Assessment of Weathervane Scallops near Kayak Island, Alaska, 2000

by

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ABSTRACT

During 27 May to 4 June 2000, the Alaska Department of Fish and Game conducted an area-swept survey of the weathervane scallop *Patinopecten caurinus* beds located southeast (East Bed) and southwest (West Bed) of Kayak Island, Alaska. The East and West beds were sampled by 1,855-m (1.0-nautical mile; nmi) tows of a 2.4-m (8-ft) wide dredge equipped with 10.2-cm (4-inch) rings and a 3.8-cm (1.5-inch) liner. The balanced survey design used a systematic pattern to sample alternate stations in the scallop beds. A scallop bed was defined as stations where survey catch rates exceeded 9 kg/nmi (20 lb/nmi). A total of 38 successful tows were made in the vicinity of the East Bed, 22 success tows were made in the vicinity of the West Bed, and 4 tows in exploratory areas.

Based on the weathervane scallop catch threshold, the East Bed was defined by 25 tows, with a mean catch and 95% confidence interval of 48.6 ±11.0 kg/nmi (107.1 ±24.2 lb/nmi). Shell heights for all weathervane scallops in the East Bed ranged from 8 to 167 mm (0.3 to 6.6 inch; n=5,101), with the most abundant shell height class, 136-140 mm (5.4-5.5 inch), representing 25% of the sampled population. Weathervane scallops in the East Bed ranged from age 1 to 18 (n=607). Based on size-at-age data extrapolated to the shell height composition of the East Bed, the most abundant cohort was age 11, representing 26% of the sampled population. Scallops age 9 and younger comprised 23% of the sampled population and age-1 scallops comprised 8% of the East Bed population abundance. A total of 609 weathervane scallops from the East Bed was visually examined for sex and spawning status; 46% were male, 42% female, and 12% were undetermined. Sex was determined for 534 scallops with 75% of the males and 52% of the females in spawning condition. In the East Bed, spawning gonads were observed in age-2 and older males and in age-3 and older females. Adult Tanner crab were not caught in the East Bed but juvenile Tanner crab were caught in 95% of the tows; mean catch abundance among all tows was 31.9 crab/nmi. Fishes were caught in 97% of the East Bed tows; mean fish catch among all tows was 1.5 kg/nmi (3.3 lb/nmi).

The West Bed was defined by 16 tows, with a mean catch and 95% confidence interval of 117.0 ±70.0 kg/nmi (257.9 ±154.2 lb/nmi). Shell heights for all weathervane scallops in the West Bed ranged from 17 to 180 mm (0.7 to 7.1 inch; n=5,726), with the most abundant shell height class, 126-130 mm, representing 25% of the sampled population. Scallops in the West Bed ranged from age 1 to 18 (n=384). Based on size-at-age data extrapolated to the shell height composition in the West Bed, the most abundant cohort was age 11, representing 23% of the sampled population. Cohort strength appeared to be weak for scallops younger than age 6 and older than age 13. A total of 383 weathervane scallops from the West Bed was visually examined for sex and spawning status, with 44% determined to be male, 43% female, and 13% undetermined. Sex was determined for 332 scallops with 60% of the males and 48% of the females in spawning condition. Spawning gonads were observed in age-3 and older males and females. Adult Tanner crab were not caught in the West Bed, but juvenile Tanner crab were caught in 82% of the tows with a mean catch abundance of 16.5 crab/nmi among all tows. Fishes were caught in all West Bed tows with a mean catch of 1.8 kg/nmi (4.0 lb/nmi).

The four exploratory tows conducted in the management area west of Kayak Island revealed no major scallop aggregations.

Estimated weathervane scallop population biomass was 1.8 million ±0.4 million kg (4.1 million ±0.9 million lb) in the East Bed and 2.8 million ±1.7 million kg (6.3 million ±3.7 million lb) in the West Bed. The 2000 survey yielded a substantial increase in estimated scallop biomass for each bed relative to the previous survey in 1998 and several harvest options were considered. However, this drastic increase in estimated biomass over only two year reveals some of the survey uncertainty and suggests a cautious approach should be taken to set the guideline harvest level (GHL). Therefore, the author recommends the fishery GHL for 2000 and 2001 be set at no more than 50% greater than the GHL applied in 1998 and 1999. Based on a meat recovery rate of 7.35%, the recommended GHL for the East Bed is 4,082 kg (9,000 lb) of meats, representing a 3.0% harvest rate of the estimated biomass. Similarly, the recommended GHL for the West Bed is 9,526 kg (21,000 lb) of meats, representing a 4.5% harvest rate of the estimated biomass.

