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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise 92-07 (TC-175)

CRUISE PERIOD: 5-24 August 1992

AREA OF OPERATION: The waters off Nihoa, Necker Island, and French Frigate Shoals (FFS), and Brooks Bank in the Northwestern Hawaiian Islands (NWHI); and the waters off Kaneohe Bay, Oahu, and Kolo Harbor, Molokai, in the main Hawaiian Islands (MHI) (Fig. 1).

TYPE OF OPERATION: Trap fishing for juvenile snappers in the waters off Necker Island and FFS in the NWHI and off Oahu and Molokai in the MHI; power gurdy fishing for adult bottomfish off Nihoa and Necker Islands, FFS and Brooks Bank in the NWHI, and for juvenile opakapaka off Oahu and Molokai in the MHI; adult opakapaka tracking off Kaneohe Bay, Oahu.

ITINERARY:

5 August Embarked scientists. Departed Snug Harbor for Necker Island, NWHI, at 1415.

6 August Continued transiting to Necker Island. Stopped off southwest Nihoa Island to conduct handline fishing for adult bottomfish from 1515-1845. Resumed transiting to Necker Island.

7 August Arrived off southeast Necker Island at 0530. Surveyed area for lobster/bottom fishing activity, then set 5 strings of baited fish traps (25 total traps) at 15-20 fm along southwest edge of bank. Deployed 2 unbaited video camera drops 1215-1345 near fish trap stations. Transited to nearby 100 fm curve 1345-1430; handlined for adult bottomfish during 1430-1630 and 1700-1900. At 1900 transited north onto bank, where overnighted at anchor in southern lee of Necker Island.

- 8 August Weighed anchor 0800 and transited to 100-fm curve north-northwest of trap lines, where line fished for adult bottomfish during 0830-1630 and 1700-1900. Transited to southern lee of island where overnighed at anchor.
- 9 August Weighed anchor 0730 and transited to 100-fm curve to southeast of trap lines. Line fished for adult bottomfish during 0830-1645 and 1715-1830. Transited back to southern lee where overnighed at anchor.
- 10 August Weighed anchor at 0800 and transited to 100-fm curve off northwest bank. Deployed portable CTD (two casts) during 0815-0900 to profile water column temperature at fishing station productive for adult opakapaka. Line fished during 0900-1630 and 1700-1830. Transited back to same anchorage where overnighed.
- 11 August Weighed anchor 0730 and transited to fish trap stations, where deployed two video camera drops during 0800-0900. Successfully retrieved 4/5 strings of fish traps during 0900-1130. Transited to 100-fm curve and handlined for adult bottomfish 1430-1630. At 1900 began transit to FFS.
- 12 August Arrived off north FFS at 0805. Set two strings of five fish traps each at 45 fm contour off Trig-Whale-Skate Island area during 0830-1015. Deployed two video camera drops near trap stations during 1015-1100. Transited to northwest bank off FFS and handlined for adult bottomfish along 100-fm curve during 1215-1330. Transited down-atoll 5 km along 100-fm curve 1330-1415, where handlined until 1630 and during 1700-1815. At 1900, transited into lagoon of atoll where overnighed at anchor.
- 13 August Weighed anchor at 0600 and began transit to Brooks Bank. Arrived at Brooks Bank 0830, where handlined for adult bottomfish until 1130, when began return transit to FFS. Arrived 100-fm curve off northwest FFS at 1330; handlined for adult bottomfish until 1630 and during 1700-1830. At 1930, began transit 9 nmi south along 100-fm contour, to anchorage southwest of La Perouse Pinnacle, where overnighed.
- 14 August Weighed anchor at 0830 instead of 0800 due to radar problems. Transited to 100-fm curve southwest of Pinnacle, where handlined for adult bottomfish during 0845-1630 and 1715-1830.

Transited northwest back to shallow lee anchorage in FFS lagoon, where overnighed.

