

## Central North Pacific Region Green Turtle Summary

Isolated from continental land masses, the Hawaiian chain of islands extends in a linear fashion for 2400 km across a vast oceanic region of the Central North Pacific (CNP). The islands range from the volcanically active island of Hawaii in the southeast at 19° N, 155° W, to diminutive Kure Atoll at the extreme northwestern end of the archipelago (28° N, 178° W) (Figure 1).

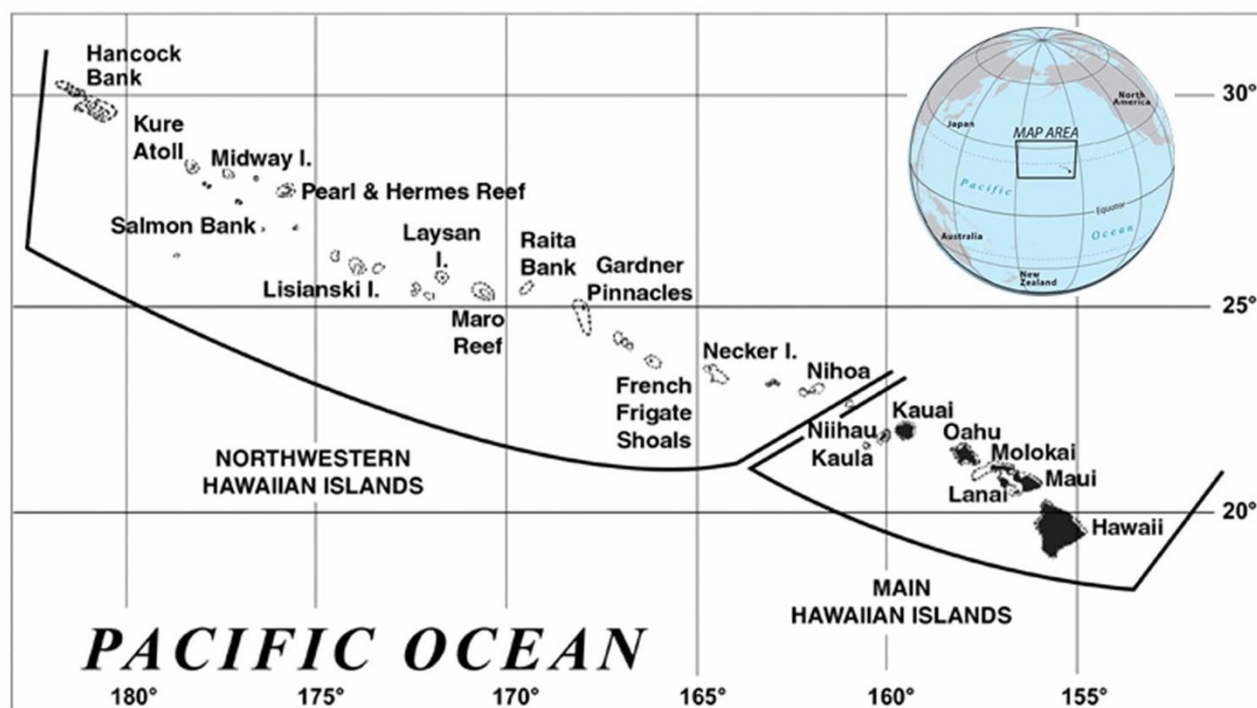


Figure 1. Hawaiian Archipelago

There are eight large and geologically young islands (0.4-5.1 million years) in the southeastern segment of the chain with resident human populations on Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai and Niihau. These eight islands are termed the Main Hawaiian Islands (MHI). There are 1.39 million inhabitants in the MHI with 0.95 million resident to Oahu (Honolulu City & County). About 7.7 million tourists come annually to the MHI for an average visit of 9 days,

with significant numbers lodging at Waikiki on Oahu and Ka'anapali on Maui. The Northwestern Hawaiian Islands (NWHI), extending from Nihoa to Kure, are geologically older (~20-30 million years) representing small remnant tips of extinct submerged volcanoes. The archipelago is therefore slowly sinking and disappearing over geologic time in the northwest, and rising and growing in the southeast. The Hawaiian Archipelago is the most geographically isolated island group on the globe.

The approximate midpoint of the Hawaiian chain is French Frigate Shoals (FFS), a crescent-shaped semi-atoll, 26 km from north to south, located at 24° N, 166° W, in the NWHI. The nearest island to FFS outside the immediate Hawaiian Archipelago, and nearest to any island or reef within the Hawaiian Archipelago, is Johnston Atoll situated 850 km to the south at 17° N, 169° W. Other prominent islands and continental land masses of substantially greater distances from FFS, but nevertheless among the nearest neighbors to the Hawaiian Archipelago, include: to the east, Clarion Island (5350 km) and Michoacán, Mexico (6600 km); to the south, Palmyra (2050 km), Kirimati Island (3000 km) and Kanton Island, Republic of Kiribati (3020 km), and Rose Atoll, American Samoa (4250 km); and to the southwest, Bikar, Republic of the Marshall Islands (2800 km).

The CNP Region of the Hawaiian Archipelago, including Johnston Atoll, is inhabited by green turtles that are geographically discrete in their normal range and movements, as evidenced by mark-recapture studies using flipper tags, microchip tags and satellite-linked transmitter tracking.

From 1965-2013, 17,536 green turtles have been tagged involving all post-pelagic size classes from juveniles to adults. With only three exceptions, the 7,360 recaptures of these tagged turtles have been made within the Hawaiian Archipelago. The three outliers involved a recovery in Japan, the Marshall Islands and the Philippines.

The principal nesting site of Hawaiian green turtles for over 200 years has been and continues to be FFS (See Balazs 1980, Lipman and Balazs 1983, Kittinger et al. 2013). Within the FFS, 5 hectare East Island accounts for ~50% of seasonal (May-September) nesting, while other islets of FFS - Tern, Trig, Gin, Little Gin - account for the other ~50% of nesting. Whale-Skate, joined by sand deposition between the former islets of Whale and Skate in the 1950's, eroded and became submerged in the mid-1990's. Information from tagging at FFS and areas in the MHI, and in the NWHI to the northwest of FFS, and at Johnston Atoll, show that reproductive females and males periodically migrate to FFS for seasonal breeding from these distant locations. At the end of the season they return to their respective foraging areas. In the overall picture FFS therefore represents the prominent focal point of green turtle nesting and hatchling production in the Hawaiian Archipelago. Satellite tracking of the reproductive migrations of 19 green turtles (16 females and 3 males) shown in Figure 2 illustrate the prominence of FFS to the CNP Region. Figures 3a-s show the satellite tracking for each of the 19 turtles. All involved movements from or to FFS and the MHI. Conventional tagging using microchips and metal flipper tags has resulted in the documentation of 164 turtles making reproductive movements from or to FFS and foraging pastures in the MHI, and 58 turtles from or to FFS and the foraging pastures in the NWHI (Table 1).

A 40-year upward trend in nester abundance (Balazs and Chaloupka 2006, Chaloupka et al. 2008, and Tiwari et al. 2010) has been shown at FFS using East Island as the index beach where systematic full season (1988-1992) and partial season monitoring and tagging have occurred from 1973-2012. In 1973, 67 nesters were directly counted at East Island. In 2011, 808 nesters were directly counted (Figure 4, Table 2 – see Wetherall et al. 1998). Figure 5 illustrates reproductive longevity for nesters tagged at FFS from 1965-2012. 56 of the 2077 turtles have been documented nesting from 25-38 years after initial tagging.

Tiwari et al. (2010) calculated that, even with the impacts from projected climate change, nesting abundance at East Island is well below carrying capacity. However, Wabnitz et al. (2010), using Ecopath Ecosim modeling, determined that a representative green turtle foraging pasture in the MHI (Kaloko-Honokohau on the west coast of the island of Hawaii) was already at carrying capacity in terms of algal grazing. This finding is consistent with the exceptional slow and decreased rates of somatic growth documented at Kaloko-Honokohau, Kiholo Bay (Balazs and Chaloupka 2004), and numerous other locations along the west Hawaii island coast and, to a lesser extent, at other heavily-used green turtle foraging pastures studied in the MHI. Growth rates of immature green turtles at the mainly marginal algal foraging pastures and underwater refugia in the NWHI have historically been exceptionally slow (Balazs 1980) since the initiation of studies in the mid-1960's.

Nesting by green turtles occurs at the NWHI's of Laysan, Lisianski, Pearl and Hermes Reef, and very uncommonly at Midway and Kure. The level of nesting at all these sites is low but presently inadequately quantified. Remoteness and isolation have resulted in the inability and/or unwillingness to devote limited research resources (personnel and money) to seasonally monitor in a comprehensive fashion the handful of nesters at these far-flung locations. Potentially up to five green turtles nest annually at each of the three locations of Laysan, Lisianski and Pearl and Hermes Reef, and one-to-none nest annually at Midway and Kure. Historical >1776 abundance of green turtle nesting in the NWHI is problematic other than at FFS. Sites to the northwest of FFS are now known to represent foraging pastures for turtles that migrate to nest at FFS. Past harvests of turtles (circa 1800's to mid-1900's) involved mainly baskers - easy to turn over when resting along the shoreline during the day and at night - hence most likely representative of resident foraging aggregations occurring year-round in the NWHI.

Green turtle nesting now occurs in the MHI (Dutton et al. 2008, Frey et al. 2013) albeit at low levels <1-2 nesters annually at widespread numerous locations (Figure 6). At Kawa'aloa, Molokai up to four nesters per year has been estimated. No nesting had been known within traditional Hawaiian history by families of the Kawa'aloa region prior to the late 1980s. The historical harvest of green turtles over 700 years of transitioning Hawaiian settlements (1250-1950) could easily have involved basking turtles. Starting in the early 1990s, all sizes of post-pelagic green turtles have begun basking (or resumed basking after cessation <1776) in widespread impressive numbers, increasing in geographic range and magnitude, throughout the MHI (Figure 7). Green

turtle basking also occurs throughout the NWHI albeit at low levels, however basking occurrences can increase to 200+ at FFS during the nesting season (Figure 8).

A long term trend (1980's-2012) of declining prevalence of green turtle fibropapiloma disease has occurred in the Hawaiian Islands (Chaloupka et al 2009, Franke et al. 2013, Van Houtan et al. 2010)

The Central North Pacific Region, inclusive of the Hawaiian Archipelago/Johnston Atoll and the green turtle nesting and foraging aggregations, has been designated a global Regional Management Unit by Wallace et al. 2010. The IUCN has designated Hawaiian green turtles as a Red List Subpopulation (Pilcher et al. 2012).

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**TABLE 1. Recovery records of green turtles observed or originally tagged at French Frigate Shoals, Northwestern Hawaiian Islands.**

Prepared by Irene Nurzia-Humburg and George Balazs,

NOAA PIFSC & JIMAR PSD Marine Turtle Research Program, April 2013.

We present a concise report on tag recoveries for individual green turtles associated with the French Frigate Shoals (FFS) breeding colony and originally tagged or recaptured at another island within the Hawaiian Archipelago and Johnston Atoll. These data build upon and significantly expand the tag recovery records reported 30 years ago by Balazs (1983). The updating and publication of a register of tag recovery records through 2013 is currently underway by Nurzia-Humburg and Balazs.

Records summarized below span data available as of March 2013 dating back to 1966.

A total of 329 turtles have been seen at both French Frigate Shoals and another island within the Hawaiian chain.

Of these, 220 were either first seen and tagged breeding at French Frigate Shoals or on a different island within Hawaii as adults then re-sighted at French Frigate Shoals in subsequent years.

We can further break down the 220 turtles above by describing that 163 of them were originally tagged at French Frigate Shoals; of these, 137 were re-sighted at one of the Main Hawaiian Islands (Kauai, Molokai, Oahu, Maui, Hawaii) while 26 were subsequently seen elsewhere along the Northwestern Hawaiian Islands (Kure, Midway, Pearl and Hermes Reef, Laysan, Lisianski, Necker) or at Johnston Atoll.

Considering the opposite direction of movement, 57 of the 220 turtles were first tagged in the Hawaiian chain somewhere other than FFS and subsequently seen nesting within FFS. More specifically, 31 migrated to FFS from another island in the Northwestern Hawaiian Islands, and 26 were originally tagged at one of the Main Hawaiian Islands.

**TABLE 1 (Continued).**

In the tables below, we present the breakdown by island of all 220 turtles.

	<b>FROM FFS</b>	<b>TO FFS</b>	<b>TOTALS</b>
<b>MOLOKAI</b>	2	9	11
<b>KAUAI</b>	12	1	13
<b>OAHU</b>	56	11	67
<b>LANAI</b>	0	0	0
<b>MAUI</b>	53	1	54
<b>HAWAII</b>	15	4	19

	<b>FROM FFS</b>	<b>TO FFS</b>	<b>TOTALS</b>
<b>LISIANSKI</b>	9	6	15
<b>LAYSAN</b>	8	2	10
<b>KURE</b>	0	1	1
<b>JOHNSTON</b>	0	3	3
<b>MIDWAY</b>	3	3	6
<b>NECKER</b>	0	2	2
<b>PHR</b>	6	15	21

Please note: the numbers listed above add up to 222, not 220; this is because turtle ID 5579 has been seen at FFS, Lisianski and Pearl and Hermes; turtle ID 3795 has been seen at FFS, Maui and Oahu. We kept the numbers in the tables to show the directionality of the movement from FFS accurately, but have counted each turtle as one individual in the totals previously listed.

The remaining 109 of 329 turtles were tagged as juveniles at one of the Main Hawaiian Islands, and subsequently encountered nesting at French Frigate Shoals (Hargrove and Balazs, 2011). Therefore the total number of turtles originally tagged on the Main Hawaiian Islands and subsequently seen at FFS, regardless of size class, is 135.

We did not further analyze records for these 109 turtles, and the breakdown by island is not included in the table above for these animals. These data are currently being examined by Hargrove and Balazs.

**Table 2.** Estimated number of green turtles nesting at East Island, French Frigate Shoals, 1973-2012 (shaded area indicates saturation surveys)

<u>Year</u>	<u>Survey nights</u>	<u>Turtles ID'd</u>	<u>Estimated nesters</u>
1973	43	66	67
1974	59	104	105
1975	30	111	120
1976	13	24	39
1977	9	44	82
1978	11	66	101
1979	13	55	77
1980	20	45	52
1981	23	127	149
1982	19	111	130
1983	17	28	35
1984	20	157	199
1985	18	131	162
1986	29	59	69
1987	26	124	143
1988	101	180	180
1989	143	294	294
1990	133	150	150
1991	119	107	107
1992	129	384	384
1993	31	181	191
1994	26	122	132
1995	31	240	252
1996	31	349	367
1997	33	481	504
1998	32	61	64
1999	31	198	209
2000	33	337	353
2001	31	295	314
2002	34	447	467
2003	41	213	219
2004	38	534	548
2005	40	336	344
2006	35	409	423
2007	33	334	348
2008	43	580	589
2009	36	270	295
2010	23	227	278
2011	35	808	843
2012	28	402	439

Table 2. (Continued).

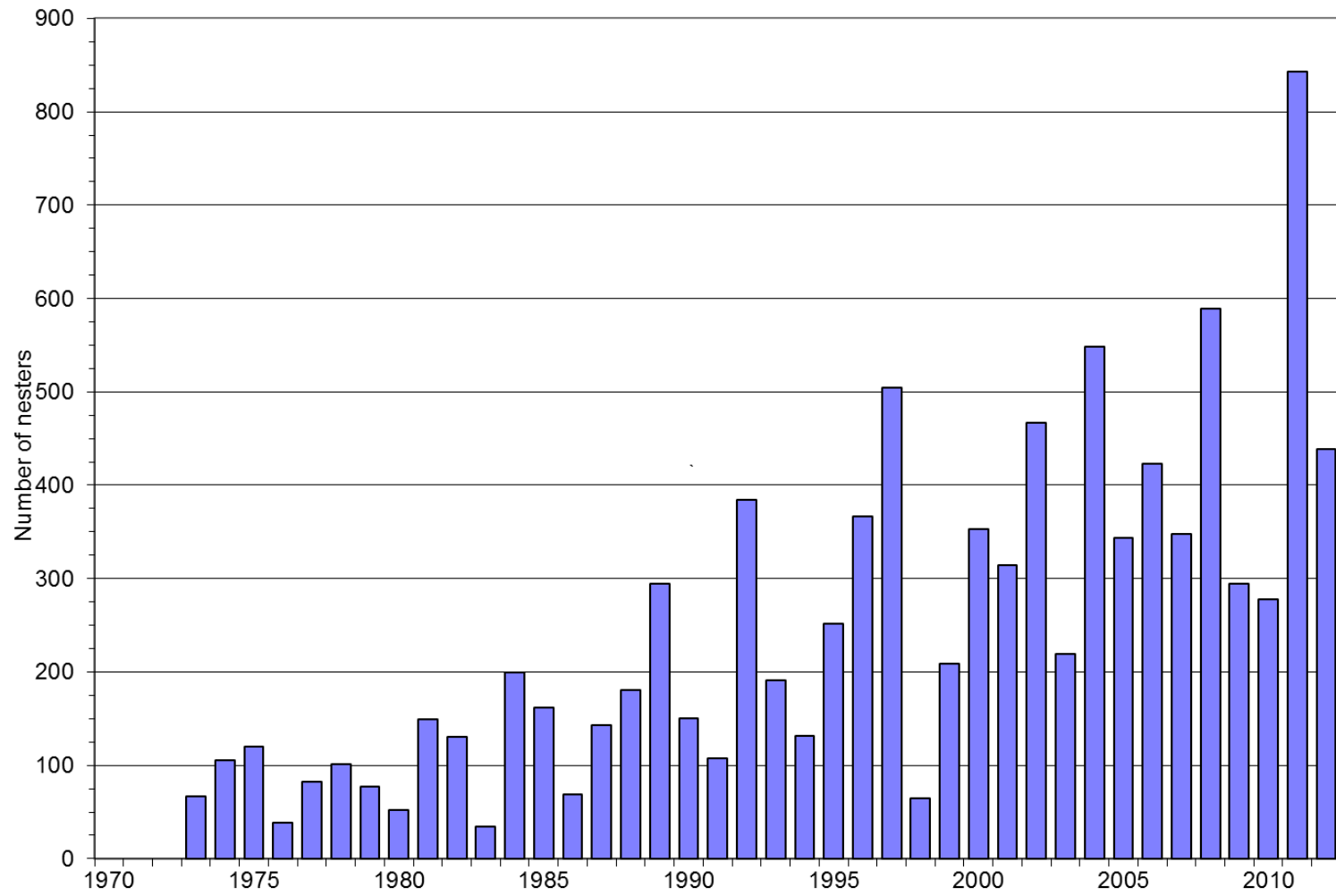
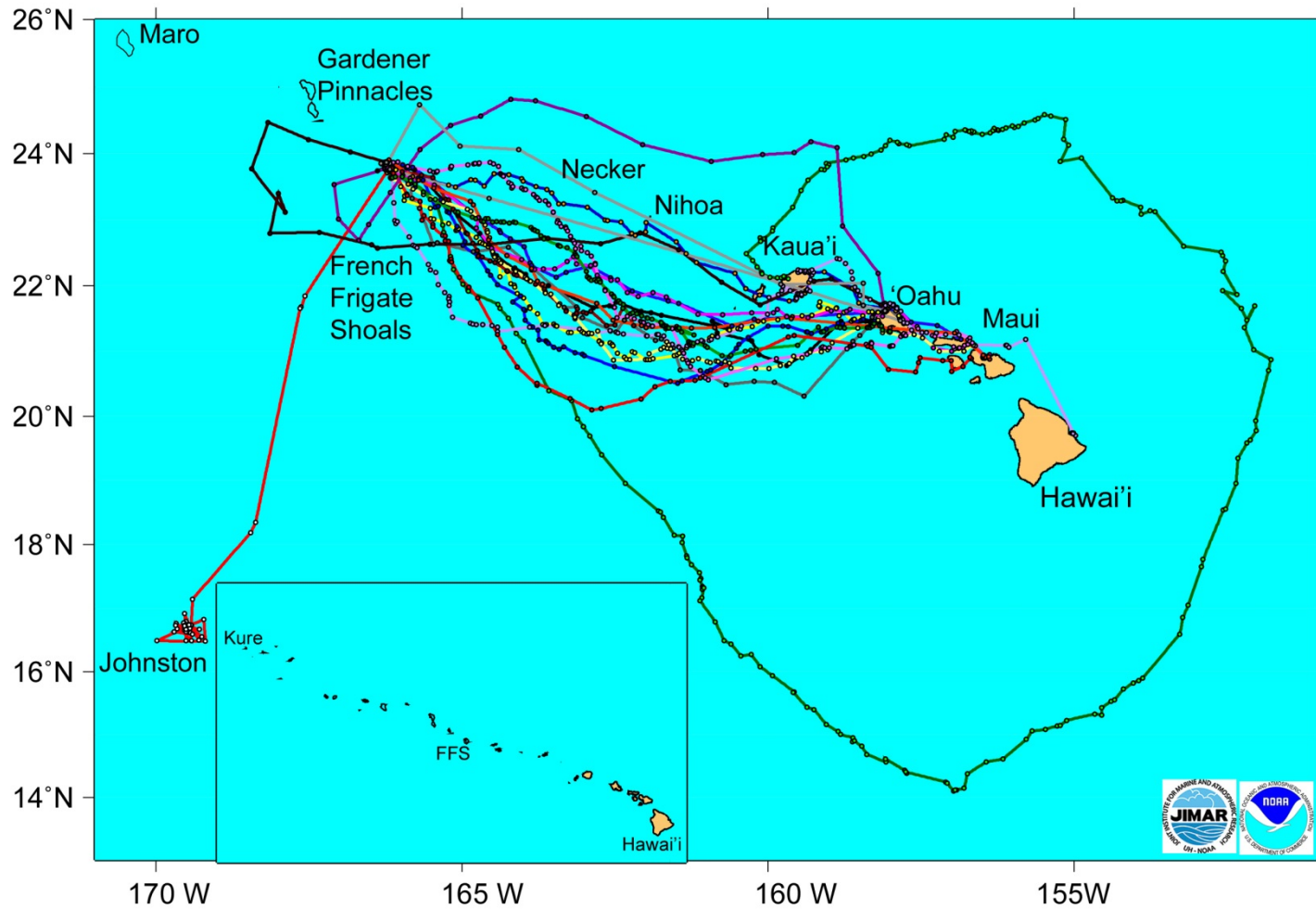


