# Initial U.S. Exploration of Nine Gulf of Alaska Seamounts and Their Associated Fish and Shellfish Resources

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*ABSTRACT—The first U.S. exploration of fish and shellfish resources associated with nine Gulf of Alaska seamounts was conducted during 40 days in June and July 1979 from the 35-m crabber-trawler* Sunset Bay. *The reconnaisance survey included detailed acoustic soundings to map seabed topography; determine the suitability of substrate for deploying a variety of fishing gears; and exploratory fishing with sablefish traps, king crab pots, bottom trawls, midwater trawls, and photographic gear to determine fish and shellfish species composition, their distribution, and relative abundance on and over the seamounts. Descriptions of each seamount (Dickens, Welker, Durgin, Pratt, Applequist, Surveyor, Quinn, Giacomini, and Patten) topography and seabed conditions, as determined from acoustic mapping, are presented along with fishery resource information for all but Applequist seamount. Species of commercial importance occurred primarily in the demersal community and included two species of king crab,* Lithodes couesi *and* L. aequispina*; snow (Tanner) crab,* Chionoecetes tanneri*; and sablefish,* Anoplopoma fimbria. *The pelagic community consisted primarily of low densities of highly diversified bathypelagic fishes and squids including several rare species of scientific interest.*

## Introduction

Undersea mountains known as seamounts are prominent features of the ocean floor and are far more numerous in the Pacific than in the Atlantic and Indian Oceans. Larina (1975) reported the occurrence of 7,100 seamounts rising more than 0.5 km above the Pacific Ocean seabed. Pacific seamounts are primarily of volcanic origin concentrated in the central and western Pacific, but clusters of spectacular undersea mountains also occur along the northeastern North Pacific and Gulf of Alaska.

In addition to the often striking geological features of seamounts, which may rise abruptly from ocean basin depths of 4,000 m to within 20 m of the ocean surface, some seamounts are known to be inhabited by surprisingly large quantities of marine life for their relatively small surface areas. This has been convincingly shown by the recent development of large Japanese and Soviet fisheries over several seamounts in the central North Pacific, northwest of Midway Island. Takahashi and Sasaki (1977) and Sasaki (1978) reported Japanese catches of pelagic armorhead, *Pentaceros richardsoni*, and alfonsin, *Beryx splendens*, have averaged 20,000-30,000 metric tons (t) annually since 1972.

Catches have principally been obtained by trawlers operating on four seamounts west of Midway Island at long. 171°-179°E, lat. 30°-36°N. They also reported that Soviet trawl catches of armorhead and alfonsin in that area may have reached 130,000 t in 1969, and while Soviet operations have continued, more recent catches are unknown. Also indicative of the initial high armorhead and alfonsin densities over these seamounts, 1,500-4,000-ton Japanese trawlers averaged catch rates of 60.2 t/hour in 1972. Since that year, however, concern for stability of the resource has mounted due to constantly decreasing catch rates which, in 1976, were 16 t/hour.

Reports of the highly valued central North Pacific seamount fisheries of Japan and the U.S.S.R. prompted the first U.S. investigation of nine major seamounts, and their associated fishery resources, in the Gulf of Alaska during a 40-day period in June and July 1979. This report is a summary of the topography, partial water temperature profile, and general fishery resource information of the seamounts investigated.

Based on the location of the "200-mile line" established by the Fishery Conservation and Management Act of 1976, Dickens, Welker, Quinn, Giacomini, and Patten seamounts are located within the U.S. controlled fishery conservation zone and Durgin, Pratt, Applequist, and Surveyor seamounts are located outside that zone in international waters (Fig. 1).

## Methods

Operations were conducted from the chartered 35 m (108 foot) trawler-crabber *Sunset Bay*. A variety of survey and fishing gear was operated in an exploratory mode designed to determine seamount topographic and temperature profiles and determine the distribution and composition of the pelagic and demersal fisheries community.

Large scale Loran-C work charts spanning the location of each seamount were prepared prior to the cruise and provided a means to map transected acoustic depth soundings, temperatures resulting from expendable bathythermograph (XBT) casts, location of trawl hauls, location of fixed gear, and comments on seabed hardness as interpreted from the acoustic soundings. After each seamount was mapped, fishing gear was deployed as dictated by seabed conditions. Bottom trawling to depths of 385 fathoms (fm) was completed with a high opening 32 m (105 foot)