- 15 August Hauled anchor at 0600. Transited to fish trap stations; arrived 0700. Successfully retrieved both strings of traps and began full-speed return transit to Kaneohe Bay, Oahu (MHI), at 0830. Heavy seas downchain of Necker Island caused slowing vessel to 9 kn after first several hours.
- 16 August Continued transit to Kaneohe Bay. At 0300, developed mechanical problems with turbocharger of starboard engine. Proceeded at 6 kn speed with port engine only until 1600, when resumed transit at full speed following turbocharger repair.
- 17 August Continued transit to Kaneohe Bay, Oahu. Arrived Kaneohe Bay at 1900. Overnighed at anchor off Sampan Channel.
- 18 August Weighed anchor 0645. Set four strings of five fish traps each along 50-fm contour off central Kaneohe Bay. Completed sets 0915 and reconnoitered with NOAA ship, *Ka'ahale'ale*, OUT OF Coconut Island at 1100 off Sampan Channel. Transferred a scientific crewmember from *Townsend Cromwell* to *Ka'ahale'ale*. At 1145, sonic-tagged and released one adult opakapaka (from *Townsend Cromwell*) at 65 fm off west side of Mokapu Peninsula. Immediately began tracking this test fish from the *Ka'ahale'ale*. At 1200 the *Townsend Cromwell* transited back to 50-fm contour off central Kaneohe Bay, where handlined for juvenile opakapaka until 1530. At 1700, the *Townsend Cromwell's* auxiliary craft (Whaler) took an injured scientific personnel ashore for treatment. At 1730, Chief Scientist transferred from *Townsend Cromwell* to *Ka'ahale'ale* to assist in tracking opakapaka. At 1915, the *Ka'ahale'ale* lost all engine power due to air in fuel lines. The *Ka'ahale'ale* and its crew adrift in 20-kn winds and 2-m seas until dragging anchor snagged reef at 30 fm off Kapapa Island. The scientific crew member being treated ashore was returned to *Townsend Cromwell* off Sampan Channel and Whaler retrieved back aboard during 1900-2000. *Townsend Cromwell* then transited north to waters off Kapapa Island. Disabled *Ka'ahale'ale*, with its crew aboard, towed to safety offshore; all *Ka'ahale'ale* crew transferred aboard *Townsend Cromwell* at 2230

for overnight. *Townsend Cromwell* anchored offshore Sampan Channel with *Ka'ahale'ale* tied astern. [August 18th was an eventful day, although thankfully less eventful than it might have been!]

- 19 August At 0800, transferred XO from *Townsend Cromwell* to *Ka'ahale'ale* to fix mechanical problem; problem fixed 0815. At 1000, transferred two *Ka'ahale'ale* crew, plus injured scientific crew member, from the *Townsend Cromwell* to the *Ka'ahale'ale*. *Townsend Cromwell* then weighed anchor and transited to Kailua Bay; arrived 1100 and began handline fishing for adult bottomfish at 100 fm, followed by handline fishing for juvenile opakapaka at 50 fm. At 1630, motored back to Kaneohe Bay, where overnigheted at anchor off Sampan Channel.
- 20 August Weighed anchor 0745; operations delayed about 1 hour due to telecommunications cable snagged on anchor. Transited to 50-fm contour off Sampan Channel, where began handline fishing for juvenile opakapaka at 0900. At 1230 began transiting to central Kaneohe Bay trap stations. Successfully retrieved all four trap strings 1300-1600. At 1615 began transiting at full speed for Molokai. Arrived off Kolo Harbor, Molokai, at 2000, where overnigheted at anchor.
- 21 August Weighed anchor 0645. Transited offshore to fish trap stations at 50 fm, where began setting 4 strings of 5 traps each at 0700. At 0900, began transit southwest of Penguin Bank; arrived at "First Finger" of Penguin Bank at 1000, and began handline fishing for adult bottomfish at 75-100 fm. At 1630 began transit back to anchorage off Kolo Harbor. Anchored at 1700 and overnigheted.
- 22 August Weighed anchor 0715 and began transiting back to "First Finger" region of Penguin Bank, where handlined for adult bottomfish during 0815-1145. At 1145 transited to "Second Finger" region of Penguin Bank, where handlined for adult bottomfish during 1215-1345. At 1400 began motoring back to 50 fm contour off Kolo Harbor, where handline fished for juvenile opakapaka during 1515-1630. Overnigheted at anchor off Kolo Harbor.
- 23 August Weighed anchor 0715. Transited offshore to 50-fm contour and handline fished for juvenile opakapaka during 0800-1630. Motored back nearshore off Kolo Harbor where overnigheted at anchor.