Figure 2.

Satellite tracking of the reproductive migrations of 19 green turtles. Fourteen female and two male green turtles tracked from French Frigate Shoals to foraging areas in the Main Hawaiian Islands, and two females and one green turtle tracked from foraging areas on Oahu to French Frigate Shoals.

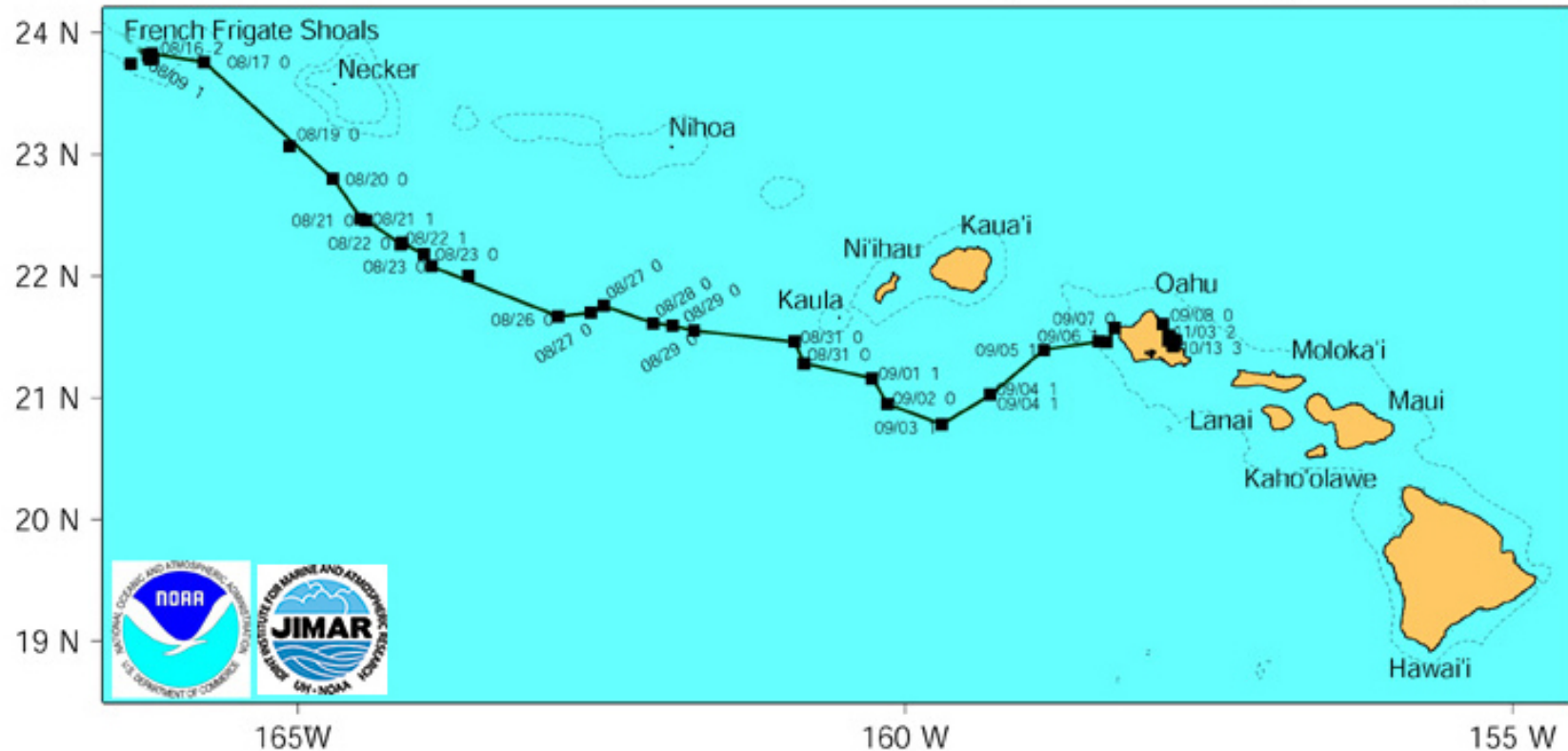


GMT map created by Denise Parker 04/2013  
 NOAA, NMFS, PIFSC  
 Trackings by G. H. Balazs

Figure 3a.

1992 Post-nesting migration of green turtle 4800 from French Frigate Shoals to Kaneohe Bay, Oahu in the Main Hawaiian Islands

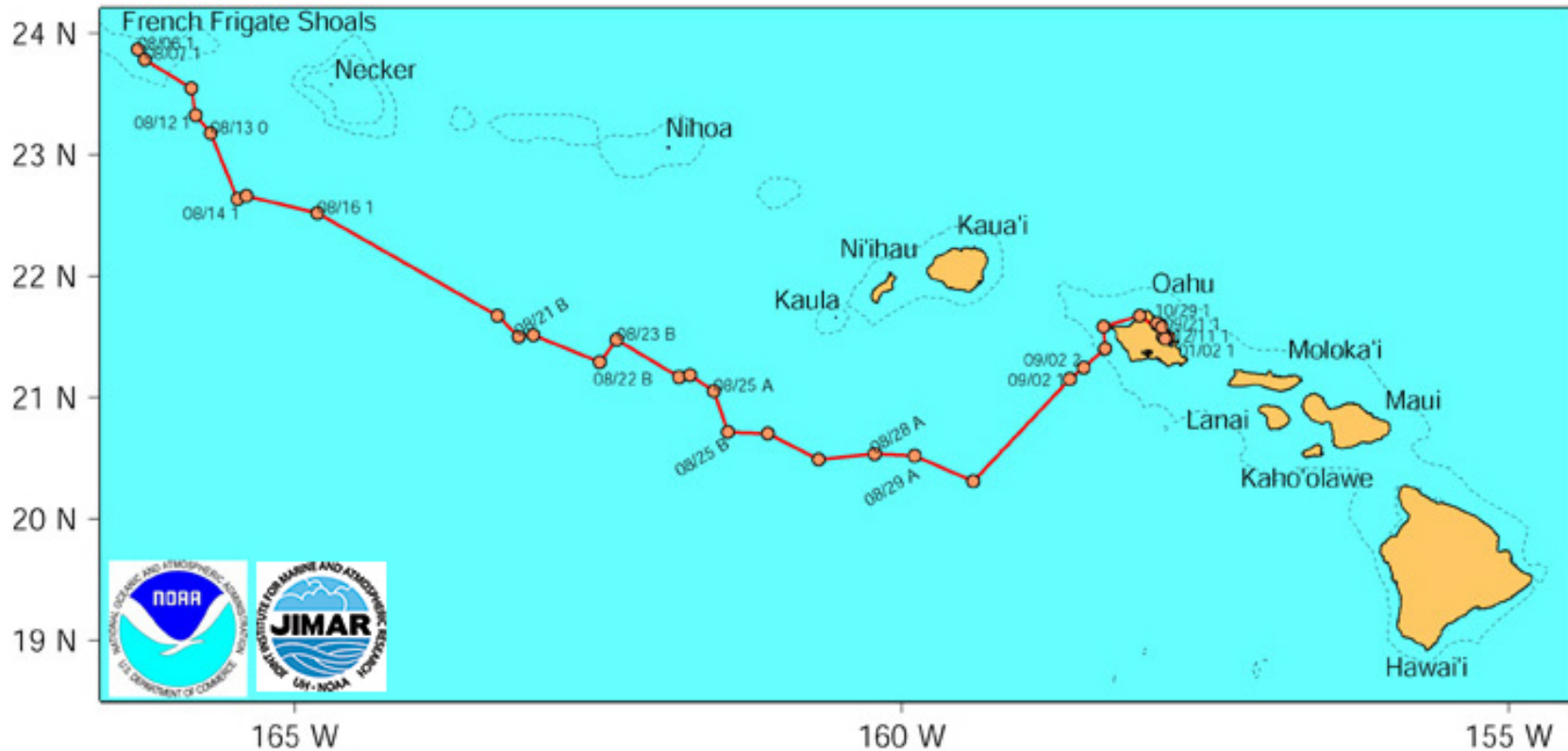
SCL: 87.0 Distance Traveled: 1130 km Days Transmitting: 140 days



**Figure 3b.**

1992 Post-nesting migration of green turtle 4801 from French Frigate Shoals to Kaneohe Bay, Oahu, Main Hawaiian Islands

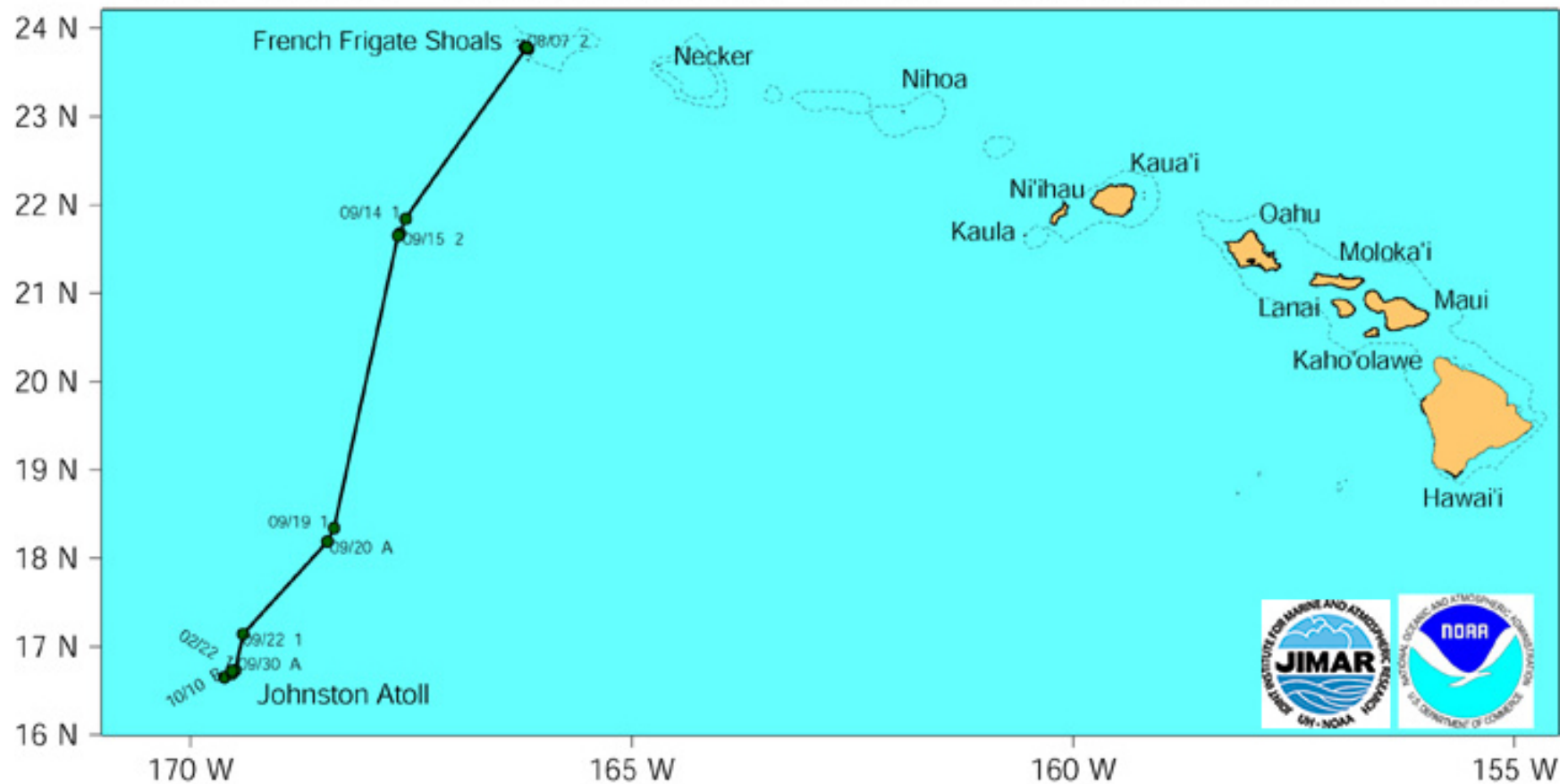
SCL: 85.0 cm    Distance Traveled: 1260 km    Days Transmitting: 286 days



**Figure 3c.**

1992 Post-nesting migration of green turtle 4802  
from French Frigate Shoals to Johnston Atoll, USA

SCL: 91.0 cm Distance Traveled: 830 km Days Transmitting: 206 days

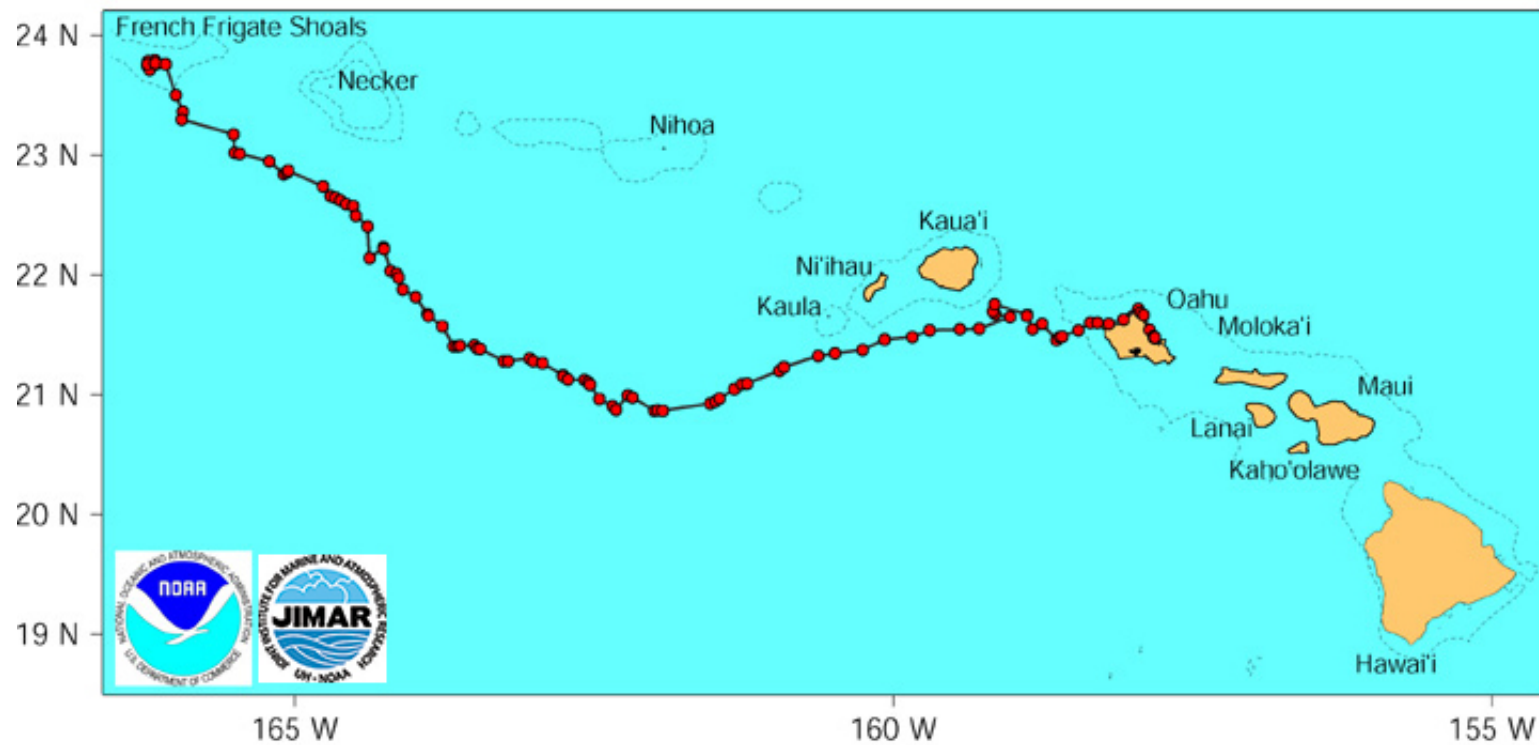


GMT map created by Denise Ellis 06/10/98



**Figure 3d.**

1993 Post-nesting migration of green turtle 4803  
 from French Frigate Shoals to Kaneohe Bay, Oahu, Main Hawaiian Islands  
 SCL: 90.1 Distance Traveled: 1180 km Days Transmitting: 138 days