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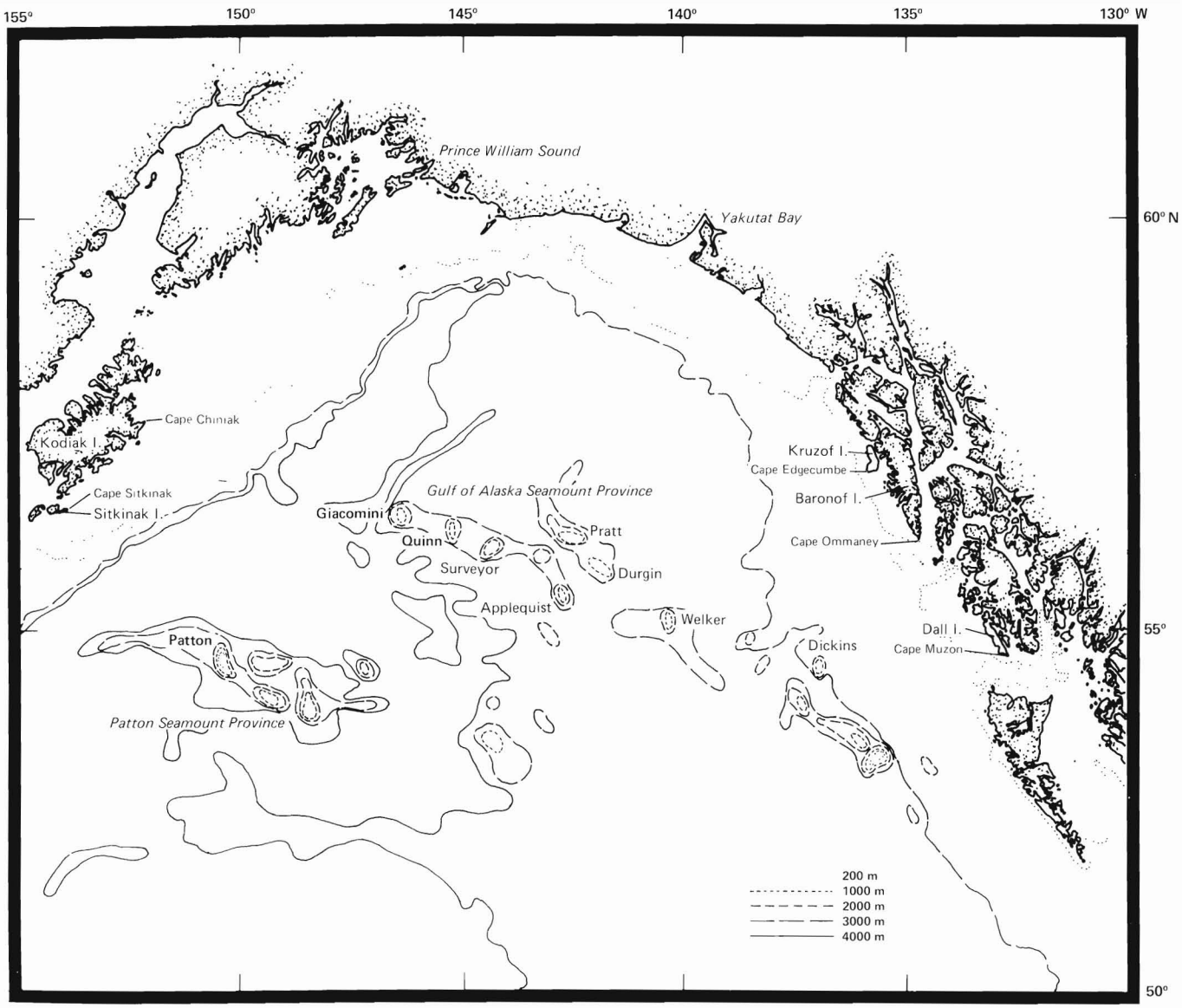


Figure 1.—Location of the nine seamounts surveyed in the Gulf of Alaska, 31 May-4 July 1979.

footrope Nor'easter[1] trawl equipped with rubber bobbins and a 32 mm (1¼ inch) mesh liner in the codend. Trawl doors used to spread the bottom trawl were 1.8 × 2.7 m (6 × 9 foot) steel V-type, each weighing about 1,045 kg (2,300 pounds). The midwater trawl net was of the east coast Canadian "Diamond" series (54 m, 177 foot footrope), equipped with a 32 mm (1¼ inch) mesh codend liner and was spread with 1.8 × 2.7 m (6 × 9 foot) Suberkrub-type doors weighing 540 kg (1,200 pounds) each.

Seventeen sablefish traps fished in strings on the seabed (Hipkins, 1974) were also used to sample the demersal fish and shellfish community. The traps were of both the Korean style 1.5 m (5 foot) diameter conical and U.S. style 2.4 m (8 foot) long rectangular design. Near the end of the survey, four 1.8 m (6 foot) square king crab pots were added to the trap strings to better sample crab populations which were encountered in surprisingly high quantities during the earlier survey period.

Deep sea still photography was conducted on Patton, Giacomini, and

[1]Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

Quinn Seamounts (Raymore[2]). The underwater camera and light source were mounted to a triangular shaped metal frame suspended 2.5 m above a baited ballast weight which was lowered to the seabed. Using this system, time-lapse 35 mm photographs were obtained during 4½-6 hour periods at depths of 237-435 fm.

## Results

### Seamount Descriptions

Descriptions of the major topographical features of all nine seamounts (Fig. 1) were successfully completed and may be summarized as follows in order of their east to west trans-Gulf location.

