

Lithodes nintokuae Sakai: A Deep-water King Crab (Crustacea, Anomura, Lithodidae) Newly Recorded from Hawaii¹

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ABSTRACT: *Lithodes nintokuae*, previously known from five specimens from the Emperor Seamount Chain, northwest of Midway Islands, is redescribed from abundant material taken at a series of localities along the Midway/Hawaiian Islands Ridge. Its recorded depth range is 450 to 1070 m. Rostral and carapace characters place it in the "*L. tropicalis* group" of the genus *Lithodes*. Features are given which differentiate it from the five other members of this group.

IN 1967 THE NATIONAL MARINE Fisheries Service (NMFS) began a survey of the deep-water shrimp resources of the Hawaiian Islands (Struhsaker and Aasted 1974, Schlais 1982). Large numbers of the caridean shrimps *Heterocarpus ensifer* Milne Edwards and *H. laevigatus* Bate were taken in trawls and traps in sufficient quantity to indicate a potential commercial fishery. Two lithodid crabs taken during trapping trials were forwarded to us in 1972 by the Bernice P. Bishop Museum, Honolulu, for identification. It was clear that these crabs then represented an undescribed species of the genus *Lithodes*.

During 1976 and 1977 Japanese fisheries surveys along the Emperor Seamount Chain, lying to the northwest of Midway Islands (Figure 1), produced an interesting series of decapod Crustacea including five specimens of a lithodid crab later described by Sakai (1978) as *Lithodes nintokuae*.

Attempts to include both *Lithodes nintokuae* and our new species from Hawaii in a key to the genus *Lithodes*, which we had been preparing, led to the realization that they were conspecific.

Some years earlier, Takeda (1974) had identified three specimens of a *Lithodes* taken during Japanese commercial fishing activities

off Midway Islands as *L. couesi* Benedict. In his description of *L. nintokuae*, Sakai (1978) questioned this identification, considering that these specimens might also belong to his new species. This material was examined by J.C. Yaldwyn with Masatsune Takeda at the National Science Museum, Tokyo, in 1979. It was agreed that Sakai's supposition was correct.

Subsequently, Robert B. Moffitt of the NMFS Honolulu Laboratory told us that he had several specimens of *Lithodes nintokuae* from off the Midway Islands and sent us color transparencies for examination. There was little doubt that these were additional records of this new Pacific lithodid. Yaldwyn later visited the Honolulu Laboratory and examined many other specimens of *L. nintokuae* that had been collected along the Hawaiian Ridge. Moffitt's Midway specimens were not available at that time.

The Hawaiian specimens provide an opportunity for a more detailed description of the morphology of *Lithodes nintokuae* than that given by Sakai. Those characters that distinguish it from other species of the genus are particularly emphasized. This has enabled us to complete a key to *Lithodes* which will allow identification of members of this genus on a worldwide basis (Dawson and Yaldwyn, in press).

ABBREVIATIONS USED: BPBM (Bernice P. Bishop Museum, Honolulu); CL (carapace length—orbit to midpoint of posterior carapace margin); NMFS (National Oceanic