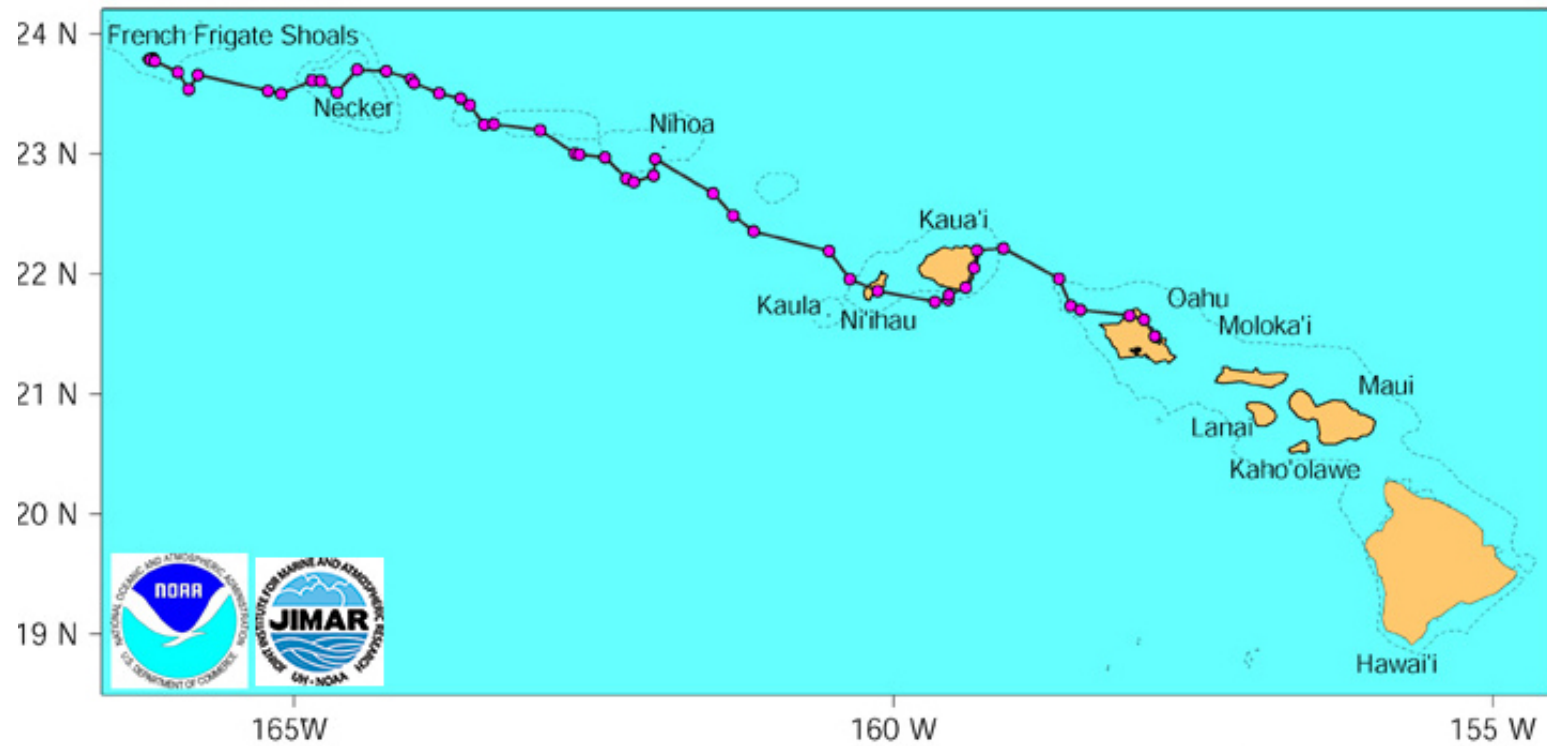
GMT map created by Denise Parker 10/10/03

**Figure 3e.**

1993 Post-nesting migration of green turtle 4804

from French Frigate Shoals to Kaneohe Bay, Oahu, Main Hawaiian Islands

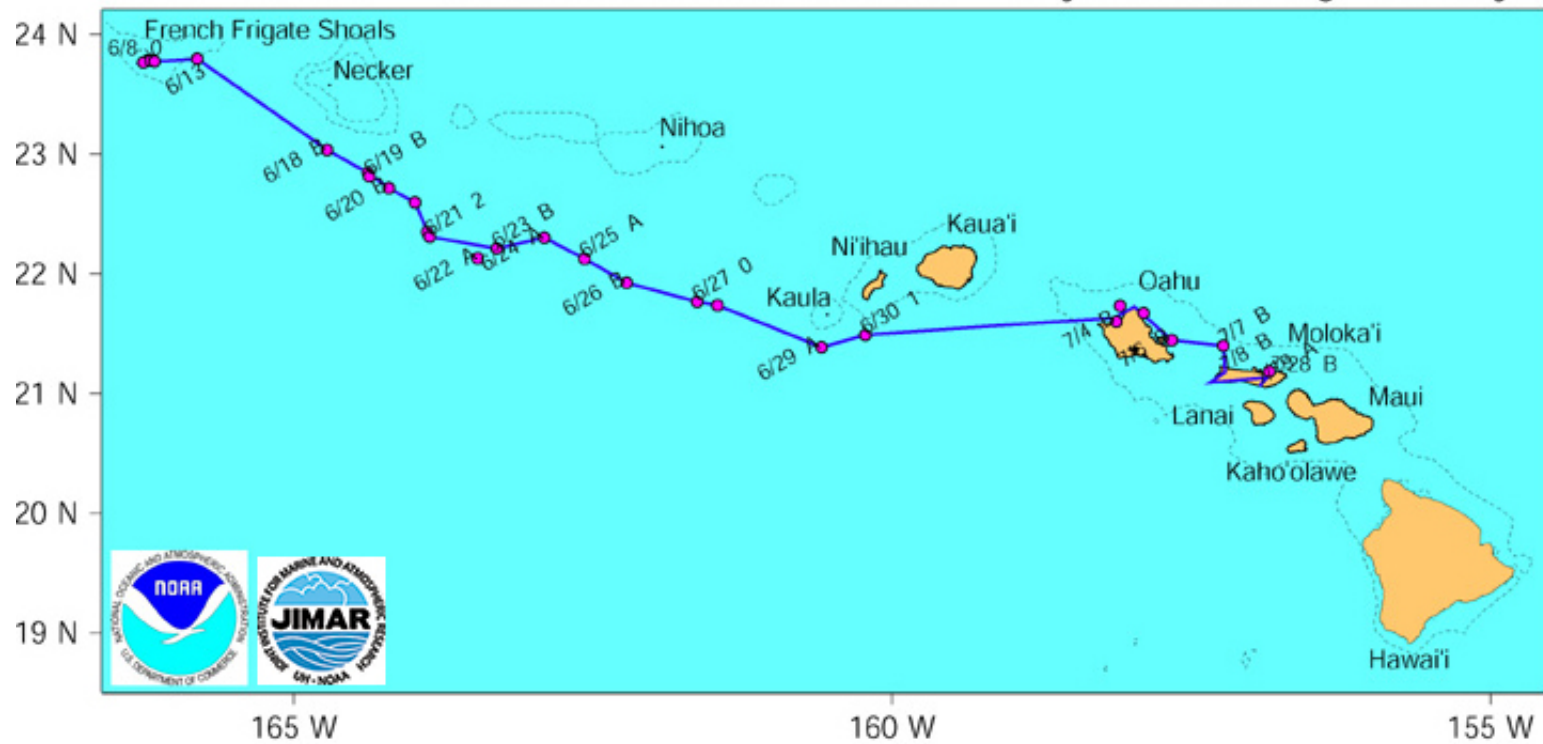
SCL: 90.4 cm Distance Traveled: 1100 km Days Transmitting: 136 days



GMT map created by Denise Parker 10/09/03

Figure 3f.

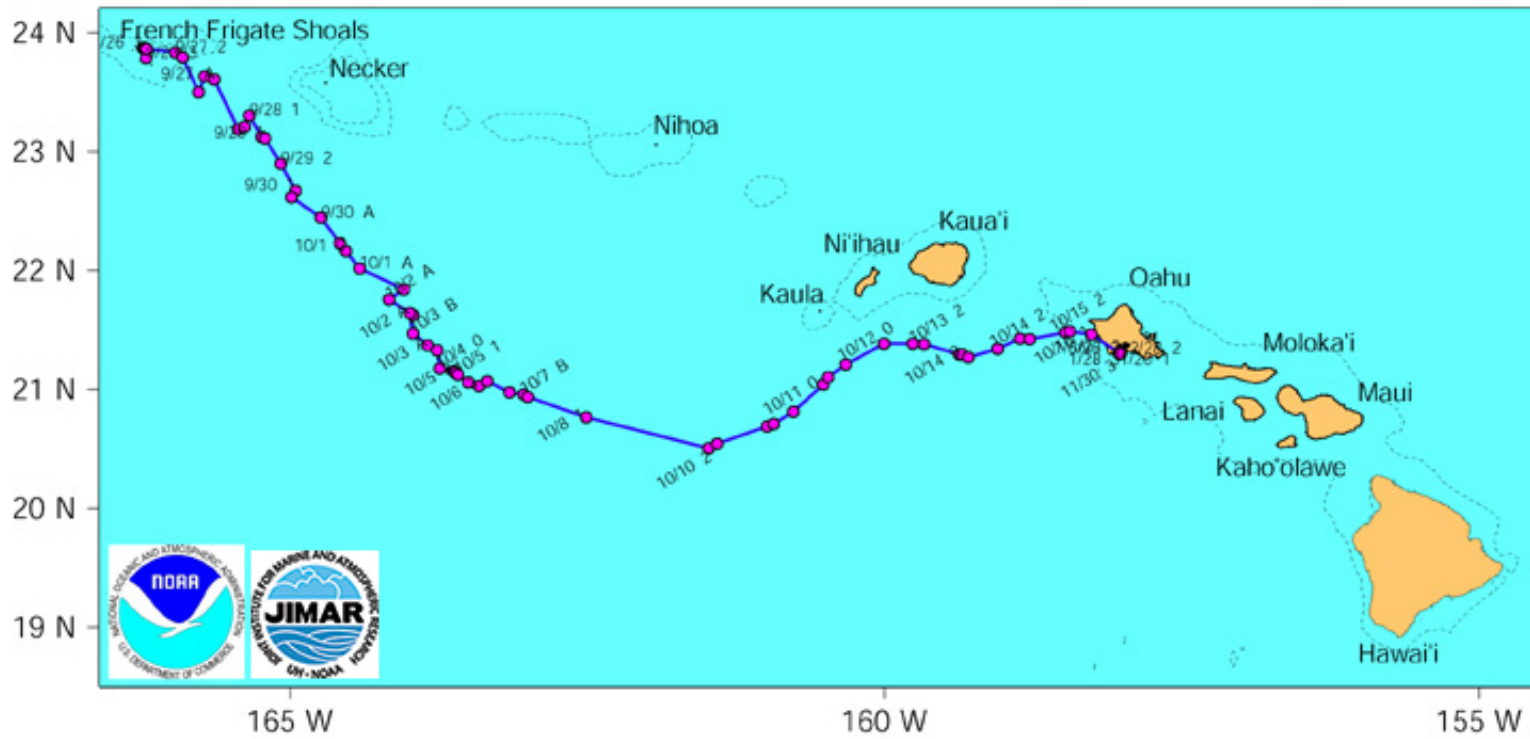
Post-nesting migration of male green turtle 22125  
 from French Frigate Shoals to Panahaha, Molokai, Main Hawaiian Islands  
 SCL: 86.0 cm Distance Traveled: 1050 km Days Transmitting: 201 days



GMT map created by Denise Parker 10/09/03

Figure 3g.

Post-nesting migration of female green turtle 22132  
from French Frigate Shoals to Ewa Beach, Oahu, Main Hawaiian Islands  
SCL: 98.0 cm Distance Traveled: 1050 km Days Transmitting: 286 days

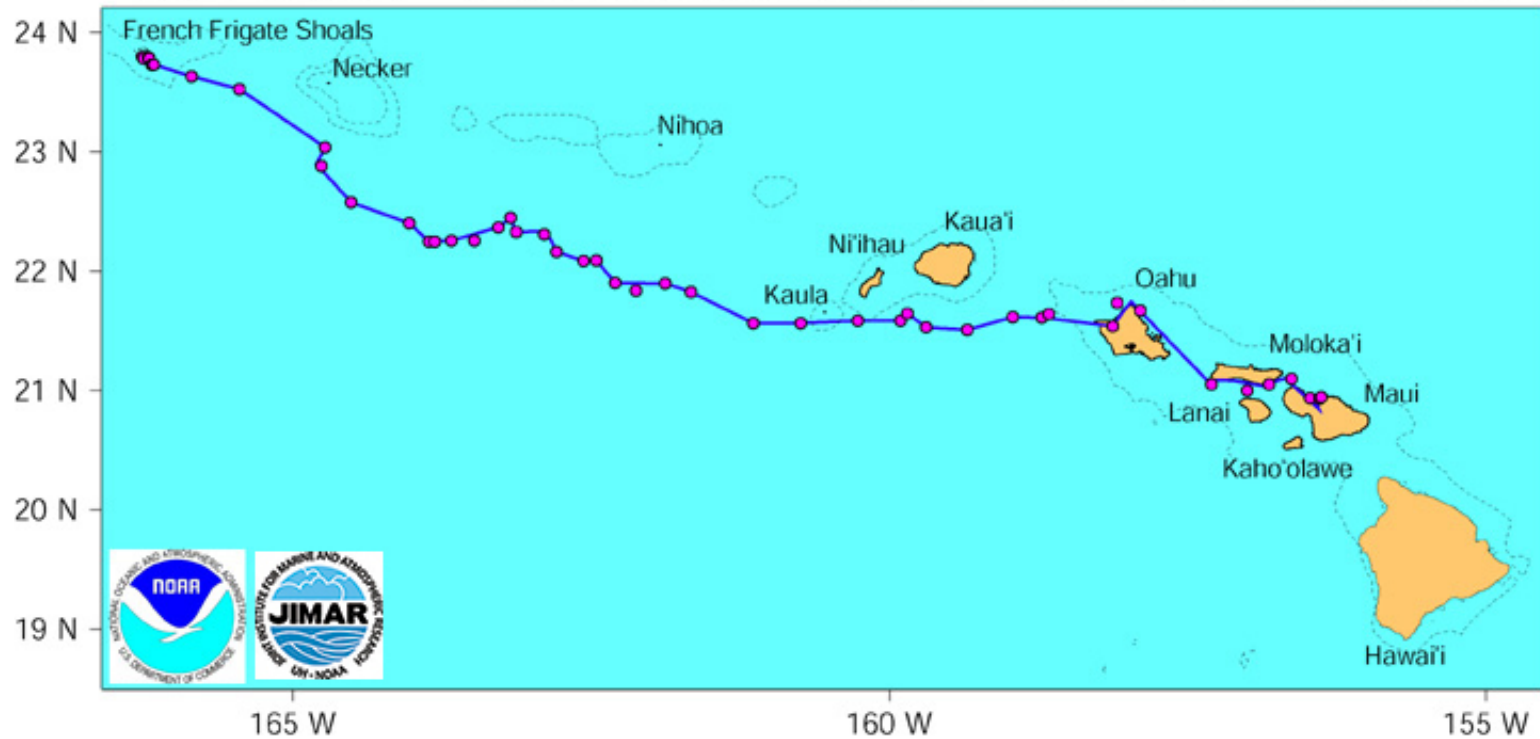


GMT map created by Denise Parker 10/09/03

**Figure 3h.**

Post-nesting migration of male green turtle 22133  
from French Frigate Shoals to Kahului, Maui, Main Hawaiian Islands

SCL: 87.0 cm Distance Traveled: 1200 km Days Transmitting: 54 days



GMT map created by Denise Parker 10/09/03

**Figure 3i.**

1997 Post-nesting migration of green turtle 24195 from French Frigate Shoals to Makaha Point, Kauai, Main Hawaiian Islands