*Dickens Seamount*

Located 145 nautical miles (nmi) true west of Cape Muzon (Dall Island) off southeastern Alaska, Dickens Seamount's center is positioned at lat. 54°31′18″N, long. 136°56′00″W. This seamount rises from abyssal plain depths of 1,600 fm to within 228 fm of the ocean surface at the central position. The top is rectangular in shape and measures approximately 2 × 5 nmi (10 nmi$^2$) with the long axis oriented in a northeast-southwest direction. Depths on top of Dickens ranged from 228 to 410 fm, with much of the 10 nmi$^2$ being at 230-300 fm. The substrate is patchy (areas of hard and soft sediment) with scattered rock pinnacles.

On 2 June 1979, XBT casts over the seamount indicated water surface temperatures of 8.5°C, a poorly defined thermocline at 16-27 fm, and a bottom temperature of 4.3°C. Over deep water adjacent to Dickens, surface temperatures ranged from 8.7° to 9.0°C, and a more discrete 3.5°C thermocline existed at 11-38 fm.

*Welker Seamount*

Located 120 nmi WNW of Dickens Seamount and approximately 201 nmi WSW of Cape Ommaney (Baranof Island) off southeastern Alaska, Welker Seamount's center is positioned at lat. 55°06′42″N, long. 140°20′36″W. Welker Seamount rises from abyssal plain depths of 1,900 fm to within 385 fm of the ocean surface at the east edge. The top is rectangular and measures 4 × 7 nmi (28 nmi$^2$) with the long axis oriented north-south. Depths on top of Welker ranged from 385 to 500 fm with most of the surface area at 420-450 fm. Rock pinnacles rising 5-20 fm high are very common over the entire surface of the seamount. Areas of soft substrate are common between pinnacles.

Temperature conditions derived from the XBT over and adjacent to Welker Seamount were very similar and typically displayed 8.0°-8.4°C surface readings, a thermocline at 11-38 fm, and 3.7°-4.2°C bottom temperatures.

*Durgin Seamount*

Located 60 nmi WNW of Welker Seamount and approximately 215 nmi WSW of Cape Edgecumbe (Kruzof Island) off southeastern Alaska, Durgin Seamount's center is positioned at lat. 55°50′00″N, long. 141°51′30″W. Durgin Seamount rises from abyssal plain depths of 1,900 fm to within 343 fm of the ocean surface near the center position of the top. Its top is rectangular, measuring approximately 4 × 7 nmi (28 nmi$^2$) with the long axis oriented in a northeast-southwest direction. The top is quite flat ranging primarily from 355 to 390 fm below the ocean surface. Rocky pinnacles and hard substrate are prominent features of the eastern half of the top, while soft sediment and occasional rock pinnacles are prominent over the western half.

*Applequist Seamount*

Located 36 nmi SW of Durgin Seamount and approximately 252 nmi WSW of Cape Edgecumbe (Kruzof Island) off southeastern Alaska, Applequist Seamount's center is positioned at lat. 55°28′30″N, long. 142°46′24″W. Applequist rises abruptly from abyssal plain depths of about 2,000 fm to within 388 fm of the ocean surface near the center position of the top. The top of this seamount consists primarily of one large, steep peak composed of hard substrate. While a minimum depth of 388 fm was determined, a maximum area of 1 nmi$^2$ occurs at depths less than 500 fm.

*Pratt Seamount*

Located 46 nmi true north of Applequist Seamount and approximately 229 nmi WSW of Cape Edgecumbe (Kruzof Island) off southeast Alaska, Pratt Seamount's center is positioned at lat. 56°14′22″N, long. 142°32′00″W. Pratt rises from abyssal plain depths of about 2,000 fm to within 385 fm of the ocean surface. The top is rather symmetrically shaped, measures 4 × 5 nmi, with most of the 20 nmi$^2$ of the top surface area being at depths of 400-450 fm. The seabed over the central and north central area is primarily soft substrate while the east, west, and southern edge areas consist of hard and soft patches of substrate with occasional rock pinnacles.

*Surveyor Seamount*

Located 58 nmi WSW of Pratt Seamount and approximately 235 nmi true south of Cape St. Elias (Kayak Island) Alaska, Surveyor Seamount's center is positioned at lat. 56°03′06″N, long. 144°19′20″W. Surveyor rises from abyssal plain depths of about 1,800 fm to within 200 fm of the ocean surface. This seamount has a relatively large, flat, oval surface comprising about 70 nmi$^2$. Depths within this area ranged from 200 fm atop a large rock pinnacle to 450 fm; however, most of the surface area was 300-350 fm. Soft substrate was extensive, particularly on the southwest and south sides. Rock pinnacles were present and most common on the north and east sides.

*Quinn Seamount*

Located 33 nmi WNW of Surveyor Seamount and approximately 220 nmi south of Cape St. Elias (Kayak Island), Alaska, Quinn Seamount's center is positioned at lat. 56°18′18″N, long. 145°13′07″W. Quinn rises abruptly from abyssal plain depths of about 2,000 fm to within 373 fm of the ocean surface. The top is rather oval, measures 3 × 4 nmi with most of the 12

[2]Raymore, P. 1979. Deep-sea floor photography on Gulf of Alaska seamounts. Northwest and Alaska Fisheries Center Monthly Report, December, p. 9-19. Northwest and Alaska Fisheries Center, NMFS, NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

nmi$^2$ surface being 400-450 fm below the surface. This seamount is characterized by considerable soft sediment, an apparent absence of rock pinnacles, and extremely steep edges which plunge to the abyssal plain.

