative, cultural or historical use reasons (*e.g.*, managing the main Hawaiian Islands separately from the northwestern Hawaiian Islands). The assessment and sustainability implications of defining distinct management units and treating data from them separately will depend on the degree of connectivity of harvested populations among such areas, either through adult migration or larval dispersal. Potential connectivity should be explored either by modeling credible scenarios of migration and dispersal or empirical verification of spatial structure in stocks (*e.g.*, via tag-release-recapture, genetics, demographic studies, etc.).

The Panel emphasizes, however, that the identification of different management units (*e.g.*, American Samoa, CNMI, Guam, and Hawaii) or areas within them (*e.g.*, main and northwestern islands of Hawaii) should not be seen as a reason to relax unnecessarily consistency in the design and methods of data collection and analysis. There is great uncertainty about the degree to which populations of the same species in different States and



Southwest Fisheries Science Center
Administrative Report H-01-04

STATUS OF LOBSTER STOCKS IN THE NORTHWESTERN HAWAIIAN ISLANDS, 1998-2000

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Marine Resource Dynamics and Assessment Program
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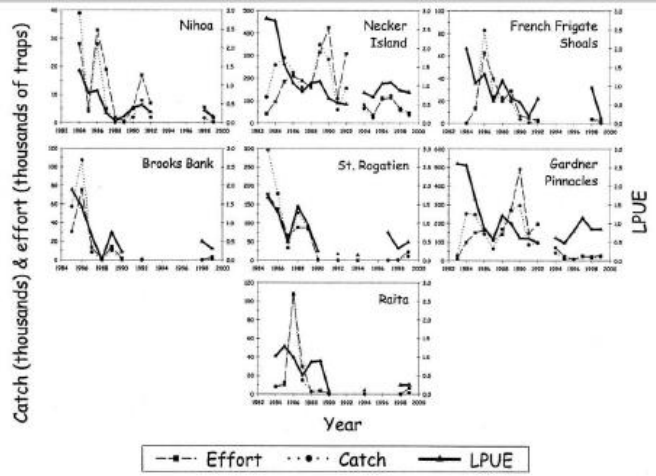
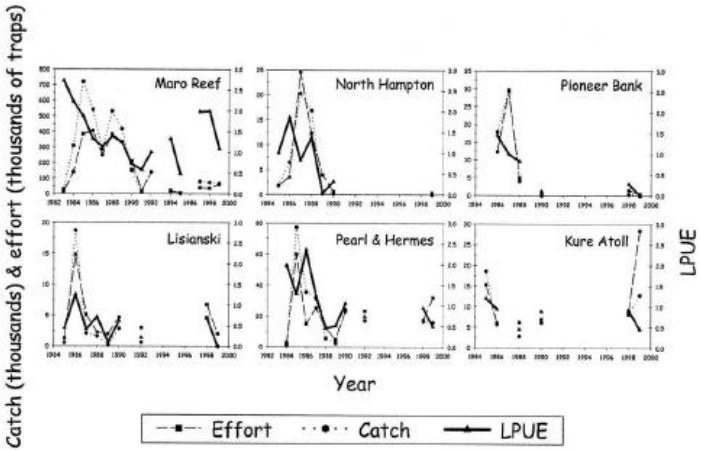
Figure 8a. Bank-specific annual metrics of LPUE, fishing effort (trap hauls) and catch from the NWHI lobster fishery.