SCL: 94.0 cm Distance Traveled: 3936 km Days Transmitting: 114 days

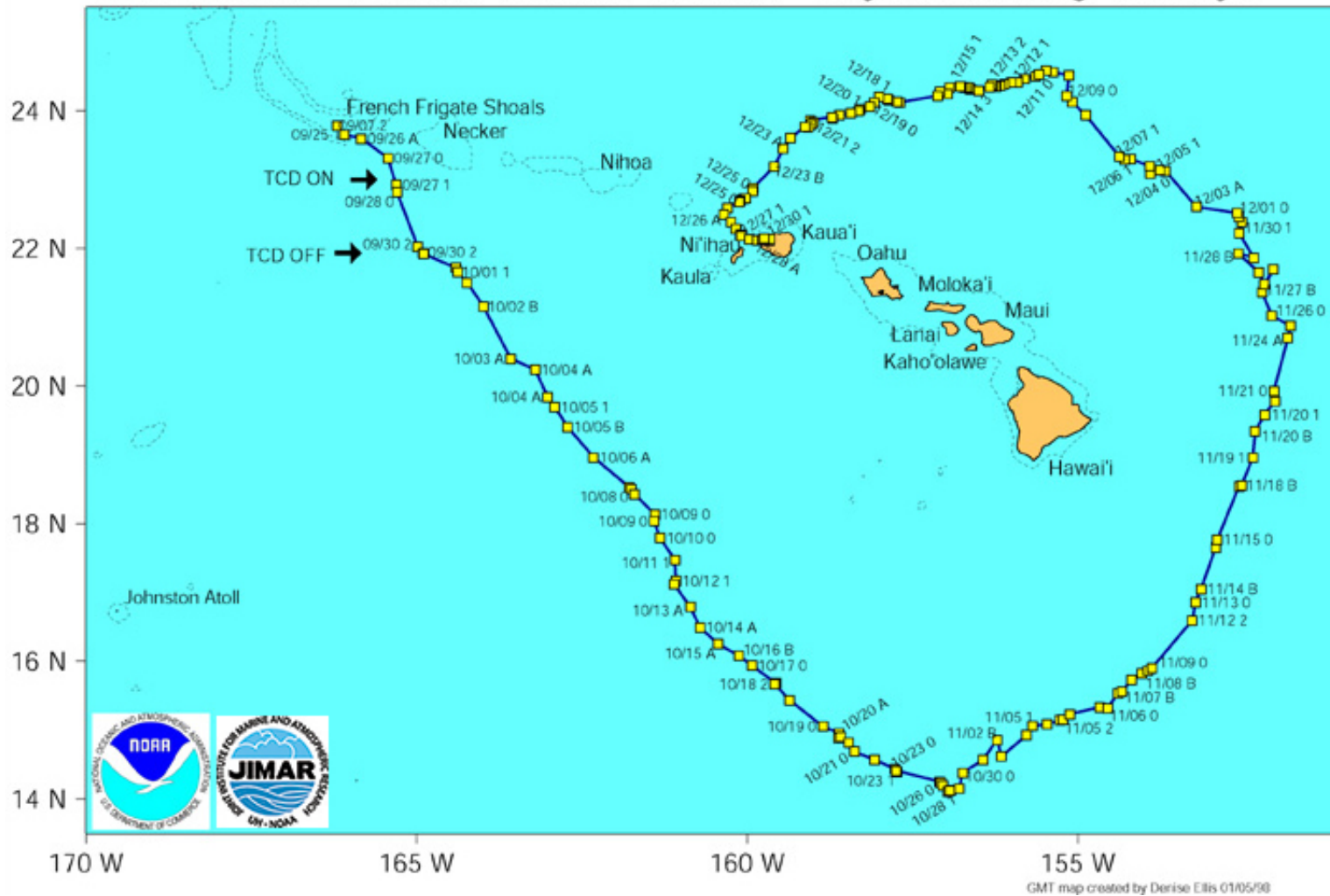
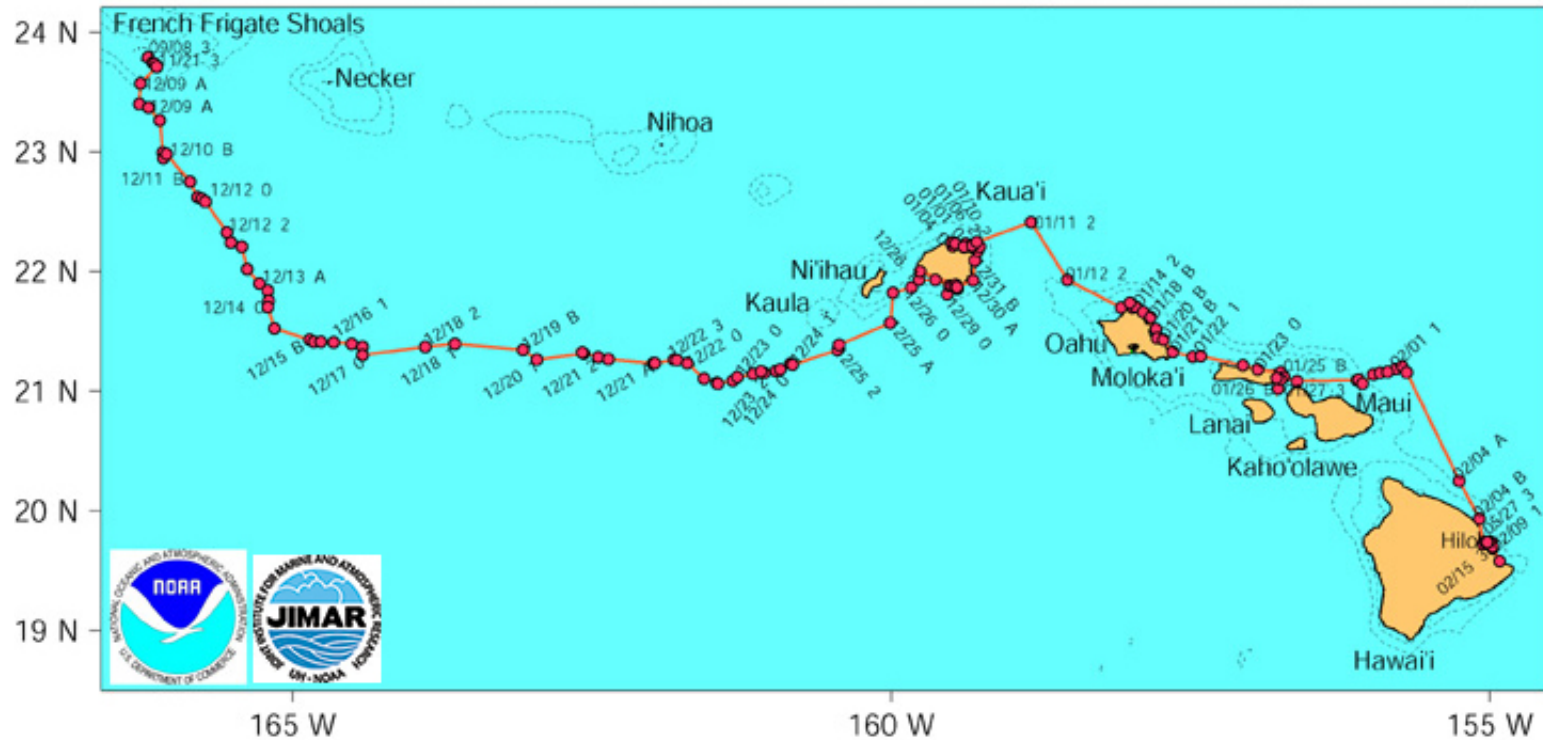


Figure 3j.

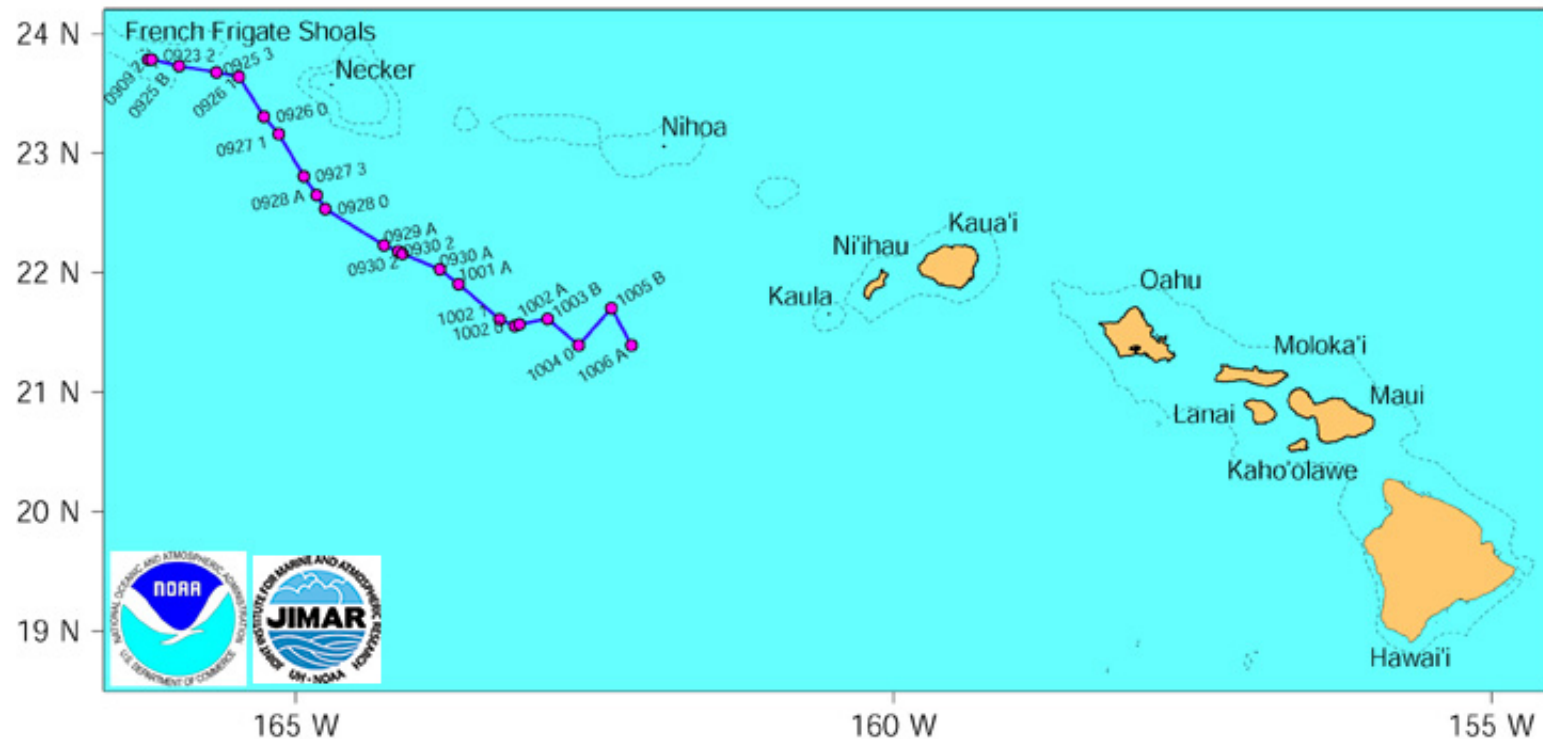
1997-98 Post-nesting migration of green turtle 24196  
 from French Frigate Shoals to Leleiwi, Hilo, Island of Hawaii  
 SCL: 81.8 cm Distance Traveled: 1721 km Days Transmitting: 261 days



**Figure 3k.**

1997 Post-nesting migration of green turtle 24197  
from French Frigate Shoals to the Main Hawaiian Islands

SCL: 95.0 cm Distance Traveled: 541 km Days Transmitting: 27 days



GMT map created by Denise Parker 10/09/03



**Figure 31.**

1997 Post-nesting migration of green turtle 24198 from French Frigate Shoals to Kahului Bay, Maui in the Main Hawaiian Islands

SCL: 87.5 cm Distance Traveled: 1297 km Days Transmitting: 71 days

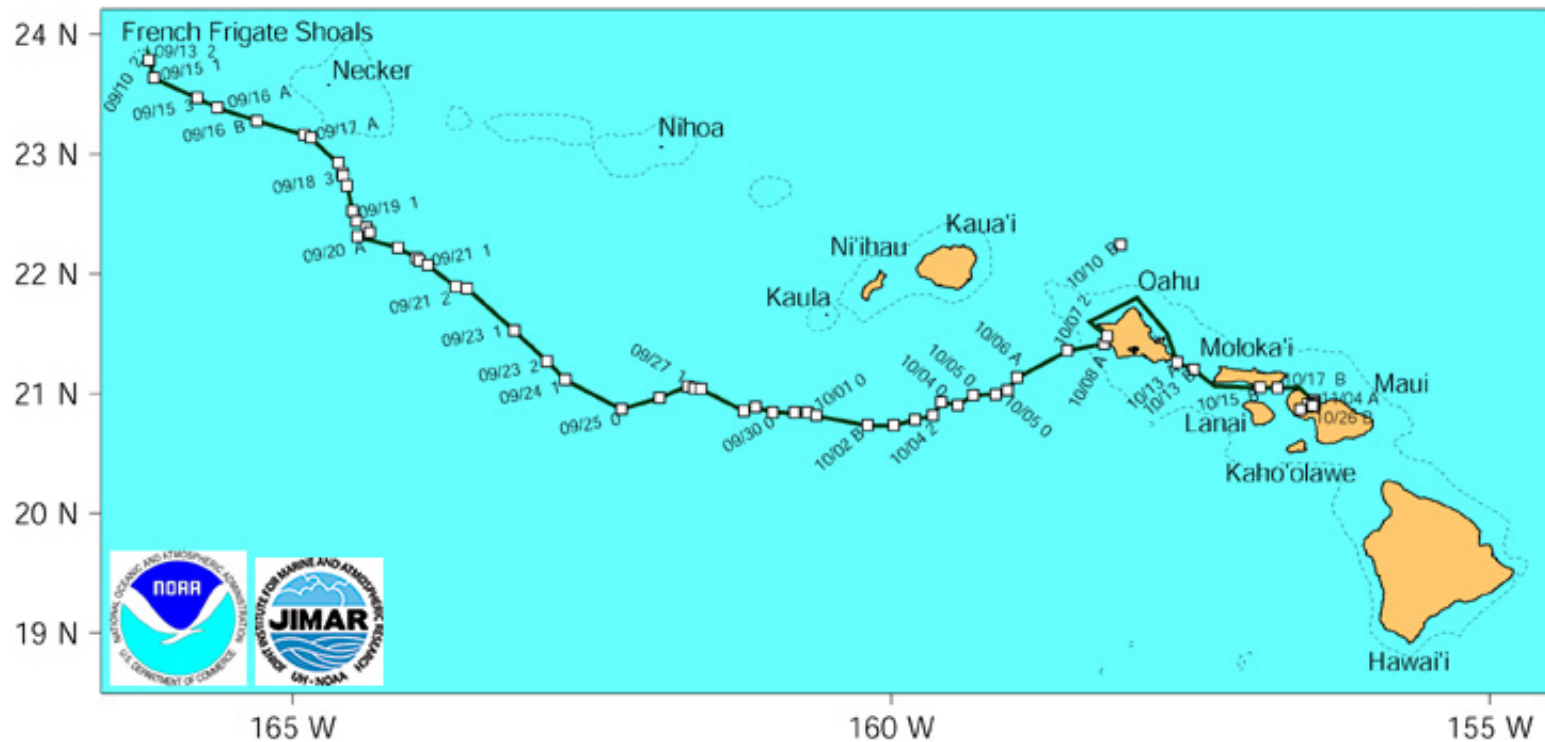
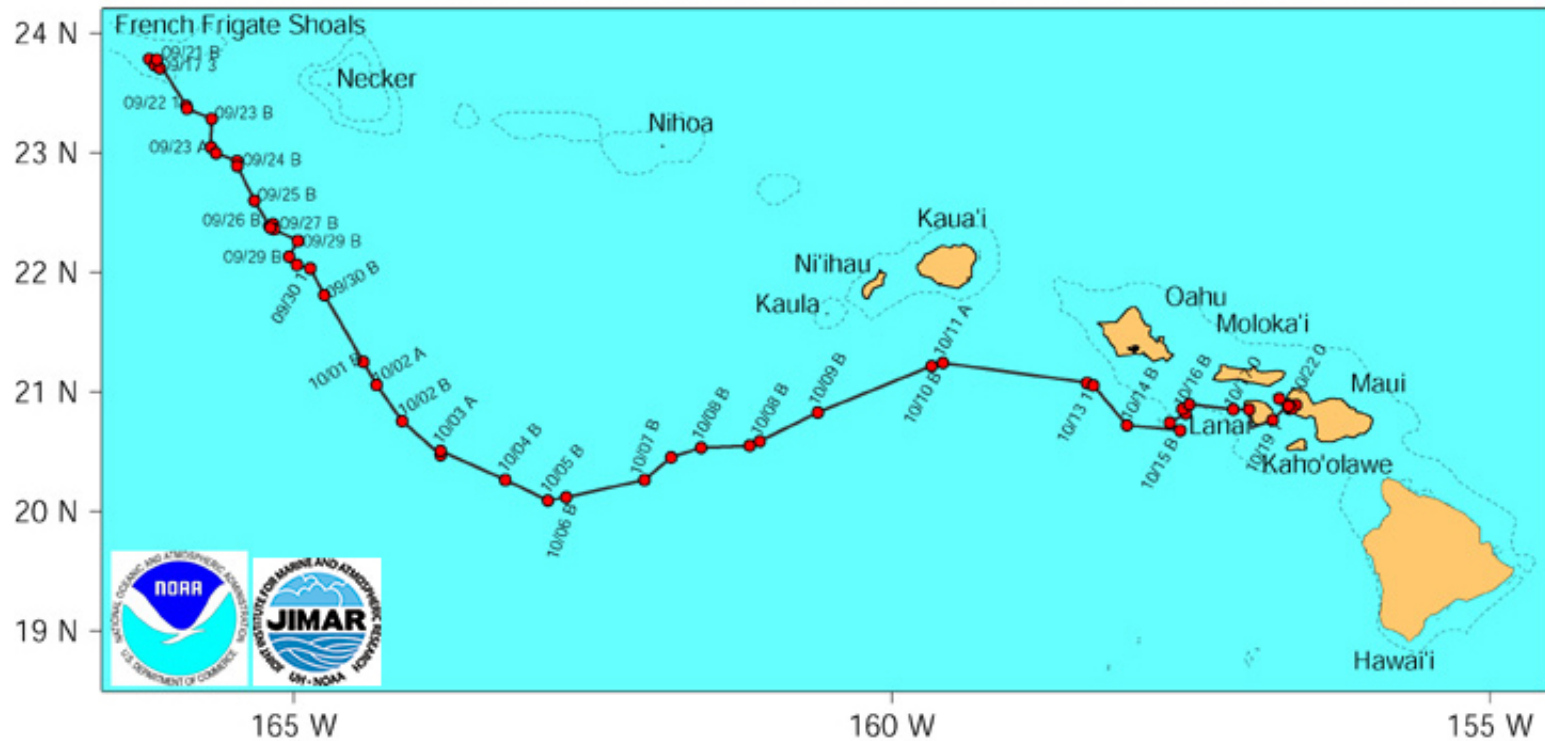


Figure 3m.