*Giacomini Seamount*

Located 40 nmi west of Quinn Seamount and approximately 198 nmi ESE of Cape Chiniak (Kodiak Island), Alaska, Giacomini Seamount's center is positioned at lat. 56°27′30″N, long. 146°24′00″W. Giacomini rises from abyssal plain depths exceeding 2,000 fm to within 367 fm of the ocean surface. This seamount has a rather symmetrical flat-topped shape comprised of about 20 nmi$^2$ of surface area at depths primarily of 370-400 fm. The substrate is predominantly soft with scattered rock pinnacles.

*Patton Seamount*

Located 175 nmi SW of Giacomini Seamount and approximately 166 nmi SE of Cape Sitkinak (Sitkinak Island), Alaska, Patton Seamount's center is positioned at lat. 54°34′22″N, long. 150°29′30″W. Patton rises from abyssal plain depths exceeding 1,900 fm to within 100 fm of the ocean surface at the NE corner of the seamount's top. The topographical features of Patton are much different from the previously described seamounts. The top measures 4 × 6 nmi; however, the 24 nmi$^2$ surface area consists of an endless series of rocky mountain peaks and canyons ranging from 100 to 500 fm depths. Areas at depths less than 200 fm are primarily mountain peaks. Areas of relatively flat and soft substrate are uncommon but occur mainly over the southwest quadrant.

## Seamount Fish and Shellfish Resources

The survey of fish and shellfish resources associated with the seamounts yielded considerable information of commercial and scientific value. Data on fish and shellfish communities were obtained from all seamounts except Applequist, where the topography prevented use of traps and bottom trawling.

**Table 1.—Sablefish and crab catches by trap-pot type obtained on the eight Gulf of Alaska seamounts fished from 31 May to 5 July 1979.**

| Seamount and date | No. and type of traps/pots fished | Avg. hours on the bottom | Depth range fished (fm) | Catch | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sablefish *Anoplopoma fimbria* | | Crab | | | | | |
| | | | | | | *L. couesi* | | *L. aequispina* | | *C. tanneri* | |
| | | | | no. | lb | no. | lb | no. | lb | no. | lb |
| Dickens 5/31/79-6/1/79 | 2 conical 5 rectangular | 14.5 | 260 | 44 | 207 | 8 | — | 1 | — | 0 | 0 |
| Durgin 6/11/79 | 5 conical 5 rectangular | 13.5 | 380-390 | 30 | 150 | 29 | 24 | 0 | 0 | 28 | 19 |
| Giacomini 7/1/79 7/4/79 | 16 conical 17 rectangular 8 king crab | 27.0 | 372-380 | 197 | 1,211 | 653 | 492 | 0 | 0 | 465 | 330 |
| Patton 6/25/79 6/30/79 | 20 conical 13 rectangular 4 king crab | 21.0 | 200-369 | 128 | 1,014 | 473 | 378 | 157 | 188 | 48 | 50 |
| Pratt 6/12/79 6/13/79 | 8 conical 10 rectangular | 18.0 | 425-450 | 25 | 125 | 17 | 17 | 0 | 0 | 33 | 25 |
| Quinn 6/18/79 7/5/79 | 13 conical 13 rectangular 4 king crab | 22.0 | 398-475 | 202 | 1,537 | 95 | 90 | 0 | 0 | 183 | 228 |
| Surveyor 6/13/79 6/17/79 | 32 conical 36 rectangular | 18.0 | 328-395 | 137 | 924 | 121 | 95 | 19 | 19 | 112 | 103 |
| Welker 6/3/79-6/5/79 | 6 conical 15 rectangular | 12.0 | 426-435 | 222 | 1,122 | 38 | 30 | 0 | 0 | 94 | 86 |

Dominant species of commercial value were found on or near the seamount substrates rather than in midwater over or adjacent to the seamounts. These species consisted of sablefish, *Anoplopoma fimbria*; deep-sea red king crab, *Lithodes couesi*; golden king crab, *L. aequispina*; and snow (Tanner) crab, *Chionoecetes tanneri*. The distribution and relative abundance of these species was most adequately assessed by trap and pot gear. Table 1 summarizes sablefish and crab catches in weight and numbers by seamount.

Sablefish, which is a dominant demersal species of the lower continental shelf and upper slope throughout the Gulf of Alaska, appeared from trap and pot catches to be the dominant finfish of each seamount's demersal fish community. Although bottom trawling was generally ineffective due to hang-up or excessive depths, 15 bottom trawl hauls on Durgin, Patton, Surveyor, and Welker Seamounts also produced catches dominated in weight by sablefish, with lesser amounts of rattails: *Coryphaenoides pectoralis*, *C. acrolepis*, and *C. cinereus*. Based on the trap and pot catches, there was also an indication that sablefish abundance on the seamounts was increasing during the June-July survey period. This was most notable on Quinn Seamount, the only seamount revisited, where initial 18 June sablefish catches produced 30 fish weighing 210 pounds from nine traps during a 20-hour period on the bottom (soak) (1.2 pounds/trap per hour), compared with 4 and 5 July catches of 172 sablefish weighing 1,327 pounds from 19 traps during a 23-hour soak (3.0 pounds/trap per hour).