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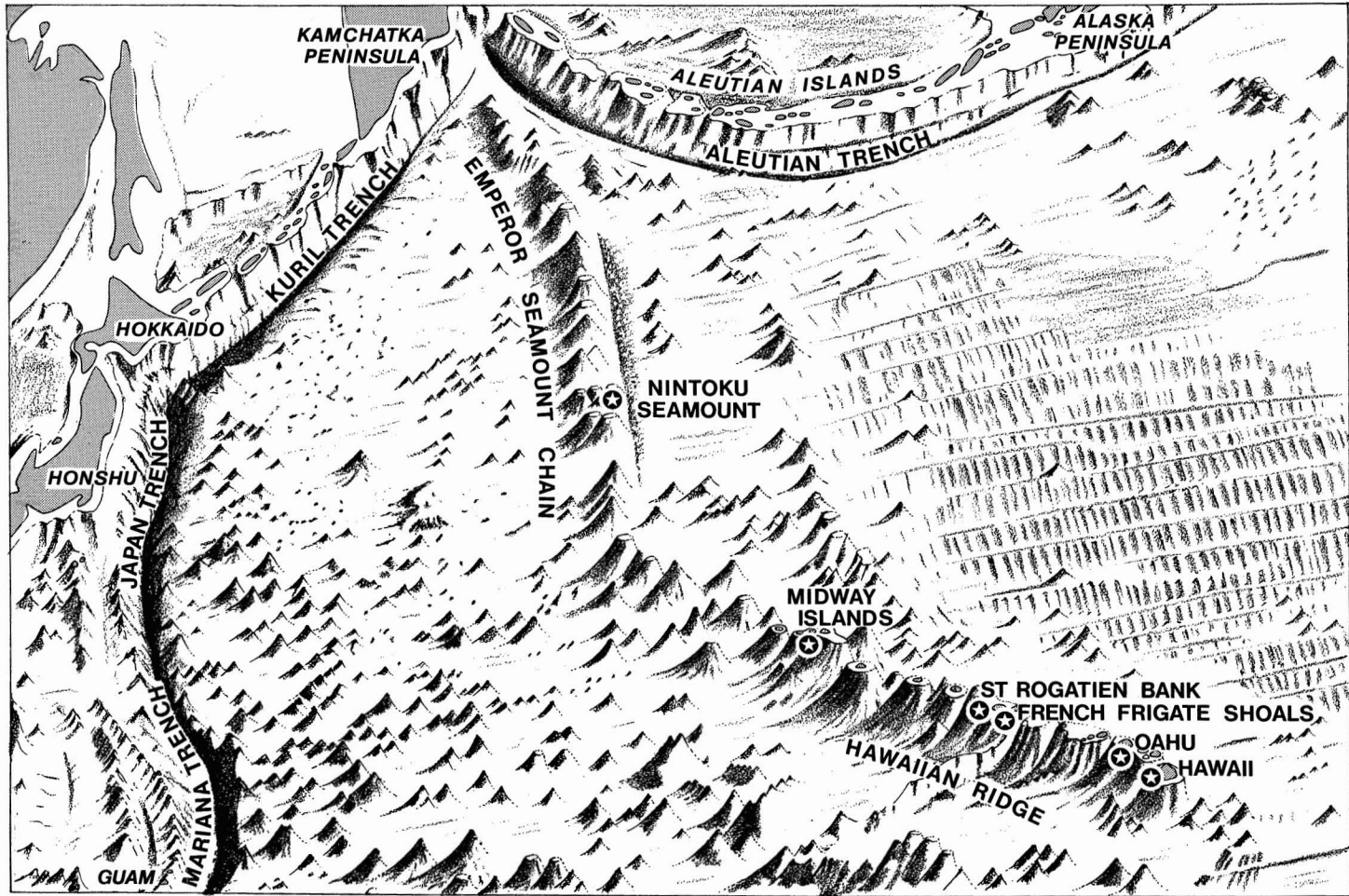


FIGURE 1. Map of northern Pacific Ocean showing Emperor Seamount Chain and Midway/Hawaiian Islands Ridge, based on *Pacific Ocean Floor*, National Geographic Society, 1969. Stars indicate records of *Lithodes nintokuae* Sakai.

and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Center, Honolulu Laboratory); NSMT (National Science Museum, Tokyo); TC (R/V *Townsend Cromwell*).

SYSTEMATICS
ORDER DECAPODA
SUBORDER REPTANTIA
SECTION PAGURIDEA
FAMILY LITHODIDAE
GENUS *Lithodes* Latreille, 1806

Lithodes Latreille, 1806:39

Lithodes, Yaldwyn & Dawson, 1970:276 (generic syn.)

Lithodes nintokuae Sakai, 1978

Figure 2-4

Lithodes couesi Takeda, 1974:206-207, pl. 1 fig. 2, pl. 3 figs. 3-4. (NON *L. couesi* Benedict, 1894).

Lithodes nintokuae Sakai, 1978:13-14, figs. 24-25, pl. IV figs. A-B.

Material Examined

Thirty-eight specimens as follows: TC 52-107, 21°23' N, 158°14' W, bottom trap, 823 m, off NW Oahu, Hawaiian Islands, 16-17 March 1971, P. Struhsaker, NMFS, Honolulu, R/V *Townsend Cromwell*, 1 male CL 59 mm (BPBM S 7995). Study specimen Figures 2, 4.

TC 54-10, 21°33' N, 158°20' W, trap, 658 m, near Kaena Point, Oahu, 7 September 1971, NMFS, 1 ovig. female CL 80 mm (BPBM S10618). Study specimen Figure 3.

32°03.8' N, 172°50.2' E, 695-820 m, NW of Midway Island, early 1970s, Nippon Suisan Kaisha Ltd., 1 male CL 105 mm, 1 ovig. female CL 115 mm, 1 female CL 63 mm (NSMT Cr. 4150); see Takeda 1974.