1998 Post-nesting migration of green turtle 4800 (GeoBar ST14)  
 from French Frigate Shoals to Lahaina, Maui, Main Hawaiian Islands

CCL: 97.8 cm Distance Traveled: 1279 km Days Transmitting: 290 days



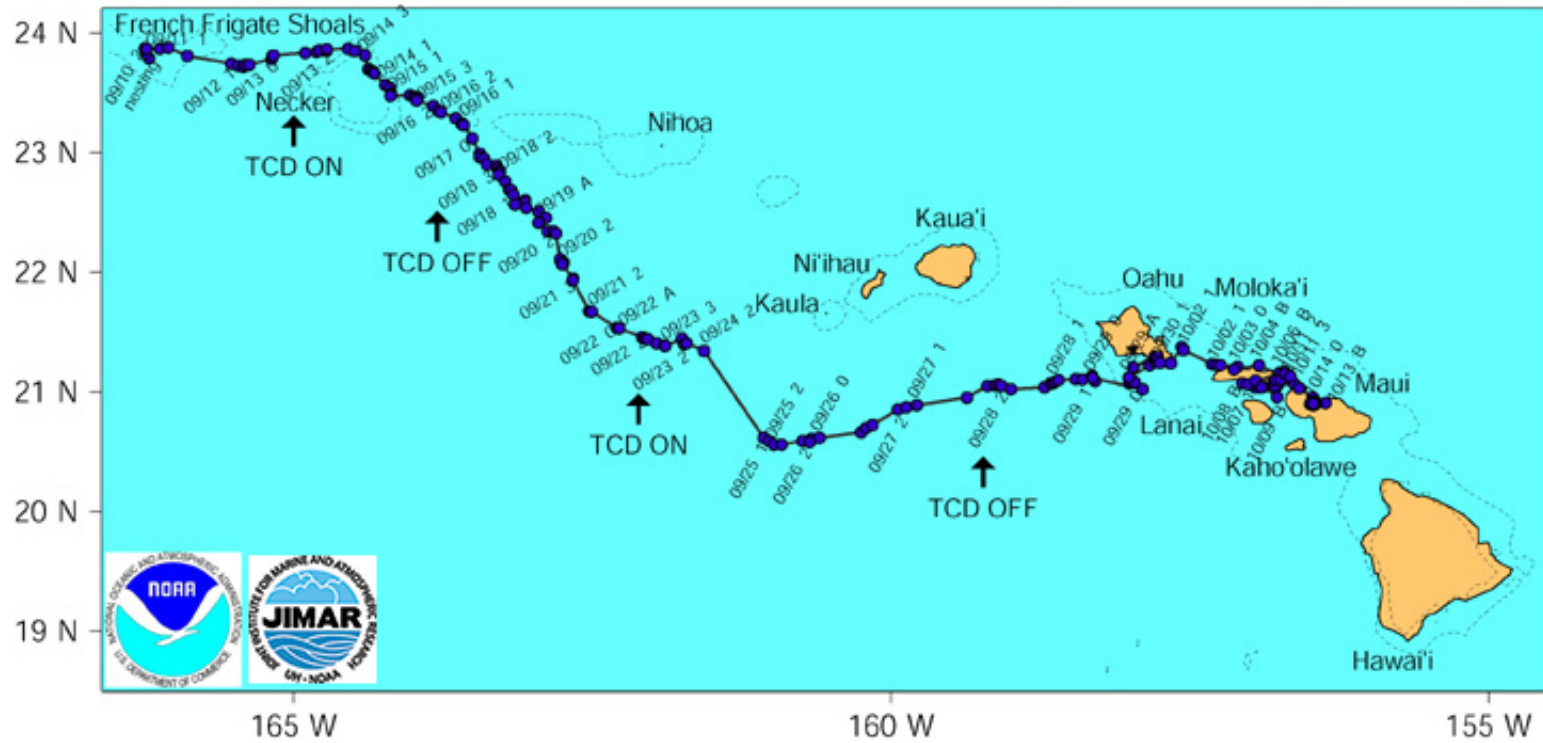
MOTOTOOL 4800; CCL 97.8 cm

GMT map created by Denise Ellis 11/02/06

**Figure 3n.**

1998 Post-nesting migration of green turtle 24192 (Carapace coil)  
 from French Frigate Shoals to Kahului, Maui, Main Hawaiian Islands

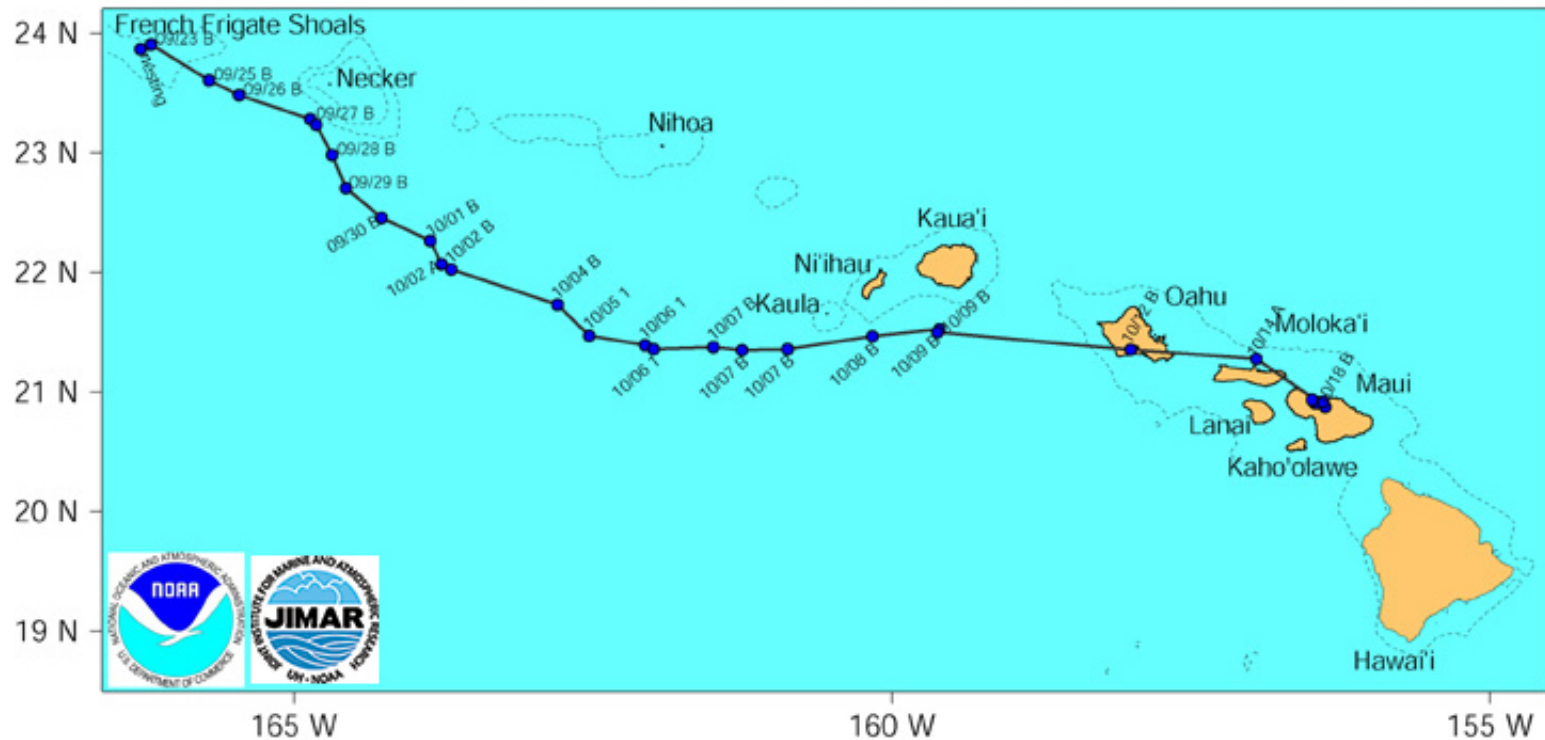
CCL: 99.7 cm Distance Traveled: 1352 km Days Transmitting: 268 days



MOTOTOOL D100, CCL 99.7 cm

GMT map created by Denise Parker 10/09/03

**Figure 3o.**  
 1998 Post-nesting migration of green turtle 24194 (GeoBar ST14)  
 from French Frigate Shoals to Kahului, Maui, Main Hawaiian Islands  
 CCL: 101.5 cm    Distance Traveled: 1166 km    Days Transmitting: 262 days



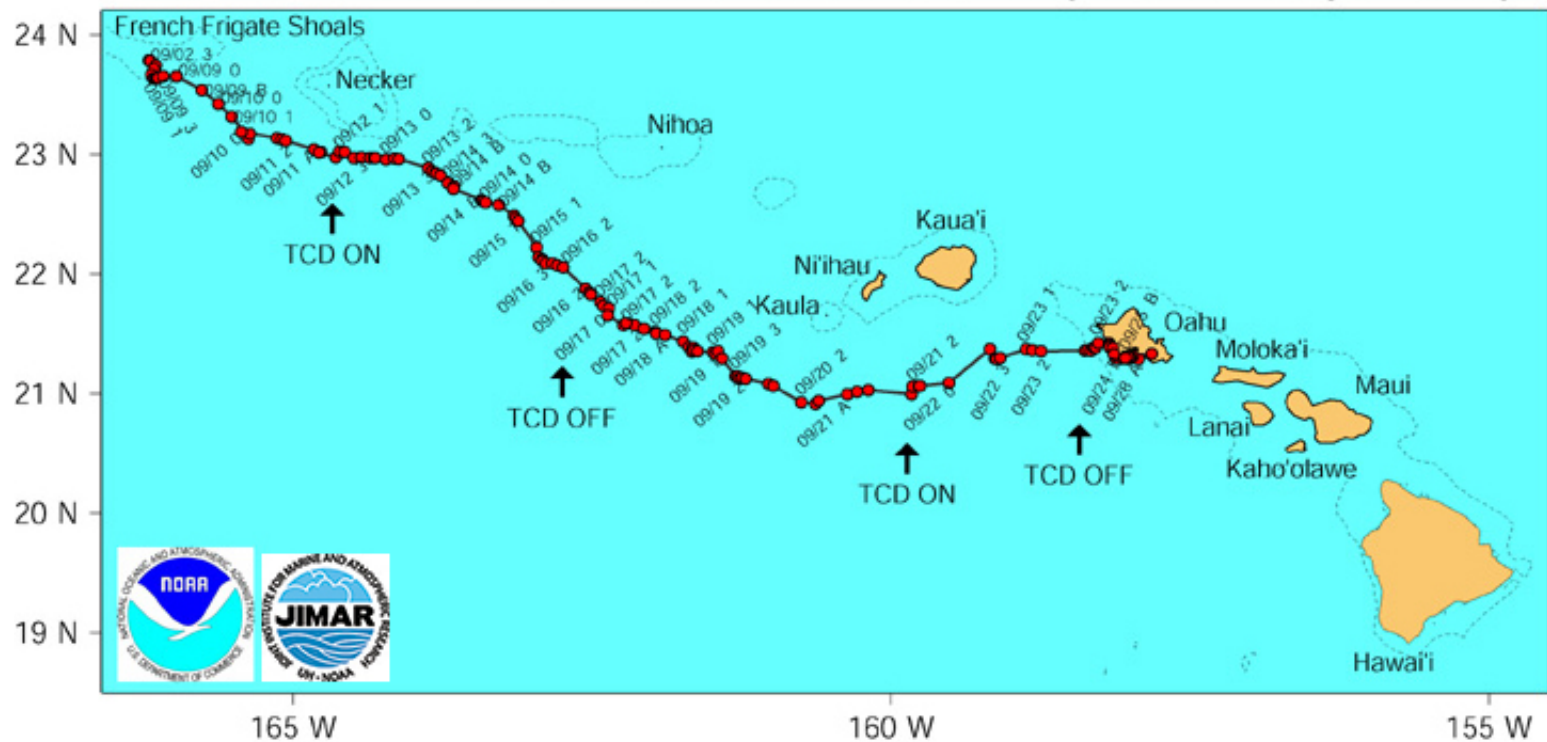
MOTOTOOL D70; CCL 101.5 cm

GMT map created by Denise Parker 10/09/03

Figure 3p.

1998 Post-nesting migration of green turtle 25694 (Head coil)  
 from French Frigate Shoals to Ewa, Oahu, Main Hawaiian Islands

CCL: 101.6 cm Distance Traveled: 997 km Days Transmitting: 325 days



MOTOTOOL D96, CCL 101.6 cm

GMT map created by Denise Ellis 11/02/98

Figure 3q.  
 2008 satellite-tracked movements of female green turtle  
 Pukalani-Yuka (L18), Argos ID 23044  
 ST-24 Duty Cycle: 6/ 24 SCL: 87.5 cm Date deployed: 2/6/08  
 Days Transmitting since deployment: 129 days Distance Traveled: 1615 km  
 Days in transit between Laniakea and Trig Is., FFS: 29 days

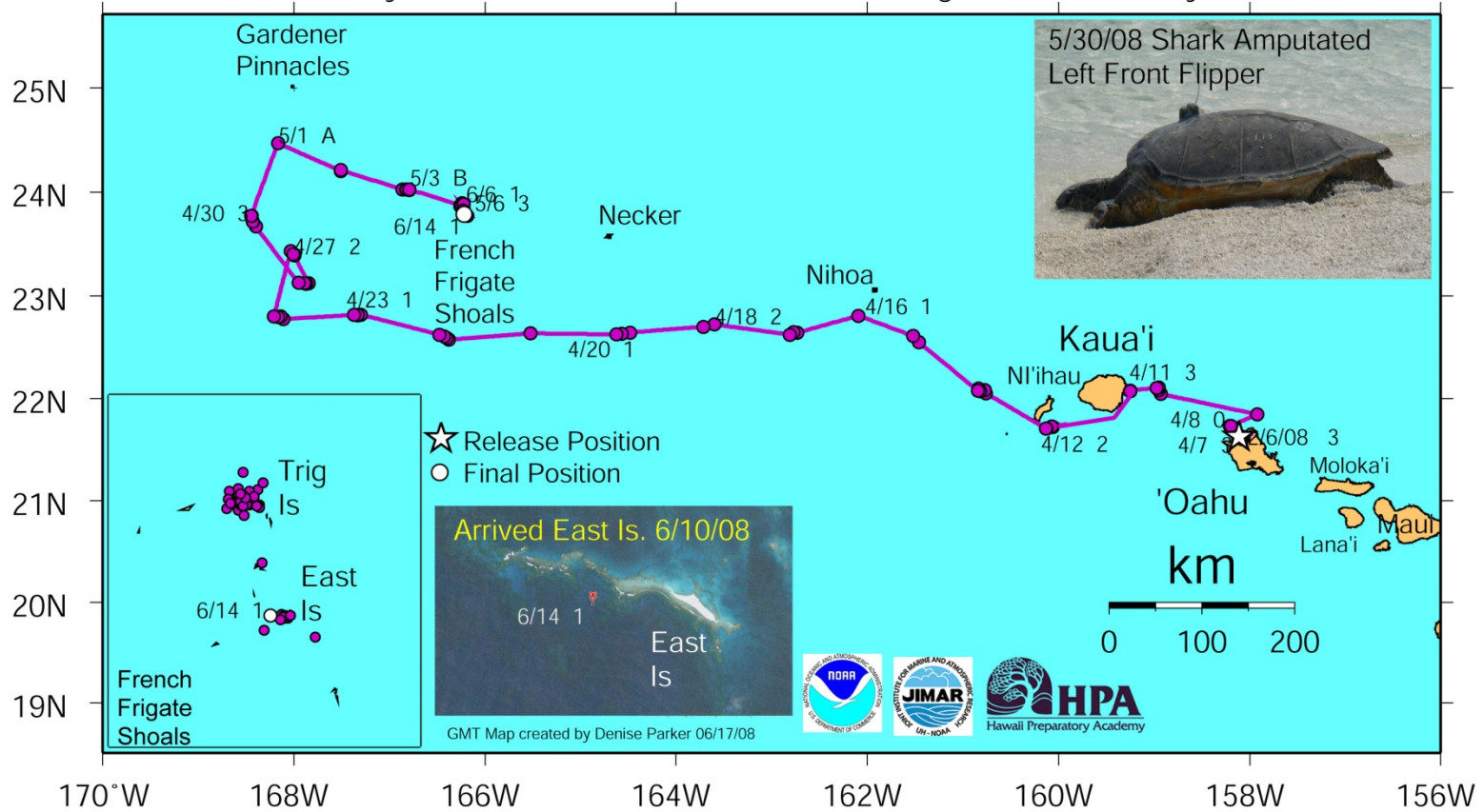


Figure 3r:  
 2010 satellite-tracked movements  
 of female green turtle, Rambling Rose (L2), ID 71917  
 TAM-2619 6/24 SCL: 87.0 cm  
 Date deployed: 3/5/10 Days transmitting: 153 days  
 Days transit to FFS: 32 days  
 Distance traveled: 1461 km

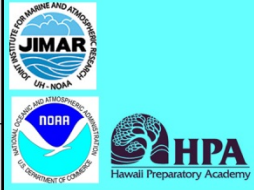
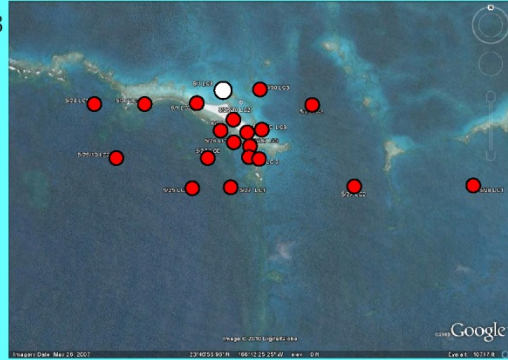
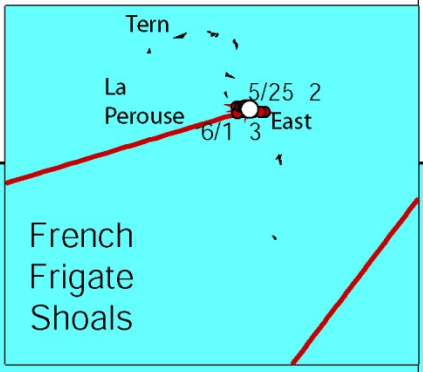
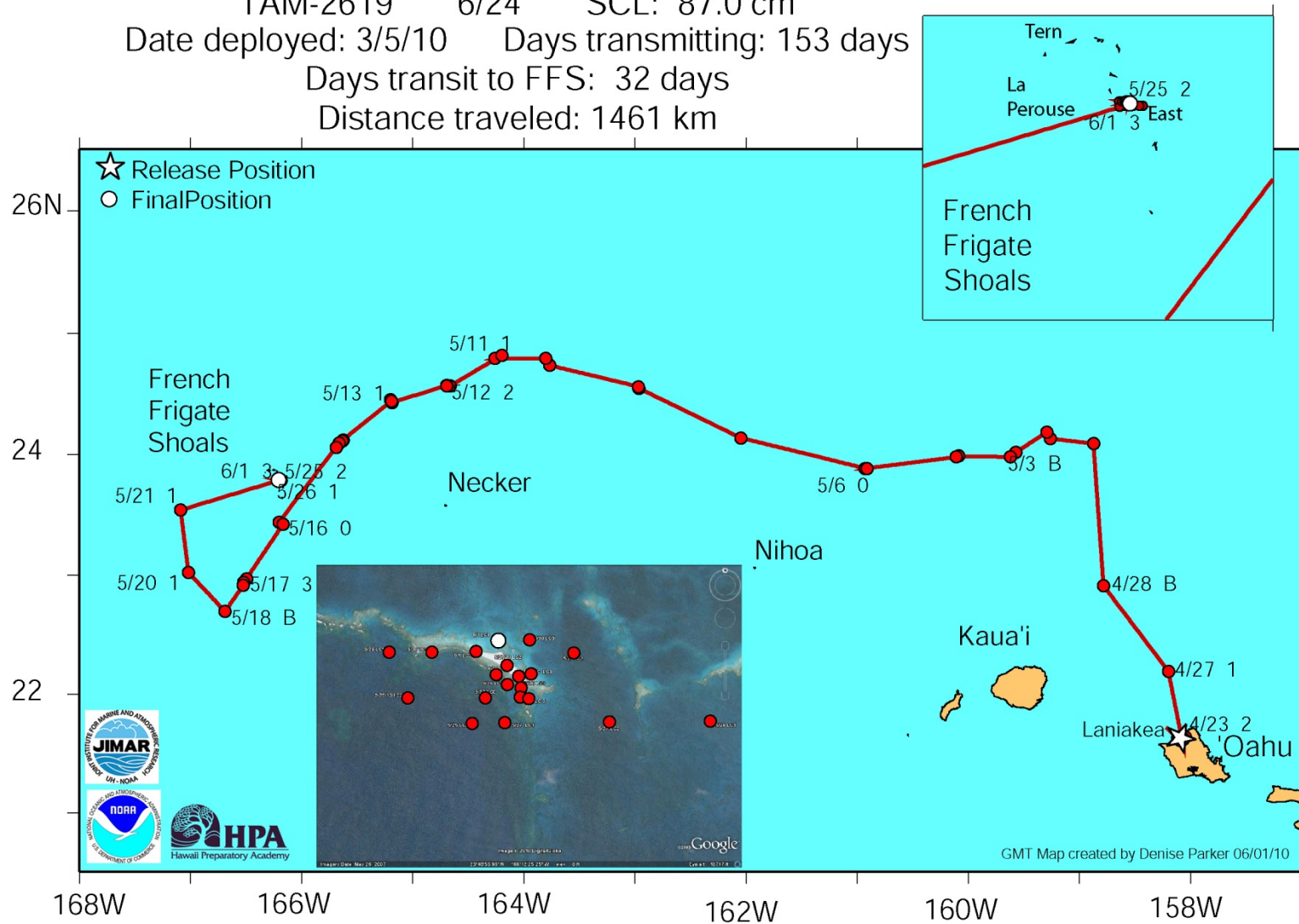