Essentially all sablefish captured were ripe, spawning, or recently spent. Males outnumbered females by over 2:1. The length composition of 653 males and 310 females sampled from the combined seamount sablefish catches is shown in Figure 2.

While the occurrence and abundance of sablefish on the seamounts were not surprising due to their abundance at similar depths on the adjacent continen-

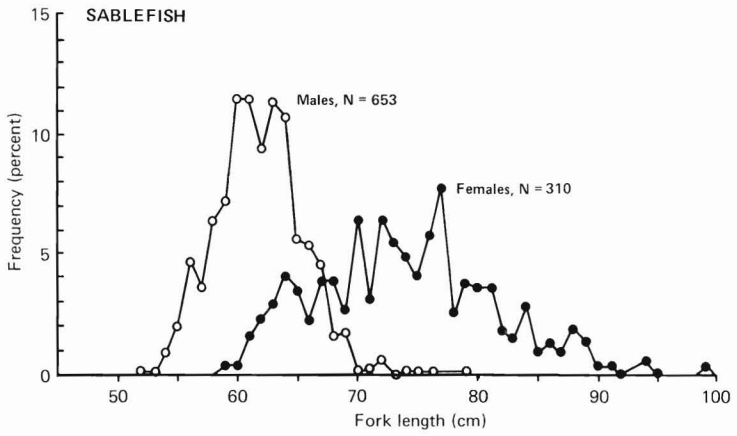


Figure 2.—Length-frequency distribution and sex ratio of sablefish obtained from collective catches on eight seamounts in the Gulf of Alaska during 31 May-4 July 1979.

tal shelf and slope in the Gulf of Alaska, the occurrence, abundance, and species diversity of crab on the seamounts were unexpected. This is best illustrated by comparing seamount crab catches with those obtained from nearly identical trap gear on the southeastern Alaska continental shelf and slope waters to assess sablefish stock abundance. In addition to gear similarities, the survey off southeastern Alaska was conducted at lat. 54°-58°N which spans the seamount locations, covers a similar depth range (150-450 fm), and was conducted during June and July of 1978 and 1979. During the 1978-79 survey off southeastern Alaska, 1,500 trap catches produced 62 deep-sea red king crab, 0 golden king crab, and 143 snow (Tanner) crab. By comparison, 232 seamount trap-pot catches (Table 1) produced 1,434 deep-sea red king crab, 177 golden king crab, and 963 snow (Tanner) crab.

Comparing catches between seamounts, the deep-sea red king crab displayed the widest distribution occurring on all seamounts, followed by snow (Tanner) crab which was obtained on seven of the eight seamounts, and the golden king crab which occurred on only Dickens, Patton, and Surveyor Seamounts. Patton Seamount, which provided the most rocky and irregular substrate as well as the shallowest depths fished, supported the most dense and diversified crab community. Figure 3 summarizes the size composition by sex and percentage sex composition obtained from the collective seamount crab catches. Many females of each crab species were carrying maturing clutches of eggs.

The underwater camera system successfully photographed crab populations on the seamounts (Fig. 4). This system was used five times, once on Patton Seamount and twice each on Giacomini and Quinn Seamounts.

Trawl sampling of the seamount communities was intended primarily to target on acoustically detected fish concentrations. However, extensive acoustic soundings of the water columns above and adjacent to the seamounts, as well as near the seamounts' substrates, failed to locate notable fish concentrations. Accordingly, trawling was conducted on bottom and in three midwater zones (zone 1 at 300-340 fm; zone 2 at 90-235 fm; and zone 3 at 7-18 fm) in an attempt to sample the apparent low density of acoustically undetected organisms near bottom and within the water column.

Catches resulting from the 15 bottom hauls and 17 midwater hauls completed on and over Dickens, Surveyor, Quinn, and Patton Seamounts generally produced low quantities of noncommercially valuable species but did produce catches representing a wide species diversity of considerable scientific interest. Table 2 lists those species obtained by respective seamount depth zones sampled. Perhaps the rarest fish obtained was the winged spookfish, *Dolichopteryx* sp., previously known only from one specimen in the North Pacific which was obtained at ocean station "Papa" (lat. 50°N, long. 145°W) in September 1969 (Hart, 1973). Hart further noted the specimen obtained at ocean station Papa probably represented an undescribed species, that it probably represented the largest specimen of the genus captured (154 mm TL) and that the genus is represented by a few rare species, mostly from the Atlantic Ocean. During the seamount survey, five spookfish, ranging in length from 130 to 200 mm FL were obtained from a midwater tow over Quinn Seamount at depths of 300-310 fm on 19 June 1979. An additional specimen measuring 200 mm FL was obtained from Patton Seamount 26 June 1979 at midwater depths of 285-305 fm.