TC 79-03, Stn. 49, String 2, 23°49.5' N, 166°26.8' W, shrimp trap, 702 m, French Frigate Shoals, Hawaiian Islands, 26 July 1979, NMFS, 1 male CL 58 mm, 4 ovig. females CL 68-81.5 mm.

TC 79-05, Stn. 6, String 3, 20°02' N, 156°02.1' W, shrimp trap, 622 m, off Hawaii Island, 9 December 1979, NMFS, 1 male CL 45.5 mm.

Shrimp traps, 548-640 m, off Kaena Point, Oahu, 10-11 March 1981, trawler *Easy Rider Too*, 10 males CL 39-82 mm, 12 females CL 39.5-87 mm (4 ovig. 62-80.5 mm).

Shrimp traps, 457-567 m, W of Kawaihae, Hawaii Island, 30-31 March 1981, trawler *Easy Rider Too*, 1 male CL 48.5 mm, 3 females CL 56-79 mm (2 ovig. 70.5-79.5 mm).

TC 81-04, Stn. 110, String 1, 24°10.4' N, 167°07.7' W, shrimp trap, 757 m, St. Rogatien Bank, Hawaiian Islands, 20 August 1981, NMFS, 1 male CL 52 mm.

OTHER MATERIAL: Known specimens of this species not examined by the authors:

42°20' N, 170°50' E, 800+ m, N of Nintoku Seamount, 20 July-September 1977, *Keikyu-maru No. 26*, Hamaya Marine Product Co., 1 male CL 116 mm (holotype), 1 female (allotype), 1 male 1 female (paratypes); see Sakai (1978:13).

41°10' N, 170°35' E, crabpot, 1070-1055 m, Nintoku Seamount, 20 August 1977, Marine Fishery Resource Research Center, Tokyo, 1 male (paratype); see Sakai (1978:13).

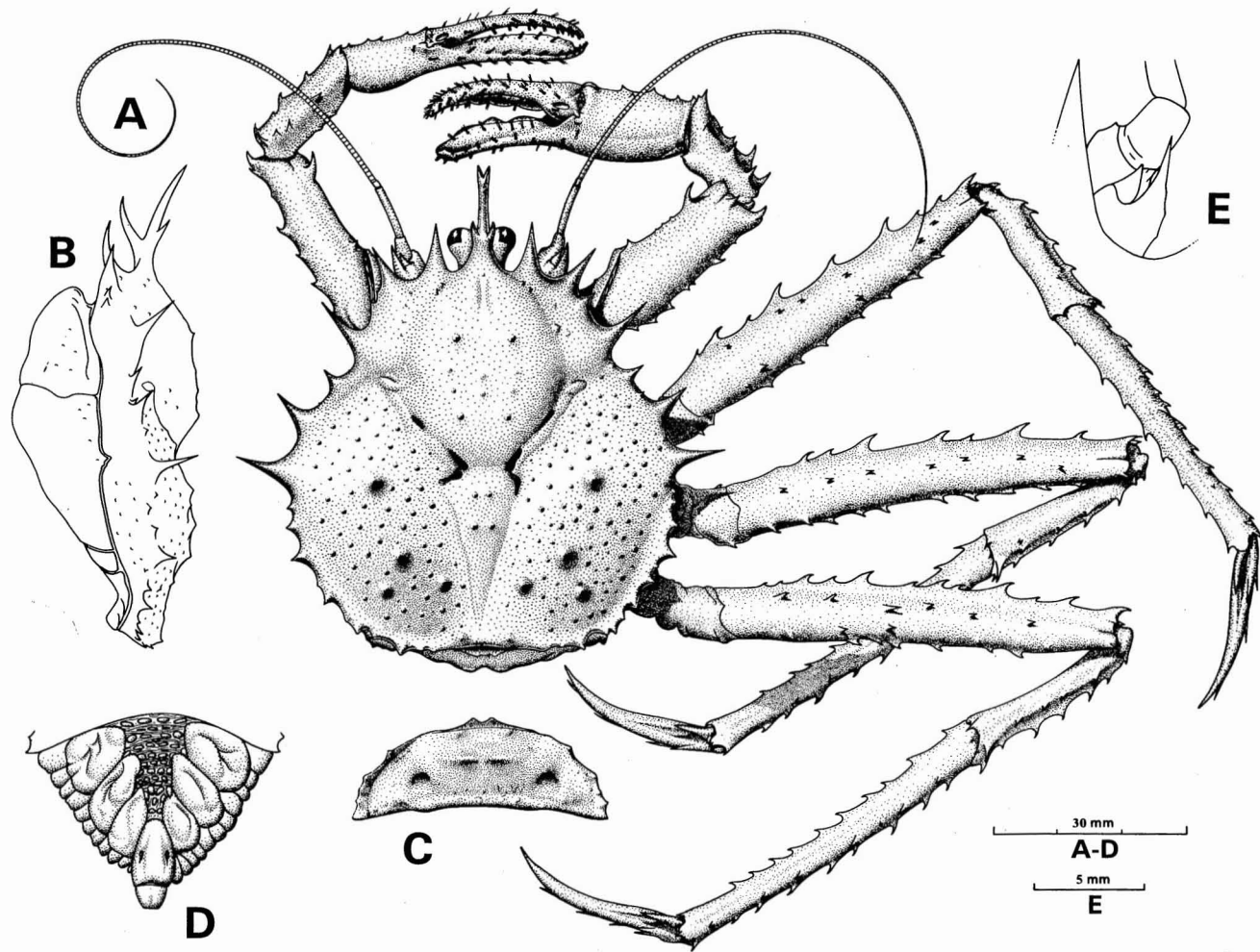
Shrimp traps, c. 695 m, off Midway Island, Sept./Oct. 1980, trawler *Easy Rider Too*, 3 males CL 50-92 mm, 1 female CL 86 mm, *vide* R. B. Moffitt (color transparencies only examined).