Figure 3s.  
 2012 movement of male green turtle, L11 (ID 23474)  
 Released 03/02/12 from Laniakea Beach SCL: 80.3 cm  
 TAM-4410 transmitter Days transmitting: 105 days

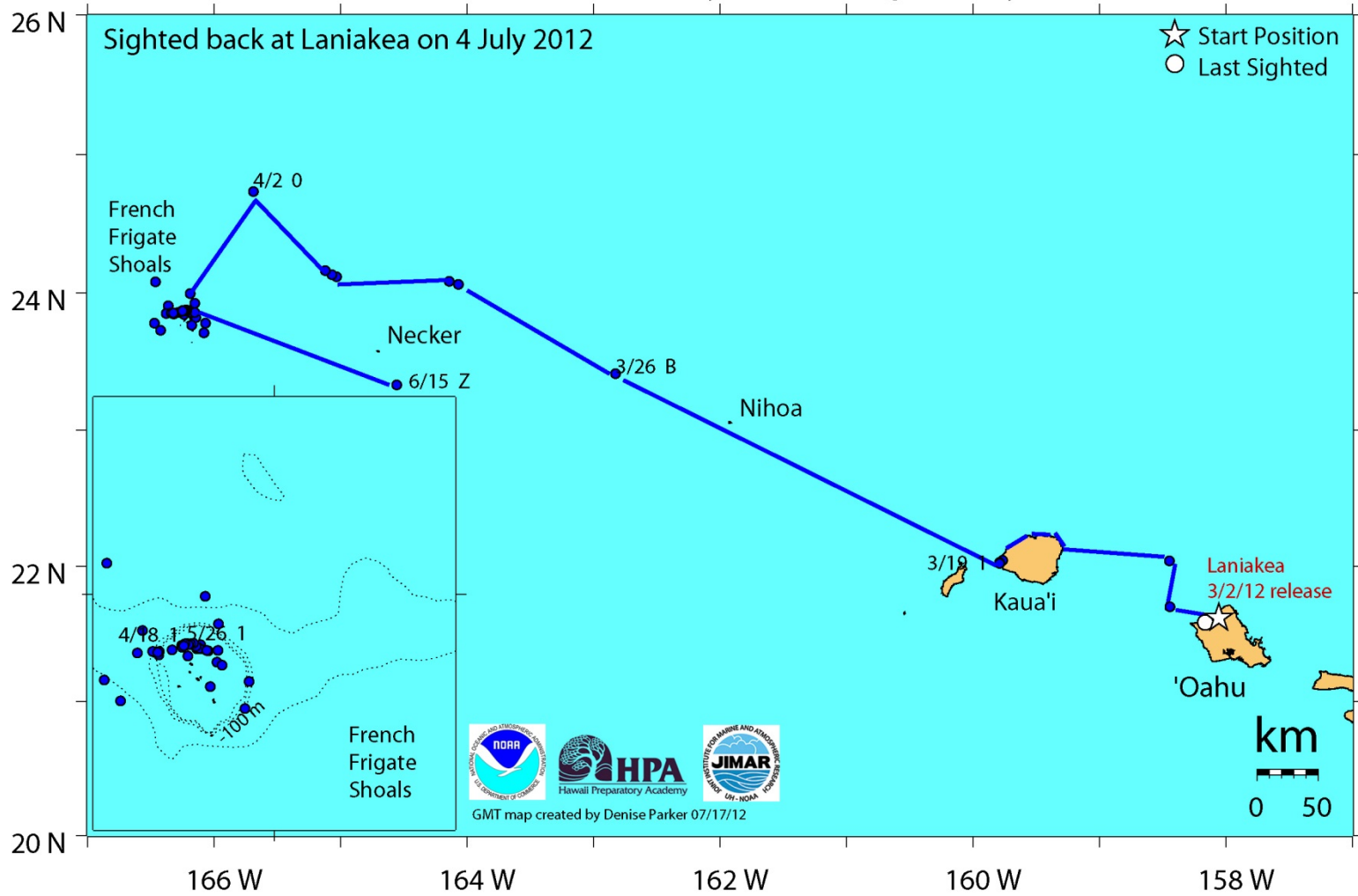
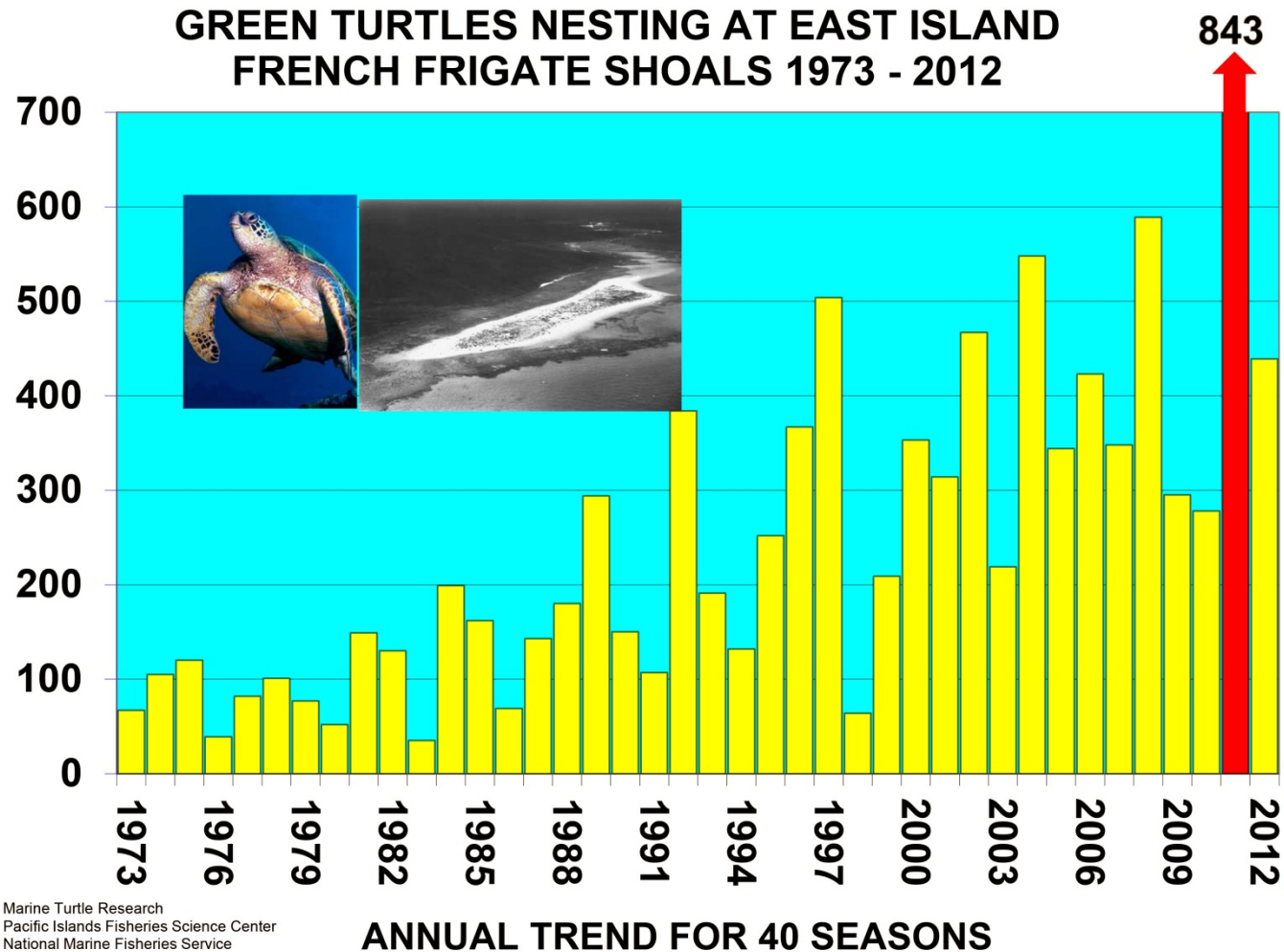
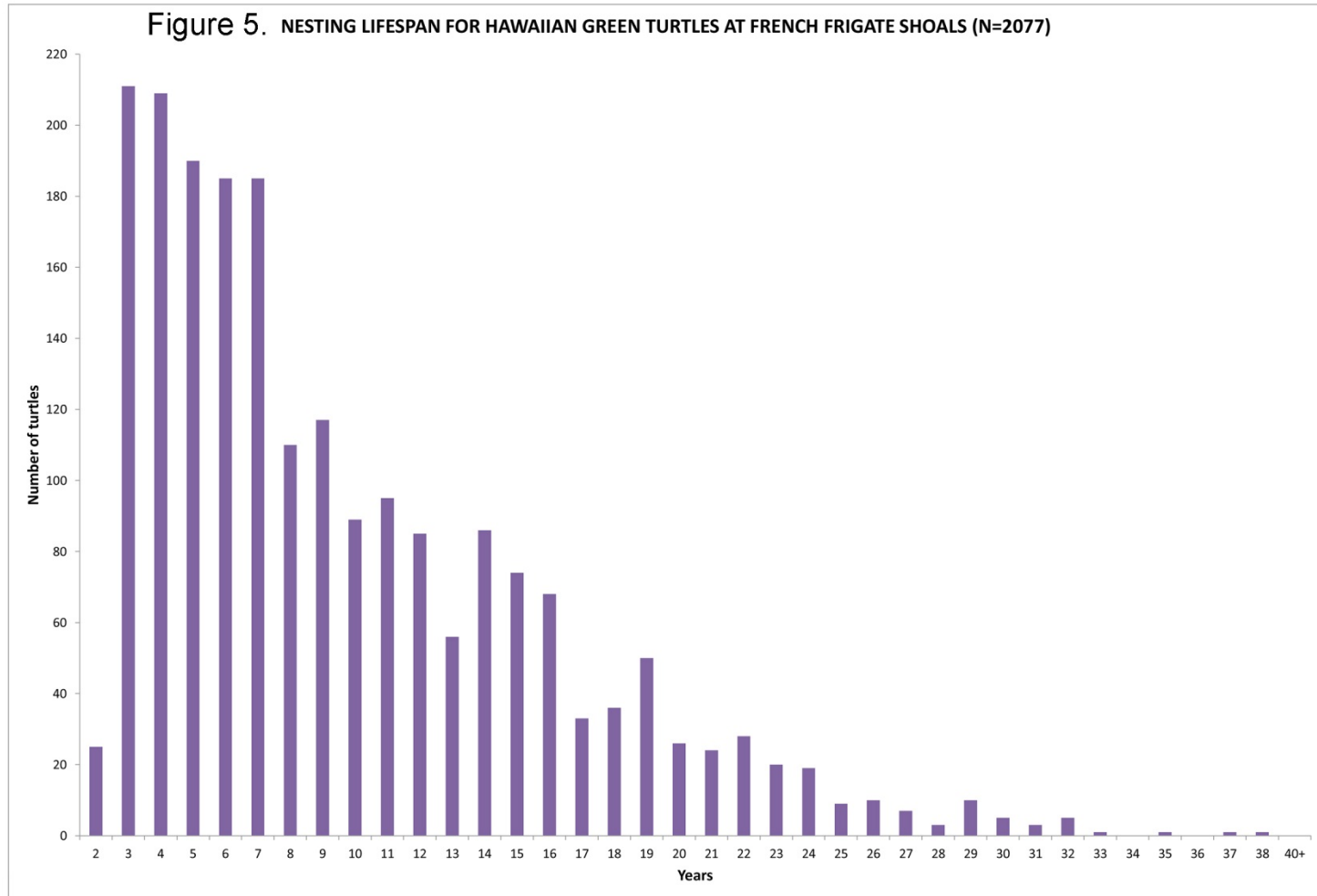




Figure 4.  
Nester abundance at the index monitoring site of East Island, FFS.  
Annual number of nesters was estimated from direct field counts.  
(Wetherall et al 1998).

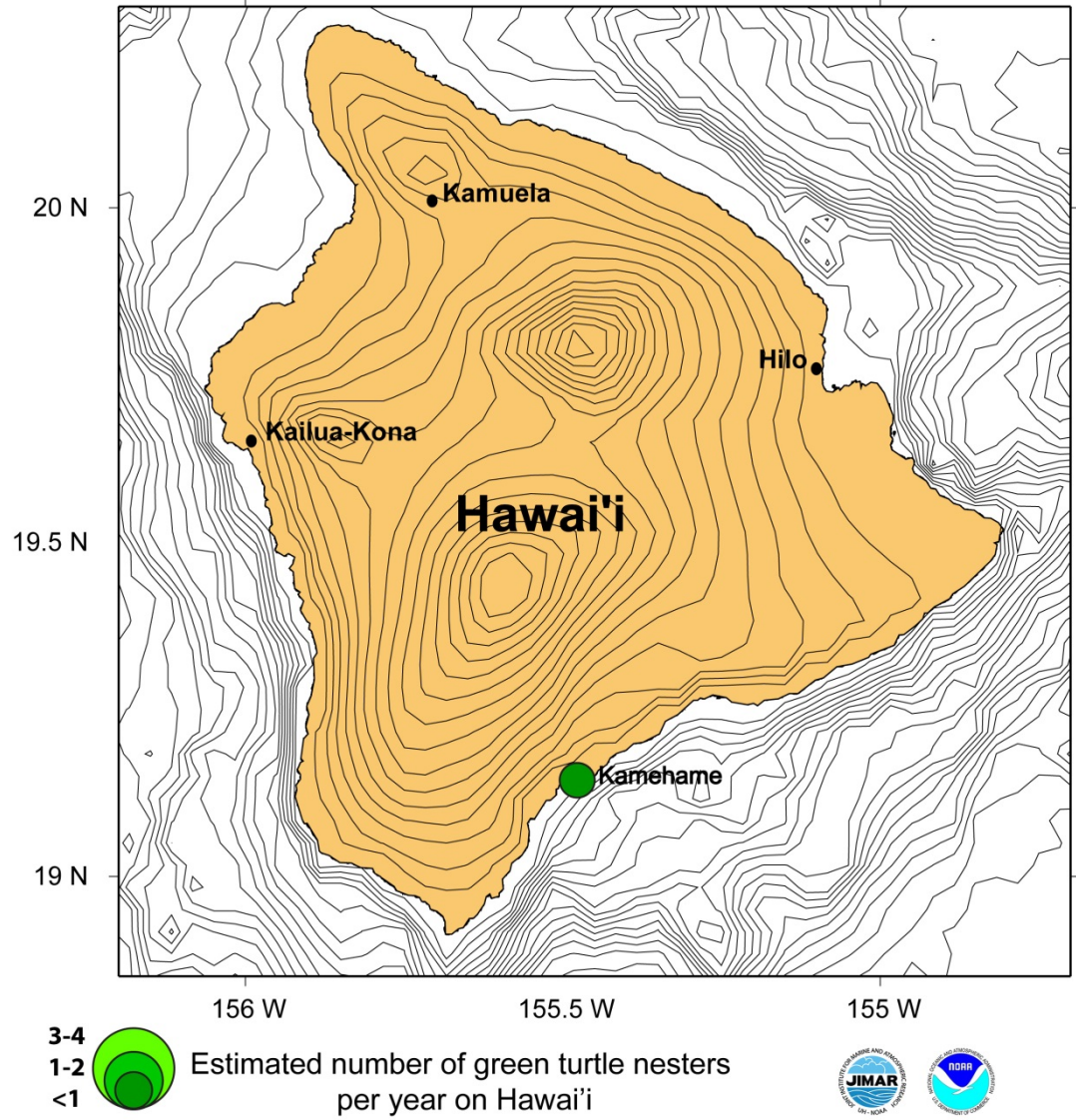


nesting lifespan yrs	# turtles
2	25
3	211
4	209
5	190
6	185
7	185
8	110
9	117
10	89
11	95
12	85
13	56
14	86
15	74
16	68
17	33
18	36
19	50
20	26
21	24
22	28
23	20
24	19
25	9
26	10
27	7
28	3
29	10
30	5
31	3
32	5
33	1
34	0
35	1
36	0
37	1
38	1
40+	0
<b>TOTAL</b>	<b>2077</b>



Graphic shows nesting lifespan of 2077 green turtles from 1968 to partial 2012 nesting season. 42,928 nesting records were examined from 1965 to partial season 2012. I. Nurzia-Humburg, S. Hargrove and G. Balazs

**Figure 6.** Estimated number of nesters in the Main Hawaiian Islands



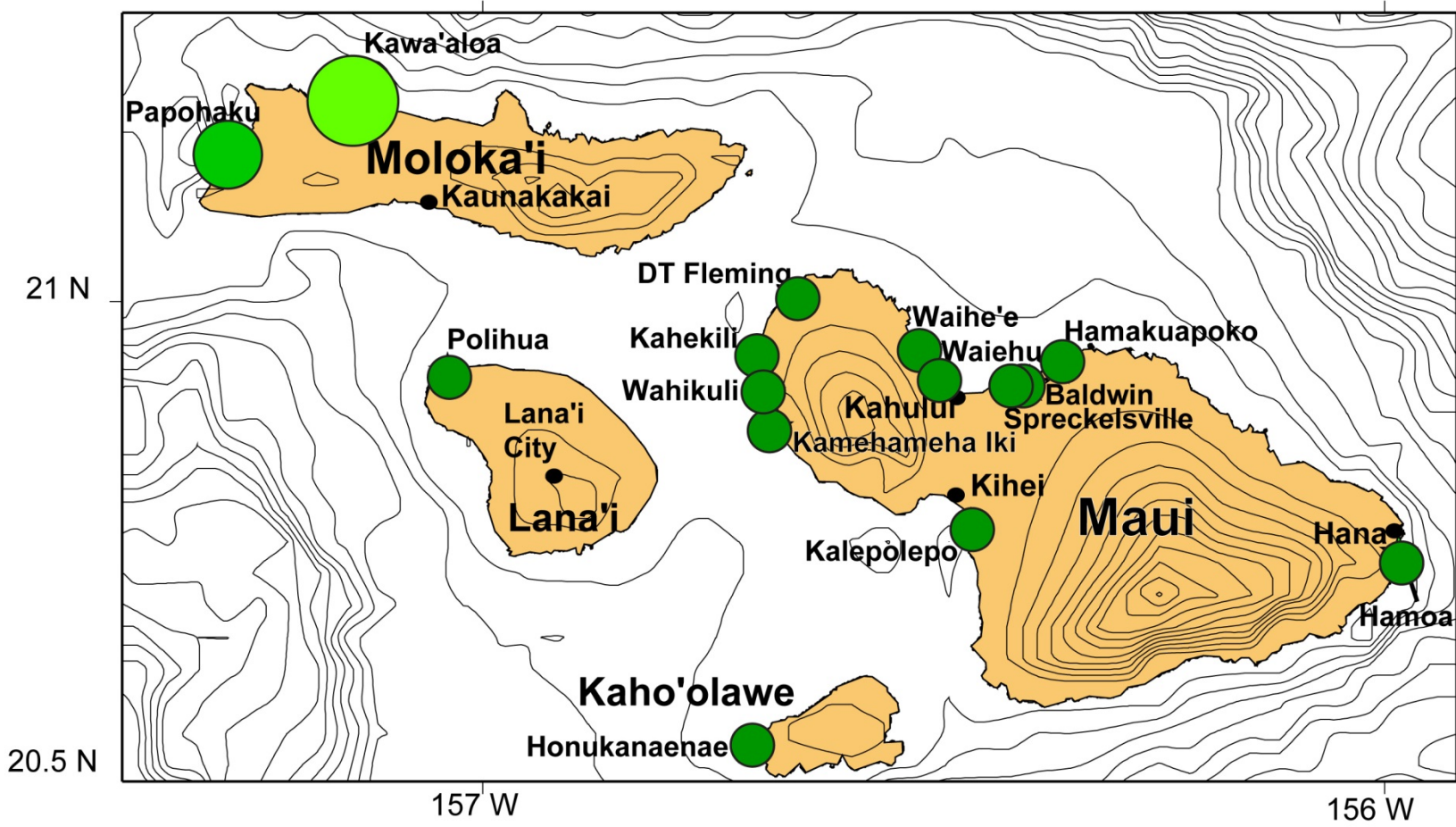
GMT map created by Denise Parker JIMAR-PIFSC

Topography lines represent 250m


Green turtle (*Chelonia mydas*) nesting locations recorded on the Island of Hawai'i

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Kamehame	19° 8.7'	155° 28.1'

Figure 6 (continued).