24 August Weighed anchor 0600. Transited to fish trap stations where began retrieving traps at 0630. At 0900, began final transit back to Snug Harbor, Oahu. Arrived Snug Harbor 1230. Off-loaded live well-stored adult and juvenile opakapaka during 1230-1330. Disembarked all crew 1330. End of cruise.

MISSION AND RESULTS:

- A. Conduct preliminary, exploratory surveys for juvenile opakapaka (*Pristipomoides filamentosus*) using large, baited funnel traps, at or near 50-fm depths off Necker Island and FFS in the NWHI and off Kolo Harbor, southwest Molokai (near Penguin Bank [adult opakapaka habitat] in the MHI); evaluate effectiveness of trap design and deployment specifics relative to catches made at known juvenile habitat off Kaneohe Bay, Oahu.
1. A total 75 trap-sets were conducted at four sites (two in the NWHI and two in the MHI). Listed in chronological order these comprised 25 trap-sets at Necker Island and 10 trap-sets at FFS, both in the NWHI and 20 trap-sets each off Kaneohe Bay, Oahu, and Kolo Harbor, Molokai, in the MHI.
 2. Traps baited with 5 kg each of chopped mackerel (*Scomber japonicus*) were fished for 3.5 to 4 days (3-night soak) in five-trap strings, with traps spaced 30-fm apart.
 3. Rectangular traps of different sizes and construction materials were evaluated. The two trap sizes tested were "Large" (6 ft long x 4 ft wide x 3 ft high) and "Small" (4 ft long x 3 ft wide x 2 ft high). Traps were constructed either of 0.5-inch hardware cloth or 1-inch chicken wire; some traps of both sizes and materials type were lined with "skirts" of 0.125-inch nylon netting and other traps were not. Each trap had a singled, narrow funnel at one of its two long ends (3-inch maximum width, to prevent possible entrapment of monk seals, *Monachus schauinslandi*).
 4. Traps of both sizes and construction types caught juvenile opakapaka. Traps with fine-mesh liners inflicted less mechanical damage to fish during the retrieval and emptying of traps aboard ship, an important issue if healthy specimens are needed for live study.
 5. Catches at the two NWHI and two MHI sites varied in composition and magnitude. Four strings with 18-20 baited traps (1 string was lost) set at 12-20 fm at

Necker Island caught 31 taxa of fishes totaling 1,573 individuals weighing 425 kg. "Taape" or blue-lined snapper (*Lutjanus kasmira*), an exotic first introduced to the MHI in 1958, comprised 78% by numbers and 76% by weight of the Necker Island total. Two strings (10 traps) deployed at 44-48 fm off northwest FFS yielded 123 fish of 12 taxa weighing 25 kg. Off Kaneohe Bay, Oahu, four strings (20 traps) caught 609 fish of 11 taxa weighing 70 kg; a locally commercial decapod ("haole crab," *Portunus sanguinolentus*) also contributed >8 kg catch. Another four strings (20 traps) fished off Kolo Harbor, Molokai, caught 459 individuals of 23 fish taxa weighing 100 kg, with haole crab accounting for another 7 kg.