Diagnosis

A medium-sized, relatively smooth *Lithodes* with prominent lateral spines anteriorly, and with scattered tubercles and low spines, four of which are enlarged, on the branchial regions of the carapace; two pairs of gastric and two pairs of cardiac spines; rostrum conspicuous, straight, terminally bifid, with a pair of lateral spines; legs long and coarsely spined.

Description

Rostrum (Figure 2A, B) relatively long and narrow, uniformly inclined dorsally



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FIGURE 2. *Lithodes nintokuae* Sakai, off Oahu, Hawaii. A-E, male CL 59 mm. A, carapace, chelipeds, right walking legs, dorsal view; B, carapace, left lateral view; C, 2nd abdominal segment, posterior view; D, 3rd-5th abdominal segments, ventral view; E, right external orbital spine, basal antennal segment with reduced scaphocerite, dorsal view. A-D to same scale, E to different scale, as indicated.

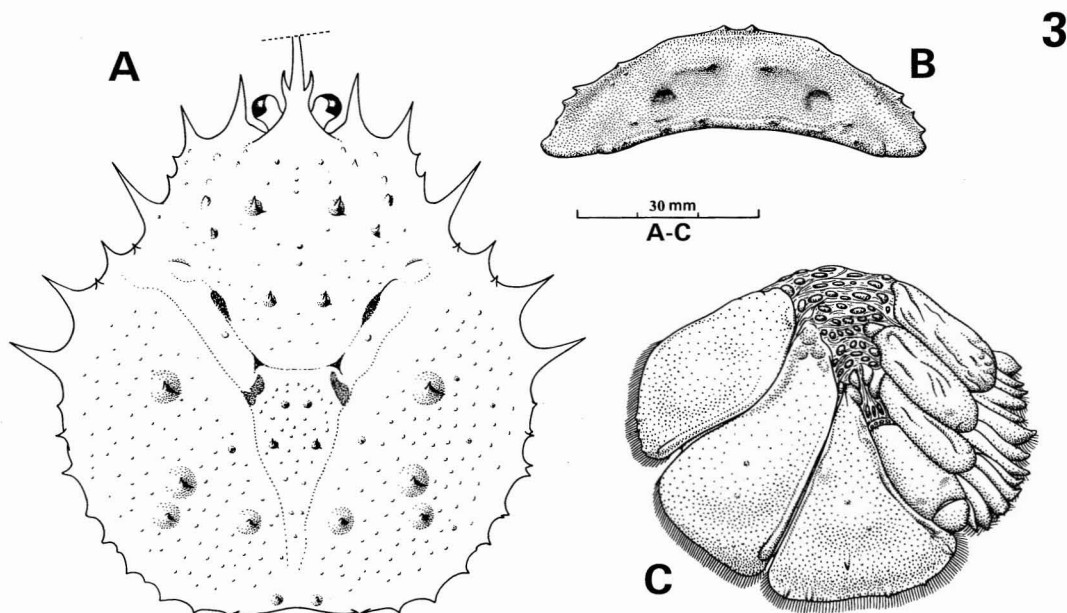


FIGURE 3. *Lithodes nintokuae* Sakai, off Oahu, Hawaii. A-C, female CL 80 mm. A, carapace, dorsal view; B, 2nd abdominal segment, posterior view; C, 3rd-5th abdominal segments, ventral view.