3-4  
1-2  
<1



Estimated number of green turtle nesters per year in Maui County

GMT map created by Denise Parker JIMAR-PIFSC

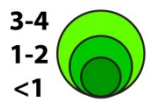
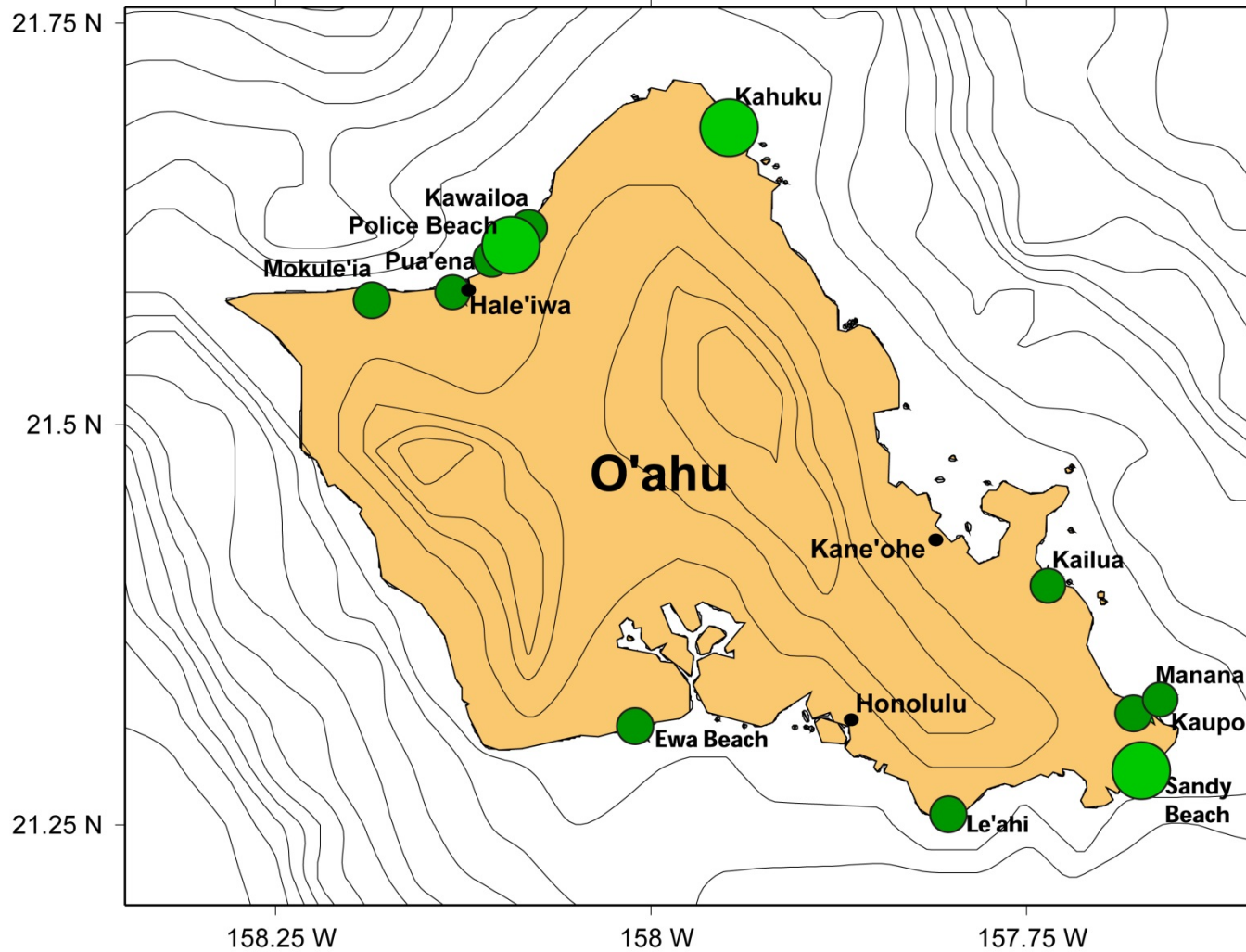
Topography lines represent 250m



Green turtle (*Chelonia mydas*) nesting locations recorded in Maui County

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
<b>Moloka'i</b>		
Papohaku	21° 9.6'	157° 16.2'
Kawa'aloa	21° 11.9'	157° 9.2'
<b>Lana'i</b>		
Polihua	20° 55.3'	157° 2.1'
<b>Kaho'olawe</b>		
Honukanaenae	20° 31.4'	156° 41.7'
<b>Maui</b>		
Kalepolepo, Kihei	20° 45.9'	156° 27.5'
Kamehameha Iki, Lahaina	20° 52.1'	156° 40.6'
Wahikuli	20° 54.2'	156° 41.1'
Kahekili, Honua Kai Resort (North Beach), Ka'anapali	20° 56.7'	156° 41.5'
D.T. Fleming Beach, Kapalua	21° 0.3'	156° 39.0'
Waihe'e	20° 56.2'	156° 30.4'
Waiehu	20° 54.8'	156° 29.5'
Spreckelsville	20° 54.4'	156° 25.7'
Baldwin Beach, Pai'a	20° 54.8'	156° 23.7'
Hamakuapoko (H-poko), Ku'au	20° 55.9'	156° 21.8'
Hamoia	20° 43.2'	155° 59.2'

Figure 6 (Continued).



Estimated number of green turtle nesters per year on O'ahu

Topography lines represent 250m

GMT map created by Denise Parker JIMAR-PIFSC

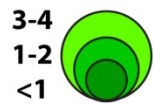
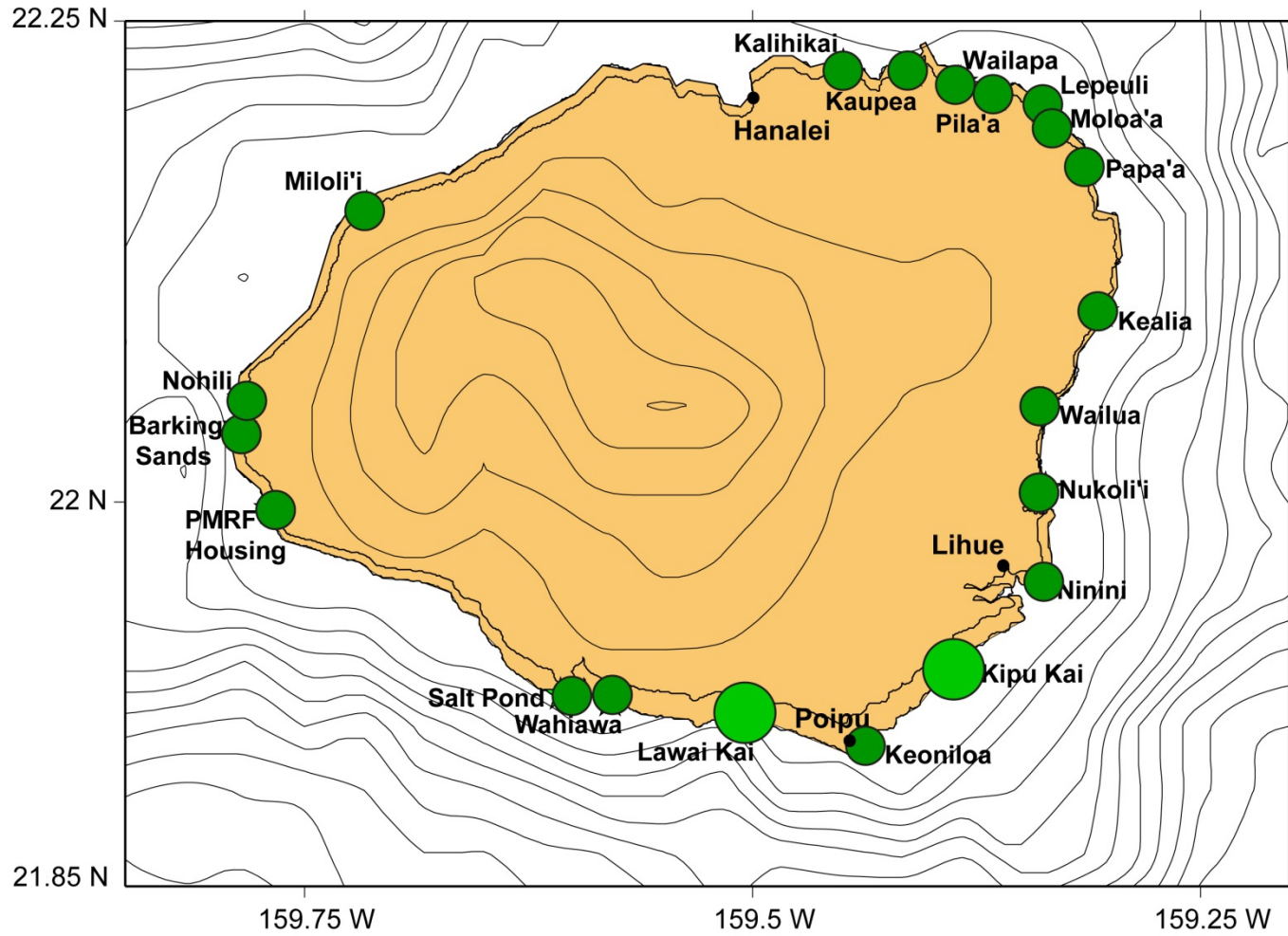


Green turtle (*Chelonia mydas*) nesting locations recorded on O'ahu

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Mokule'ia	21° 34.9'	158° 11.0'
Waialua	21° 21.5'	158° 7.7'
Pua'ena Point	21° 36.1'	158° 6.4'
Police Beach	21° 36.8'	158° 5.6'
Kawailoa	21° 37.4'	158° 5.0'
Ewa Beach	21° 18.6'	158° 0.4'
Kahuku	21° 41.1'	157° 56.7'
Kailua	21° 24.1'	157° 44.2'
Manana	21° 19.7'	157° 39.6'
Kaupo	21° 18.9'	157° 40.0'
Sandy Beach	21° 17.2'	157° 40.2'
Le'ahi (Diamond Head)	21° 15.4'	157° 48.0'



Figure 6 (Continued).



Estimated number of green turtle nesters per year on Kauai

GMT map created by Denise Parker JIMAR-PIFSC

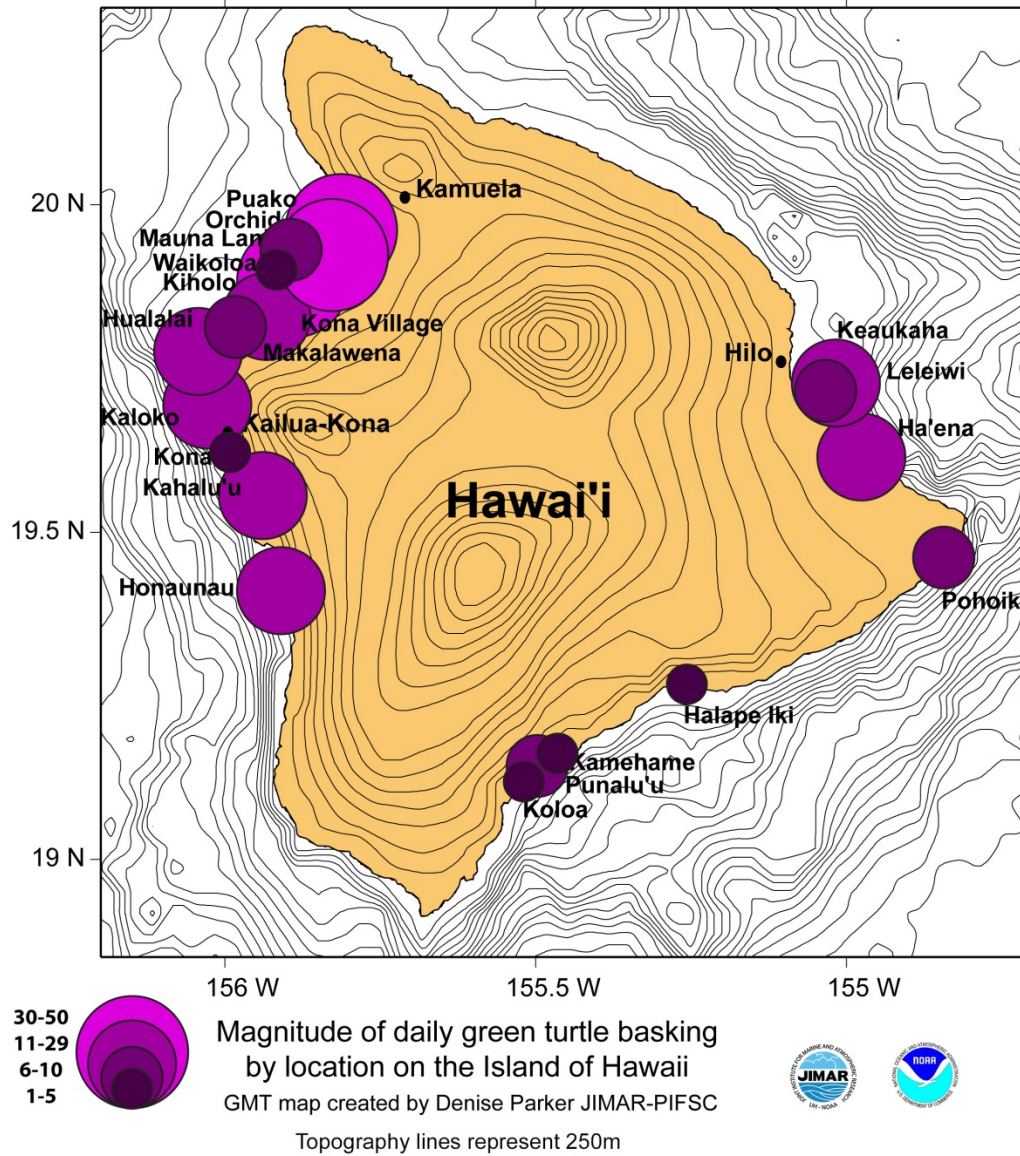
Topography lines represent 250m



Green turtle (*Chelonia mydas*) nesting locations recorded on Kaua'i

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Lawai Kai	21° 53.3'	159° 30.1'
Wahiawa	21° 53.8'	159° 34.5'
Salt Pond County Beach Park	21° 54.0'	159° 36.4'
PMRF, Pacific Missile Range Facility Housing	21° 59.8'	159° 46.1'
Barking Sands	22° 3.9'	159° 46.9'
Nohili ditch	22° 3.2'	159° 47.0'
Miloli'i	22° 9.1'	159° 43.1'
Kalihikai	22° 13.6'	159° 26.9'
Kauapea (Secret Beach)	22° 13.4'	159° 24.7'
Wailapa	22° 13.0'	159° 23.1'
Pila'a	22° 12.7'	159° 21.9'
Lepeuli, (Larsen's Beach)	22° 12.3'	159° 20.3'
Moloa'a	22° 11.6'	159° 20.0'
Papa'a	22° 10.4'	159° 18.8'
Kealia	22° 5.9'	159° 18.3'
Wailua	22° 3.0'	159° 20.2'
Nukoli'i	22° 0.4'	159° 20.2'
Ninini, Nawiliwili	21° 57.5'	159° 20.3'
Kipu Kai	21° 54.8'	159° 23.6'
Keoniloa, Poipu	21° 51.5'	159° 26.3'