A second species of the spookfish family captured during the seamount survey was the barreleye, *Macropinna microstoma*, which Hart (1973) described as an uncommon species occurring from northern Baja California to the Gulf of Alaska. The largest specimen previously reported was 44 mm in length. Sixteen barreleye ranging in length from 60 to 140 mm FL were obtained on Surveyor and Quinn Seamounts. All specimens were captured in bottom trawl or zone 1 midwater trawl hauls.

Specimens of the uncommon species included in Table 2 have been lodged at the University of Washington's College of Fisheries museum for further study.

## Summary and Conclusions

Survey of the nine Gulf of Alaska seamounts has provided descriptive information on each seamount size, topographical characteristics, and associated pelagic and demersal fish and shellfish resources.

Although the crest of Applequist Seamount rises steeply to a terminal single peak, the crests of Dickens, Welker, Durgin, Pratt, Surveyor, Quinn, Giacomini, and Patton Seamounts are rather flat and range in size from 10 to 70 $nmi^2$. Hence, these seamounts, with the exception of Patton which has a highly irregular crest, might be more properly termed "gyotes."

Except for the predominantly rocky and irregular crest on Patton, the crests of the remaining seven seamounts or gyotes are generally composed of soft substrate with scattered rock pinnacles rising 5-20 fm above the tops. The presence of such pinnacles hampered the effectiveness of bottom trawling for demersal fauna, while traps and pots proved to be effective gear for sampling demersal fish and shellfish resources on the substrates encountered.

Commercially valuable species encountered (sablefish, deep-sea red king crab, golden king crab, and snow (Tanner) crab) were members of the demersal faunal community. The pelagic community consisted of low densities of noncommercially valuable squid and small bathypelagic fishes and immature salmon.

Catches obtained by traps indicated sufficient sablefish densities to support commercial harvest of this species using either traps or longline gear as presently fished on the adjacent continental shelf and slope areas in the Gulf of Alaska and the northeast Pacific coast. More detailed and quantitative resource assessment surveys would be required to determine the magnitude of this resource and its potential annual sustained yield. Also, while sablefish encountered on the seamounts were in spawning condition, it is not known whether this population represents a self-sustaining resident stock independent of the coastal stock.