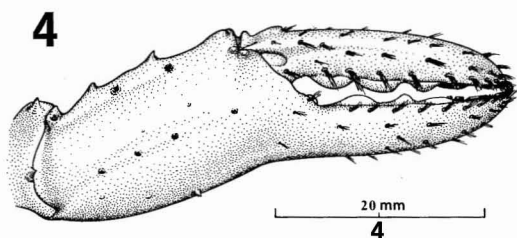


FIGURE 4. *Lithodes nintokuae* Sakai, off Oahu, Hawaii. Male CL 59 mm. Hand of right cheliped, outer surface.

and about a quarter of carapace length in medium-sized specimens (proportionately longer in smaller specimens); terminally narrowly bifid, armed with a single pair of lateral spines situated at about the proximal third of its length; basal spine of rostrum strong and slightly curved dorsally; no secondary spines dorsally or laterally.

Carapace (Figures 2A, 3A) with regions clearly delineated. Gastric region with two pairs of distinct, but not strong, spines; anterior pair usually somewhat larger than posterior pair; smaller spines may be present between major pairs and in midline. Cardiac

region with two pairs of distinct, but not strong, spines; anterior pair usually smaller than posterior pair, sometimes virtually suppressed. Posterior gastric pair of spines subequal in size to posterior cardiac pair. Intestinal region with one pair of low spines. Dorsal branchial region with numerous uniformly distributed small tubercles, sometimes pointed, at least four of which are enlarged and grouped in a distinct pattern, one at level of second walking leg, a diagonal pair at level of third walking leg, and a single spine between this pair and midline of carapace. Lateral margin of carapace with strong external orbital spine extending anteriorly beyond the eyestalk; one strong gastric spine anteriorly with one or two, or no, small gastric spines separating it from a strong, hepatic spine; about 10 to 14 lateral marginal spines of which the three most anterior increase in size posteriorly and are more strongly developed than the irregularly spaced and sized posterior series.

Abdomen with first segment almost obscured by carapace but with a pair of median posterior tubercles visible in both dorsal (Figure 2A) and posterior (Figures 2C, 3B upper

edge) view. Second segment (Figures 2C, 3B) entire although incipient (but never complete) sutures may delineate marginals from the fused median and lateral plates; anterior half with a pair of transverse ridges, clearly visible in dorsal view (Figure 2A lower edge); posteriorly, and slightly laterally, a pair of obvious subcircular pits, thickened posterior margin with several low tubercles. Male third to fifth segments (Figure 2D) symmetrical, median area membranous with numerous, closely spaced, calcified nodules arranged more or less in transverse rows; lateral plates large and paired on each segment; marginal plates subdivided into blunt platelets, usually three on third segment and four on each of fourth and fifth segments. Female third to fifth segments (Figure 3C) markedly asymmetrical curving to right; median area as for male, lateral plates paired with those on left side grossly enlarged; marginals absent on left, subdivided on right somewhat irregularly into about four elongated and acute platelets per segment.

Eyes prominent, dark-pigmented cornea mainly ventral and wider than stalk, no spines on stalk; basal antennal segment (Figure 2E) with prominent anterolateral spine, scaphocerite reduced to a simple conical form, distinctly shorter than anterolateral spine.

Chelipeds (Figures 2A, 4) in both male and female subequal in length and about twice carapace length, one more robust than other. Larger cheliped (right in all but 2 of the 38 specimens examined) with merus bearing several spines along dorsolateral and ventromedial surfaces, the most conspicuous of which is the most distal of the ventromedial series; carpus with several spines laterally, dorsally, and medially; hand with fingers slightly longer than palm, bearing two irregular rows of spines along both dorsal and outer surfaces of palm, fixed finger with two large, rounded teeth, free finger with three similar teeth. Smaller cheliped similar except for hand, which has slender, untoothed fingers about $1\frac{1}{2}$ times palm, spines on palm less developed.