6. Juvenile opakapaka were trapped at all sites except Necker Island. The opakapaka catch, however, was token (3 fish in 1/10 traps) at FFS. A total of 383 juvenile opakapaka weighing 60 kg were trapped off Kaneohe Bay, Oahu. The traps set off Molokai yielded another 89 juvenile opakapaka weighing 24 kg. At both MHI sites, the juvenile opakapaka trapped included young-of-the-year (YOY) as small as 13 cm FL. The largest juveniles trapped were 28 cm FL (Kaneohe Bay) and 35 cm FL (Molokai). The three juveniles trapped off FFS were YOY (15.1-16.6 cm FL); these represent the first reported catches of YOY-sized opakapaka from anywhere in the NWHI.
7. A single juvenile kalikali (*Pristipomoides sieboldii*) was trapped at each of the two MHI sites (Kaneohe Bay: 19.0 cm FL; Molokai: 20.6 cm FL). The only other juvenile, deep-reef bottomfish trapped was a single recruit *Caranx lugubris* trapped off Molokai.

B. Use the *Townsend Cromwell's* power gurdies to handline specimens of subadult- to adult-sized bottomfish (snapper, grouper, jacks) from along 75- to 100-fm contours on banks off, near, and en route to Necker Island and French Frigate Shoal in the NWHI; and off Kaneohe Bay, windward Oahu, and Kolo Harbor, southwest Molokai, in the MHI; collect ovary specimens for characterization of body size at 50% sexual maturity; evaluate depth, time of day, etc. effects on barotrauma of handlined fish.

1. Conducted 320 line-hours of power gurdy handline fishing (four hooks per line) at a total 39 stations. (Line-hours represent total fishing time or gross total effort, as the values include time spent retrieving and lowering gear, as well as time spent rebaiting and rerigging lost and damaged gear.) About 82% of total line-time was spent fishing for adult bottomfish at 60-

120 fm (NWHI: 17 stations; MHI: 5 stations), and 18% was spent fishing for juvenile opakapaka at 35-90 fm (18 stations).

2. Terminal gear differed between adult and juvenile handlining in terms of hook size, breaking strengths of leaders/snells, and weights used. Size nos. 26-30 Izuo Circle hooks, 80-200 lb test terminal lines, and 5 kg weights were used to fish adults on the deep reef. Size nos. 8 and 10 Izuo AH hooks, 10-20 lb terminal lines, and 2-kg weights were used for juvenile opakapaka fishing. Stripped squid was the primary bait used for both adults and juveniles.
3. A total 430 subadult-adult bottomfish individuals of 15 species were handlined, for a grand mean CPUE of 1.63 fish·line·hr⁻¹. CPUE averaged >eightfold greater at the NWHI versus MHI stations (1.95 & p.we fish·line·hr⁻¹, respectively).
4. Matched ovary and body weight data were collected for 208 bottomfish specimens. Gonad samples were fixed in 10% formalin for a total 195 subadult-adult females of 5 species of eteline snappers, 1 grouper, and 1 jack. These comprised 75 ehu (*Etelis carbunculus*), 48 kalikali (*Pristipomoides sieboldii*), 28 gindai (*P. zonatus*), 22 opakapaka, 4 yellowtail kalikali (*P. auricilla*), 10 hapuupuu (*Epinephelus quernus*), and 8 butaguchi (*Pseudocaranx dentex*).
5. The fraction of severely barotraumatized specimens (ruptured swimbladder, eye or skin embolisms) was about one-third for all major species pooled (excluding kahala, for which these data were not recorded). The incidence of severe trauma varied among the major species; the most frequently and severely impacted were demersal species (hogo, *Pontius macrocephalus*: 100%, $n = 4$), gindai (74%), and hapuupuu (>>50%). The least traumatized were ehu (11%), butaguchi (<10%), and kalikali (21%). Incidence of severe trauma in opakapaka was intermediate (31%). Only infrequently (4% of total catch) was a specimen spared the lesser traumas of stomach eversion and swimbladder distension. Swimbladder distension occurred more frequently (96% of total, excluding kahala) than stomach eversion (78%).
6. A total 90 fish individuals were handlined at the "juvenile opakapaka" stations, for a grand mean CPUE of 1.6 fish·line·hr⁻¹. Two species (opakapaka and the pufferfish, *Lagocephalus hypselogeneion*) accounted for 93% of all fishes caught. Juvenile opakapaka comprised the majority (48; 53%). Puffers contributed another

40% (36 fish). Six individuals of 4 other species were caught, including 2 juvenile (15.5, 16.9 cm FL) kalikali, both caught off Kolo Harbor, Molokai.