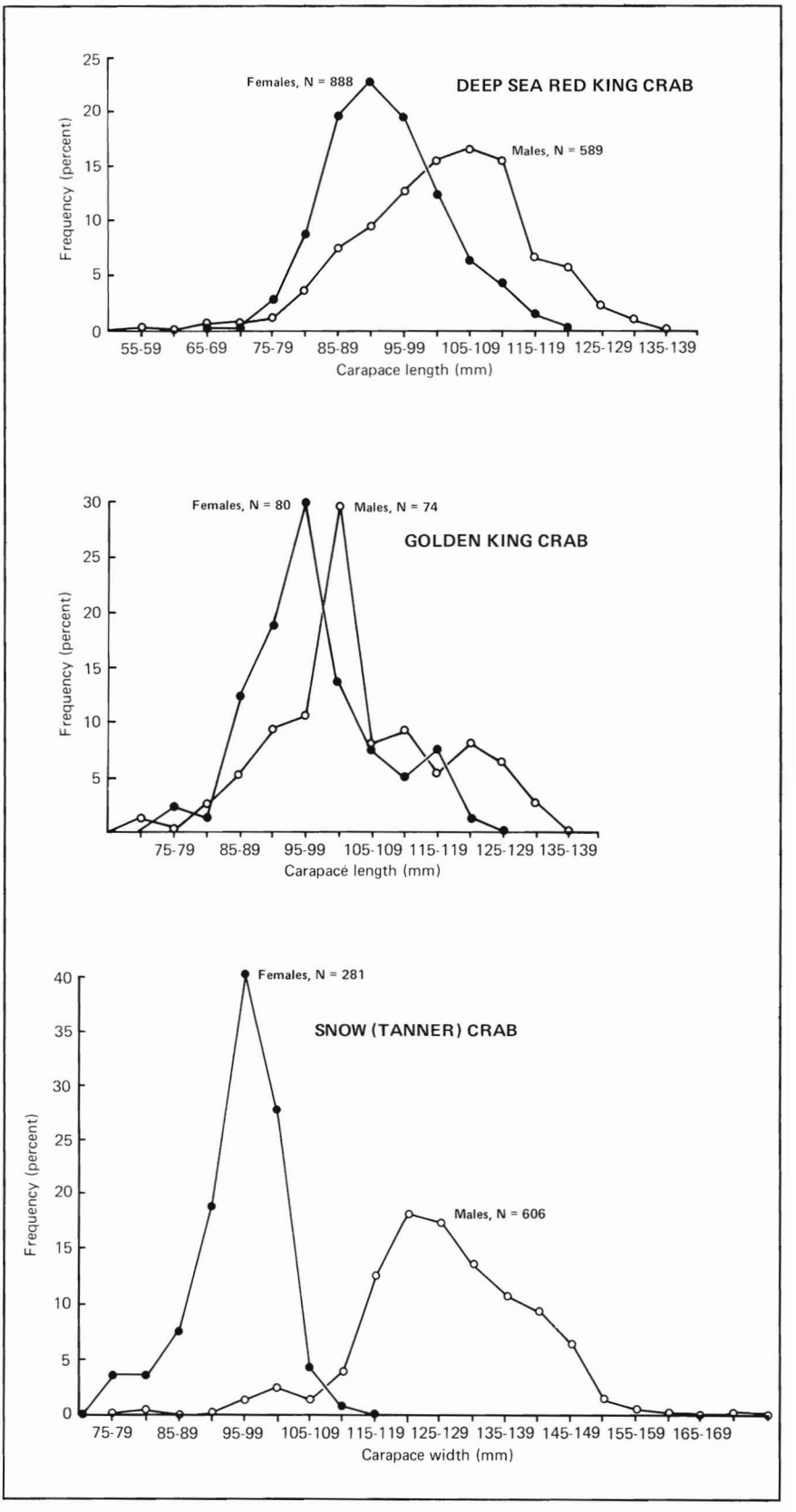


Figure 3.—Carapace size composition and sex ratios of deep-sea red king crab, golden king crab, and snow (Tanner) crab obtained from collective trap and pot catches on eight seamounts in the Gulf of Alaska during 31 May-4 July 1979.

Figure 4.—Deep-sea red king crab and snow (Tanner) crab on Giacomini Seamount at 377 fm, 3 July 1979. Several animals are feeding on organisms obtained on or under the soft substrate. (NMFS photo by Paul Raymore.)

The occurrence and apparent significant densities of king and snow crab on the seamounts were unexpected and proved to be a notable discovery of the survey. Due to the commercial value of these species, it may be desirable to conduct further quantitative studies of their distribution, abundance, and life history.

Studies are continuing on the collections of rare and uncommon fish, squid, octopus, and shrimp, presently at the University of Washington's College of Fisheries. These collections are of considerable scientific value and may represent numerous extensions to known geographic distributions and size composition.


## Acknowledgments

For many years prior to his December 1979 retirement as Assistant Director of the National Marine Fisheries Service's Northwest and Alaska Fisheries Center, Alonzo T. Pruter had planned to conduct an exploratory survey of fishery resources associated with seamounts in the Gulf of Alaska. This study was conducted primarily as a result of his interest. It was my pleasure to work with "Al" for many years prior to this survey and to join him on his last cruise as a fishery biologist with the Northwest and Alaska Fisheries Center.

Thanks are also expressed to Olf Austenberg, Captain of the chartered vessel *Sunset Bay*, and his crew for excellent cooperation during the survey.

**Table 2.—Fish, crustaceans, and cephalopods obtained by trawl on and over five seamounts in the Gulf of Alaska. BT signifies bottom trawl, MT1 signifies midwater trawl at depth of 300-340 fm, MT2 signifies midwater trawl at depth of 90-235 fm, and MT3 signifies midwater trawl at depth of 7-18 fm. (*) = bottom trawl that may not have been on bottom at all times.**

| Species | Seamounts | | | | | |
|---|---|---|---|---|---|---|
| | Dickens | Welker | Durgin | Surveyor | Quinn | Patton |
| Fish | | | | | | |
| Anoplopomatidae | | | | | | |
| *Anoplopoma fimbria* | — | BT | BT | BT | — | BT |
| Argentinidae | | | | | | |
| *Nansenia candida argentine* | — | — | — | MT1 | MT1 | — |
| Bathylagidae | | | | | | |
| *Bathylagus milleri* | — | BT* BT | BT* BT | MT1 | MT1 | MT1 |
| *B. pacificus* deep | — | — | — | BT MT1 | MT1 | MT1 |
| *Leuroglossus stilbius schmidti* sea smelt | — | — | — | MT1 | MT1 | MT1 |
| Chauliodontidae | | | | | | |
| *Chauliodus macouni* | MT2 | BT* BT | BT* BT | MT2, BT MT1 | MT1 | MT1 MT2 |
| Cyclopteridae | | | | | | |
| *Aptocyclus ventricosus* | — | — | — | BT | MT1, MT3 | MT1 MT2 |
| Icosteidae | | | | | | |
| *Icosteus aenigmaticus* | — | — | BT* | — | — | — |
| Macrouridae | — | BT | — | — | — | — |
| *Coryphaenoides acrolepsis* | — | — | BT | BT | — | BT |
| *C. cinereus* | — | BT | BT | BT | MT1 | BT |
| *C. pectoralis* | — | BT | BT | BT | — | BT MT1 |
| Melamphaeidae | | | | | | |
| *Poromitra crassiceps* | — | BT | BT* BT | BT MT1 | — | — |
| *Melamphaes lugubris* | — | BT | BT* BT | BT MT1 | — | MT1 |
| Melanostomiatidae | | | | | | |
| *Tactostoma macropus* | — | BT* | BT* | BT MT1 | MT1 | — |
| Moridae | | | | | | |
| *Antimora microlepis* | — | BT | — | BT | — | — |
| Myctophidae | MT2 | — | — | MT2 | MT3 | MT2 MT1 |
| *Diaphus theta* | MT2 | BT | BT* | MT1 MT2 | — | — |
| *Lampanyctus regalis* | | | | | | |
| *Protomyctophum thompsoni* | MT2 | — | — | — | — | MT1 |
| *Stenobrachius leucopsarus* | MT2 | BT* BT | BT* BT | MT2 BT, MT1 | — | MT1 MT2 |
| Nemichthyidae | — | — | — | BT MT1 | — | MT1 |
| *Aricotena bowersi* | — | — | BT* | — | — | |
| Oneirodidae | | | | | MT1 | MT2 |
| *Oneirodes thompsoni* | — | BT | — | MT1 | — | — |
| Opisthoproctidae | | | | | | |
| *Dolichopteryx* sp. | — | — | — | — | MT1 | MT1 |
| *Macropinna microstoma* | — | — | — | BT MT1 | MT1 | MT1 |
| Oreosomatidae | | | | | | |
| *Allocytus verrucosus* | — | — | — | MT2 | — | — |
| Paralepididae | | | | | | |
| *Notolepis rissoi rissoi* | — | — | — | MT1 | MT1 | — |