First to third walking legs (second to fourth pereopods) similar but becoming progressively longer posteriorly, second about $2\frac{1}{2}$ times

carapace length; merus armed with an irregularly spaced row of spines along dorsal and ventral edges, some scattered spines more or less linearly arranged along outer surface; carpus similarly spined along dorsal edge and outer surface; propodus similar to merus, all three segments with inner surface smooth; dactyl armed with collar of spines proximally and other spines on dorsal edge; propodus and carpus distinctly compressed; fifth pereopod reduced and tucked under carapace as usual for genus.

Pleopods absent in male; female with first to fifth pleopods on left side, first only on right, all pleopods uniramous. Eggs in later stage of development more than 2 mm in length (probably indicating direct development).

Branchial formula

Lithodes nintokuae has 11 gills and 3 exopods as follow:

	MAXILLIPEDS			PEREOPODS				
	1st	2nd	3rd	1st	2nd	3rd	4th	5th
Pleuro-branches								1
Arthro-branches			2	2	2	2	2	
Podo-branches								
Epipods								
Exopods	1	1	1					

A branchial formula for the genus *Lithodes* has been published by Gurney (1942: 151) and by Balss (1957:1590), presumably derived from *L. maia* Linnaeus, 1758, of European waters. This agrees with our formula, the only difference being that Gurney places the single pleurobranch on the fifth pereopod whereas it is on the fourth in *L. nintokuae*. Bouvier (1894:162) gave a formula for "*Lithodes brevipes*." Since this species is now in *Paralithodes*, its formula (which agrees with ours) may be taken as representative of that genus. At the family level Makarov (1962:221) gives 11 gills on each side with the pleurobranch on the fourth pereopod and two arthrobranches on third maxilliped and first to fourth pereopods.

Abnormality

One nonovigerous female specimen taken off Kaena Point, March 1981, shows reversed abdominal asymmetry, having enlarged third to fifth lateral plates on the right side instead of the left as usual in females.

Color

Hawaiian specimens were described as being "blood red" in color when collected (Michael P. Seki, pers. comm.). Transparencies provided by Robert B. Moffitt of the Midway Island specimens show the anterior part of the carapace, the cardiac area, and walking legs as bright pinkish-red with the branchial regions purplish-red. The fingers of the chelipeds appear distinctly dark. Sakai's color plate (1978: pl. IV) of the holotype depicts it as yellowish-brown.

Distribution and Depth Range

Central Northern Pacific from Emperor Seamount Chain along Hawaiian Ridge to the Hawaiian Islands, depth range 450–1070 m (see Figure 1).

Since the presence of this species has only become known through recent deep-water fishery explorations, it may well be that its range will be found to be more extensive as such activities expand in this region.

Discussion

Based on characters of the rostrum and of carapace spinulation, the 12 known species of *Lithodes* can be divided into four groups, that is, the *aequispina*, *antarcticus*, *maia*, and *tropicalis* groups (Dawson and Yaldwyn, in press). The combination of a bifid rostrum bearing a single pair of dorsolateral spines with two pairs of gastric and two pairs of cardiac spines on the carapace places *L. nintokuae* in the *L. tropicalis* group. Within this group the lack of carapace spinulation distinguishes it from *L. wiracocha* Haig, 1974; the straight continuation of the proximal part of the rostrum into the distal part distinguishes it from *L. longispina* Sakai, 1971 and *L. turritus* Ortmann, 1892; the anterior pair of cardiac

spines smaller than the posterior pair and the four enlarged tubercles on each dorsal branchial region distinguish it from *L. tropicalis* A. Milne Edwards, 1883 (see Milne Edwards and Bouvier 1900:266); and the 10 to 13 marginal branchial spines on each side of the carapace distinguish it from *L. murrayi* Henderson, 1888.

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The late Dennis M. Devaney of the Bernice P. Bishop Museum, Honolulu, provided the two specimens of lithodid which form the basis of this study, and we are grateful for his interest in our project on Pacific lithodids over the years. This paper is intended as a personal tribute to his wide interests in Hawaiian marine fauna.

Further specimens of lithodids from the Hawaiian area were examined at the NMFS Honolulu laboratory through the kindness of Michael P. Seki. Robert B. Moffitt of the same laboratory sent us transparencies and other information on this species. We thank them both for their cooperation.

Masatsune Takeda provided an opportunity at the National Science Museum, Tokyo, for one of us to examine specimens. His help and interest in our project is greatly appreciated.

The drawings were done by W. R. Webber of the National Museum, Wellington, New Zealand, and we are pleased to have his continuing assistance with our work.

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