- C. Conduct video camera drops at select stations to characterize the general bottom topography.
1. Six video camera deployments (all unbaited) were conducted. Four drops were made near the fish trap stations off Necker Island and two drops were made near fish trap stations at FFS.
- D. Conduct CTD casts at select stations to describe temperature profiles for the water column overlying the station.
1. Two casts of the Applied Microsystems, Ltd. Model STD-12 portable CTD were conducted at a handline station off FFS that was unusually productive for adult opakapaka.
- E. Complete 1- to 2-day tracking of a sonically tagged, adult opakapaka or other deep-reef bottomfish off Kaneohe Bay; this task required the live-capture of potential test fish in the NWHI, the subsequent holding and transport of specimens to Oahu in the *Townsend Cromwell's* baitwells, and coordinated operations of the *Townsend Cromwell* and the NOAA vessel, *Ka'ahele'ale*, to tag, release, and track the test fish.
1. A total 9/58 (16%) adult opakapaka, handlined during daylight hours (0830-1630) from 60-120 (median 85) fm depths off Nihoa, Necker Island and FFS in the NWHI, during the period 6-14 August, appeared sufficiently healthy when captured to warrant maintenance and transport aboard ship. The swimbladders of most fish were vented (by hand, using a syringe needle) when fish were first placed in the baitwell.
 2. Two handlined adult opakapaka had dummy transmitters inserted manually into their stomachs when brought aboard ship. Both appeared minimally traumatized upon capture (a 47-cm FL fish caught at 75 fm off Nihoa Island at 1715 on 6 August, and another 58 cm FL fish caught at 90 fm off Necker Island at 0900 on 8 August). (The dummy tag used approximated the dimensions of the sonic transmitter to be used in the Kaneohe Bay tracking experiment; see baitwell until it died (the 47-cm fish, within 12 h) or until it became moribund (the 58-cm fish, 25 h). When examined, each fish still retained the dummy tag in its intact, but otherwise empty, stomach. Autopsy revealed that the 58-cm fish (an adult female) had a badly lesioned swimbladder; the 47-cm fish (an adult male) had no lesions on its

swimbladder or other obvious injury that could have resulted in its death.

3. All live-maintained fish were held in the *Townsend Cromwell's* forward baitwells for as long as they remained healthy (several for >1 wk). None of the fish ate during capture, despite trial feedings with small, live reef fish as well as stripped and chunk squid, repeated at various times of day and night beginning several days following capture. Only five fish lived until 15 August, when the ship began return transit to the MHI. Four fish survived the return transit to Kaneohe Bay, Oahu.
4. A VEMCO Model 3VP=3H-01 pressure transmitter with reed switch (dimensions: 80 mm long x 18 mm diameter) was manually inserted into the stomach of a large adult opakapaka (61 cm FL, sex unknown, caught at 80 fm off FFS at 1400 on 12 August). The fish was tagged at 1145 on 18 August, then immediately released at the sea surface from the *Townsend Cromwell* over a bottom depth of 65 fm, 1.5 nmi west-northwest of Mokumanu Island off of the Mokapu Peninsula. The fish was tracked from the NOAA vessel *Ka'ahale'ale* for the next 2-3/4 hr (until 1430), when it apparently regurgitated its tag in 40 fm of water about 1.5 nmi from its release point. While tagged, the fish traveled in a generally west-northwest (upbay) direction. During the first hour, the fish made 4 dives of about 5-min duration, at approximately 10-minute intervals, to depths of 44, 52, 41, and 68 fm. For the next 1-1/4 h, it swam at 22±2 fm, with one brief dive to 41 fm. During the last half-hour, it swam at an average depth of 14 fm, with another brief dive to 41 fm. Bottom depths during the tracking period ranged from 70 to 130 to 50 fm.

**SCIENTIFIC
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Attachment