| Species | Seamounts | | | | | |
|---|---|---|---|---|---|---|
| | Dickens | Welker | Durgin | Surveyor | Quinn | Patton |
| Pleuronectidae | | | | | | |
| *Embassichthys bathybius* | — | — | — | BT | — | BT |
| Salmonidae | | | | | | |
| *Oncorhynchus gorbuscha* | — | — | — | MT3 | — | MT3 |
| *O. keta* | — | — | — | MT3 | MT3 | MT3 |
| *O. nerka* | — | — | — | MT3 | — | MT3 |
| Scopelarchidae | | | | | | |
| *Benthalbella dentata* | — | — | — | BT MT1 | MT1 | MT1 |
| Scopelosauridae | | | | | | |
| *Scopelosaurus harryi* | — | — | — | MT1 | MT1 | MT1 |
| Scorpaenidae | | | | | | |
| *Sebastolobus altivelis* | — | BT | BT | BT | — | BT |
| Searsidae | | | | | | |
| *Sagamichthys abei* | — | — | — | MT1 | MT1 | — |
| Zaproridae | | | | | | |
| *Zaprora silenus* | — | — | — | — | MT3 | MT3 |
| Zoarcidae | | | | | | |
| *Bothrocara remigerum* | — | BT | — | — | — | — |
| Invertebrates | | | | | | |
| Lithodidae | | | | | | |
| *Lithodes aequespina* | — | — | — | BT | — | — |
| *L. couesi* | — | — | BT | BT | — | BT |
| Majidae | | | | | | |
| *Chionoecetes tanneri* | — | — | BT | BT | — | |
| Bolitaenidae | | | | | | |
| *Japetella heathi* | — | — | BT* | MT1 | MT1 | MT1 |
| *Octopus* (unidentified) | — | — | — | MT2 BT | | |
| Vampyroteuthidae | | | | | | |
| *Vampyroteuthis infernalis* | — | — | — | — | MT1 | — |
| Chiroteuthidae | | | | MT1 | | |
| *Chiroteuthis* sp. | — | — | — | — | MT1 | MT1 |
| Cranchiinae | — | BT | — | MT1 | — | — |
| Species A | — | — | — | — | MT1 | MT1 |
| Species B | — | — | — | — | MT1 | MT1 |
| Gonatidae | — | — | BT* BT | MT1 | MT1 | MT1 BT |
| *Gonatus* sp. | — | — | — | — | MT1 | MT1 |
| Octopoteuthidae | — | BT | — | MT1 | — | — |
| *Octopoteuthis* sp. | — | — | — | — | MT1 | — |
| Squid (unidentified) | MT2 | BT | BT | BT MT3, MT2 | MT3 | — |
| Pasiphaeidae | | | | | | |
| *Pasiphaeia pacificus* | — | BT | BT* BT | BT MT1 | MT1 | MT1 |
| Mysidae | | | | | | |
| *Gnathophausia gigas* | — | — | — | MT1 | MT1 | MT1 |

## Literature Cited


Hart, J. L. 1973. Pacific fishes of Canada. Fish. Res. Board Can., Bull. 180, 740 p.

Hipkins, F. W. 1974. A trapping system for harvesting sablefish *Anoplopoma fimbria*. U. S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Fish. Facts-7, 20 p.

Larina, N. I. 1975. Podvodnye gory tikhogo okeana (Seamounts of the Pacific Ocean). [In Russ., Engl. summ.] Okeanologiya 15:89-94. (Transl. in Oceanology 15:62-66, 1976.)

Sasaki, T. 1978. The progress and present status of the seamount fishing ground development program. Bull. Jpn. Soc. Fish. Oceanogr. 33:51-53.

Takahashi, T., and T. Sasaki. 1977. Kitataiheiyo chubu kaizan ni okeru tororu gyogyo (Trawl fishery in the central North Pacific seamounts). [In Jpn.] Far Seas Fish. Res. Lab., Shimizu, Jpn., Northern waters groundfish fisheries—Data (3), 45 p. (Translated by T. Otsu, 1977, 49 p.; avail. Southwest Fish. Cent., Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, P. O. Box 3830, Honolulu, HI 96812, as Transl. 22.)