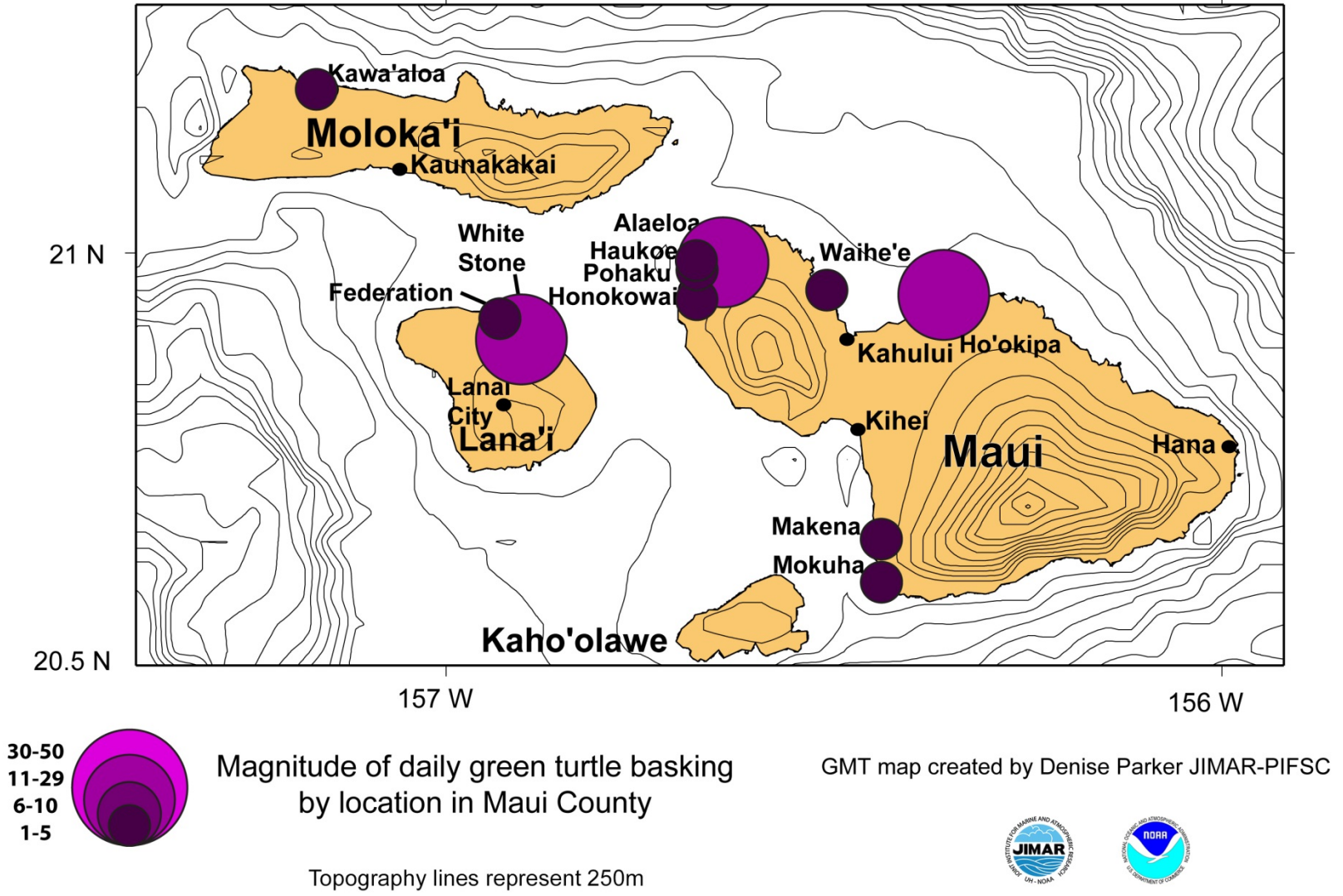
**Figure 7. Magnitude of daily green turtle basking in the Main Hawaiian Islands**



Green turtle (*Chelonia mydas*) basking locations recorded on the Island of Hawai'i

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Honaunau	19° 25.3'	155° 54.7'
Kahalu'u	19° 34.8'	155° 58.0'
Kona Tennis Club	19° 37.8'	155° 59.4'
Kaloko-Honokohau	19° 40.3'	156° 1.6'
Makalawena	19° 47.5'	156° 1.6'
Hualalai North Resort	19° 49.3'	155° 59.8'
Kona Village	19° 49.9'	155° 58.1'
Kiholo	19° 51.6'	155° 55.4'
Waikoloa	19° 55.5'	155° 53.3'
Mauna Lani	19° 56.6'	155° 52.2'
Orchid Hotel	19° 57.1'	155° 51.7'
Puako	19° 57.8'	155° 51.3'
CarlSmith Park (4-mile)	19° 44.0'	155° 1.7'
Leleiwi Park (Waiuli, Wai'olena)	19° 44.1'	155° 0.8'
Ha'ena (Shipman)	19° 38.5'	154° 58.6'
Pohoiki	19° 27.4	154° 50.5'
Halape Iki	19° 16.2'	155° 15.6'
Kamehame	19° 8.7'	155° 28.1'
Punalu'u	19° 8.1	155° 30.3'
Koloa	19° 7.6'	155° 30.7'

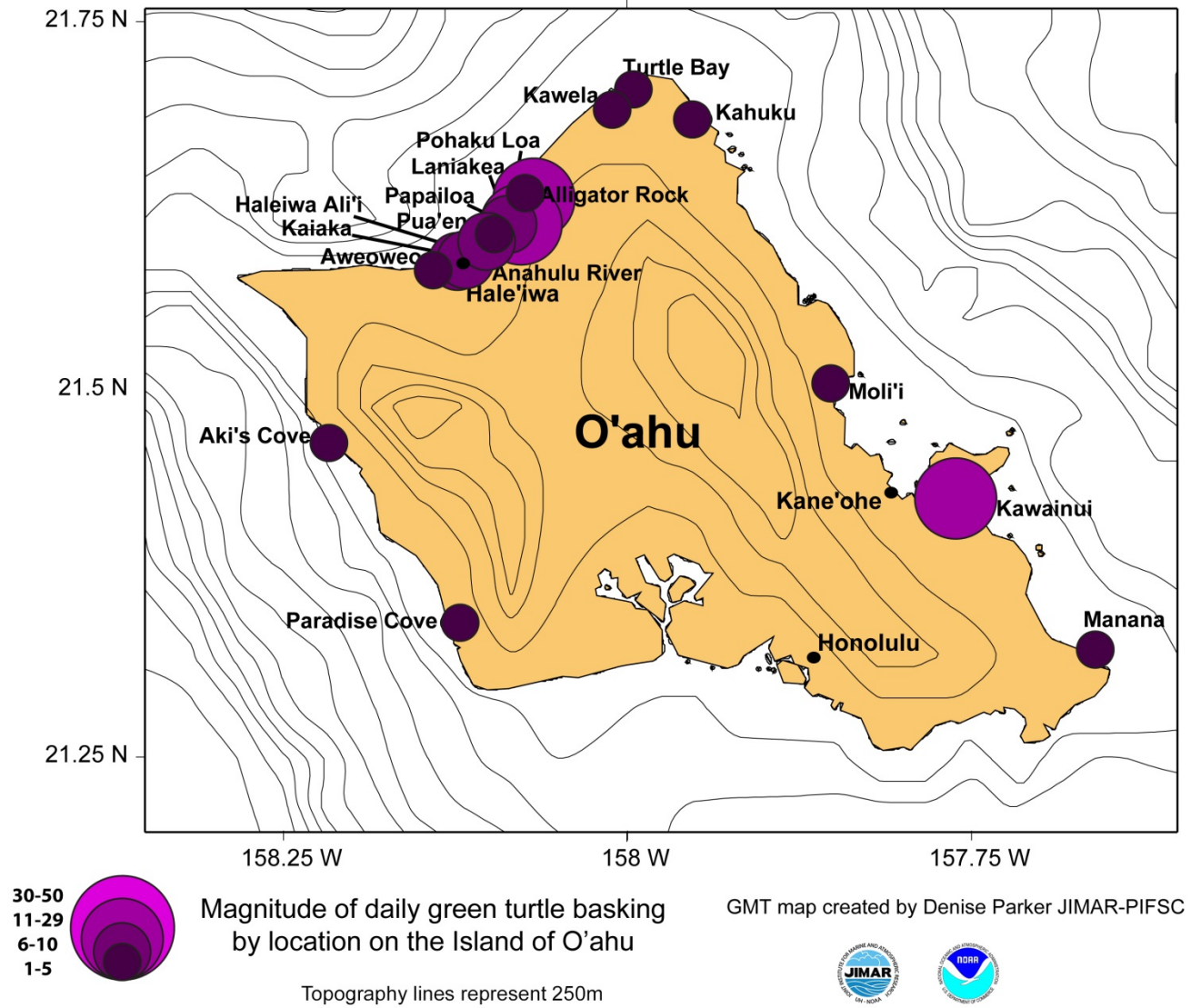
Figure 7 (Continued).



Green turtle (*Chelonia mydas*) basking locations recorded in Maui County

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
<b>Moloka'i</b>		
Kawa'aloa	21° 11.9'	157° 9.2'
Kawakiu Nui	21° 12.2'	157° 14.9'
<b>Lana'i</b>		
White Stone	20° 53.7'	156° 52.4'
Federation Camp	20° 54.7'	156° 53.8'
<b>Maui</b>		
Mokuha (Fishbowl)	20° 36.0'	156° 26.2'
Makena Landing/5 caves	20° 39.4'	156° 26.5'
Honokowai	20° 57.3'	156° 41.2'
Pohaku Park (S-Turns)	20° 58.0'	156° 40.9'
Haukoe (Hale Malia Rd)	20° 59.2'	156° 40.3'
Alaeloa	20° 59.3'	156° 40.2'
Waihe'e	20° 57'	156° 30.7'
Ho'okipa	20° 56.0'	156° 21.5'

Figure 7 (Continued).

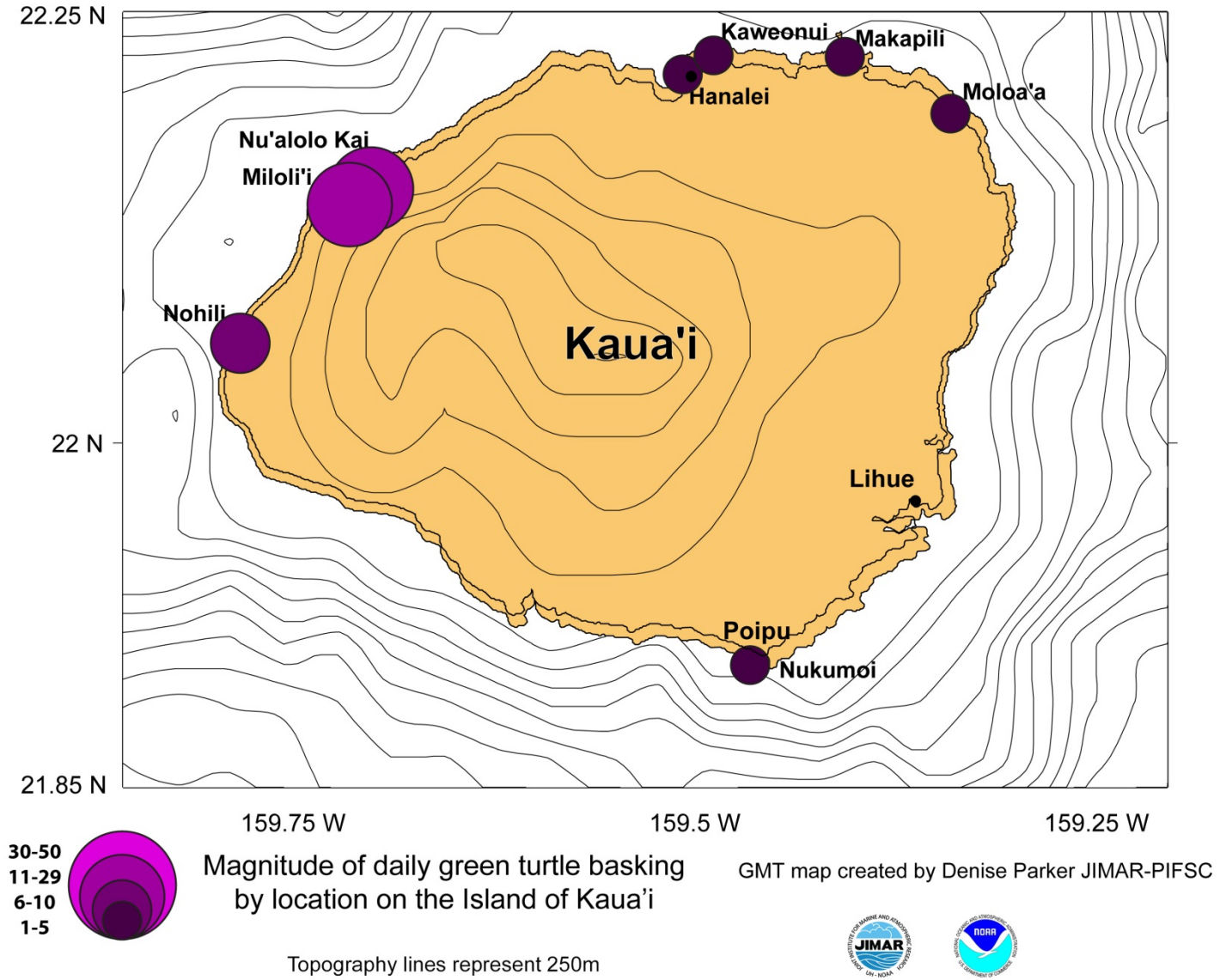


Green turtle (*Chelonia mydas*) basking locations recorded on O'ahu

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Paradise Cove	21° 20.5'	158° 7.7'
Aki's Cove	21° 28.1'	158° 13.0'
Aweoweo Beach Park	21° 35.0'	158° 8.4'
Kaiaka Beach	21° 35.3'	158° 7.0'
Haleiwa Ali'i Beach Park	21° 35.6'	158° 6.6'
Anahulu River	21° 35.7'	158° 6.3'
Pua'ena Point	21° 36.1'	158° 6.4'
Papailoa	21° 36.8'	158° 5.6'
Laniakea	21° 37.1'	158° 5.1'
Pohaku Loa Way	21° 37.7'	158° 5.0'
Alligator Rock	21° 37.8'	158° 4.4'
Kawela Bay	21° 41.7'	158° 0.7'
Turtle Bay	21° 42.3'	157° 59.8'
Kahuku	21° 41.1'	157° 56.7'
Moli'i	21° 30.4'	157° 50.8'
Kawainui Canal	21° 25.5'	157° 44.6'
Manana	21° 19.7'	157° 39.6'



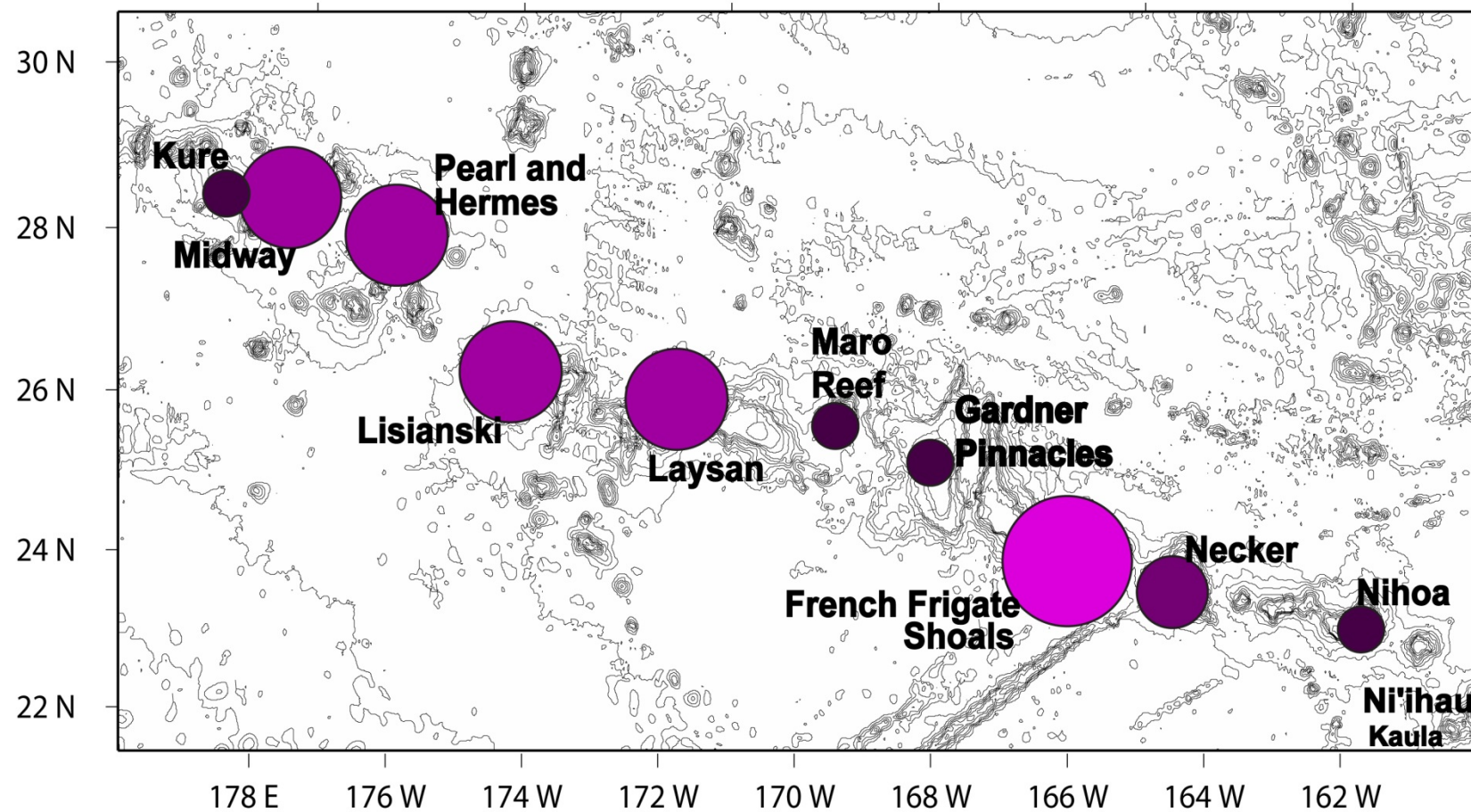
Figure 7 (Continued).



Green turtle (*Chelonia mydas*) basking locations recorded on Kaua'i

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Nukumoi, Poipu	21° 52.3'	159° 27.3'
Nohili	22° 3.8'	159° 47.0'
Miloli'i	22° 9.1'	159° 43.1'
Nu'alolo Kai	22° 9.5'	159° 42.0'
Hanalei	22° 12.8'	159° 29.8'
Kaweonui	22° 13.7'	159° 28.7'
Makapili (Crater Hill)	22° 13.5'	159° 23.8'
Moloa'a	22° 11.6'	159° 20.0'

Figure 8. Magnitude of daily green turtle basking in the Northwestern Hawaiian Islands



21- 200+ Summer

11-20

3-10

≤1-2



Magnitude of daily green turtle basking  
by location in the NWHI

GMT map created by Denise Parker JIMAR-PIFSC



Topography lines represent 500m

Green turtle (*Chelonia mydas*) basking locations recorded from the Northwestern Hawaiian Islands

<b>PLACE NAME</b>	<b>LATITUDE (N)</b>	<b>LONGITUDE (W)</b>
Nihoa	23° 23.5'	161° 55.5'
Necker	23° 35.0'	164° 42.0'
French Frigate Shoals	23° 45.0'	166° 10.0'
Gardener Pinnacle	25° 1.0'	167° 59.0'
Maro Reef	25° 25.0'	170° 35.0'
Laysan	25° 50.0'	171° 50.0'
Lisianski	26° 2.0'	174° 0.0'
Pearl and Hermes	27° 55.0'	175° 45.0'
Midway	28° 13.0'	177° 22.6'
Kure	28° 25.0'	178° 25.0'