INTRODUCTION

The weathervane scallop *Patinopecten caurinus* inhabits coastal waters of Alaska from Dixon Entrance to Kodiak and into the Bering Sea (Kaiser 1986; Shirley and Kruse 1995). The Alaska Department of Fish and Game (ADF&G) and the National Marine Fisheries Service cooperatively manage commercial fisheries for weathervane scallops off Alaska in the Southeast, Yakutat, Prince William Sound, Cook Inlet, Kodiak, and Bering Sea Management Areas.

The fishery for weathervane scallops in Registration Area E, the Prince William Sound Management Area, developed in 1992 (Table 1; Figure 1). In that year, four vessels harvested 94,925 kg (208,836 lb) of shucked scallop meats (Berceli et al. 2003). The following year the Alaska Board of Fisheries established a guideline harvest range (GHR) of 0-22,727 kg (0-50,000 lb) of shucked scallop meats. The 1993 fishery harvested 28,667 kg (63,068 lb). In 1994, the board defined the fishing season as opening 15 January and closing 15 February, unless closed prior to that date by emergency order.

Following the 1995 fishery closure, a vessel neither licensed by the state of Alaska nor registered with ADF&G harvested weathervane scallops from federal waters off Kayak Island (Figure 1). The additional harvest was estimated to total 27,273 kg (60,000 lb) of shucked scallop meats, which, in itself, exceeded the upper limit of the Area E GHR (Berceli and Brannian 2000). This fishing activity identified a previously undetected regulatory problem, and NMFS subsequently closed all federal waters off Alaska to scallop fishing. Because of the unanticipated harvest of weathervane scallops in 1995, the Area E scallop fishery remained closed in 1996 and until federal regulations were restructured.

Due to the greater than anticipated 1995 harvest, ADF&G initiated dredge surveys of the weathervane scallop bed east of Kayak Island in 1995 to evaluate the stock and harvest levels (Charles Trowbridge, ADF&G, Homer, Alaska, personal communication). Given ADF&G budget and survey time constraints, a biennial survey of Kayak Island scallops was established beginning in 1996 (Bechtol and Bue 1998; Bechtol 2003). Although the survey design has remained consistent among years, ADF&G expanded the area surveyed in 1998 to include both the East Bed and the West Bed. Specific objectives of the 2000 Kayak Island survey were to:

1. Estimate biomass, abundance, age and size composition, and sexual maturity of weathervane scallops in this population.
2. Estimate shucked scallop meat recovery.
3. Provide a guideline harvest level for this weathervane scallop population.
4. Determine relative bycatch of king and Tanner crabs as well as other species.

This report documents methods used to conduct the 2000 survey of weathervane scallops at Kayak Island and the rationale used to set the guideline harvest level (GHL) for the commercial fisheries in 2000 and 2001.

GENERAL BIOLOGY

Weathervane scallops exhibit a patchy distribution extending from Point Reyes, California to the Pribilof Islands, Alaska (Foster 1991). Scallops occur from intertidal depths to 300 m (Foster 1991), but in Alaskan waters are more commonly found at depths of 37-229 m (20-125 fathoms) on a variety of substrates, including mud, clay, silt, sand, and pebble (Hennick 1973; Barnhart and Rosenkranz 2000). Scallop aggregations, or "beds," are typically elongated or elliptical in shape with an orientation, often north-south, in the direction of mean current flow (Kruse et al. 2000).

Scallops are mostly dioecious, with males distinguished by white testes and females by red-orange ovaries (Hennick 1970). Gonads reach full maturity in mid December to late January, and remain "ripe" until spawning. Broadcast spawning of spermatozoa and eggs typically occurs over a period of 3-4 days from May to July. Fertilized eggs settle to the substrate and hatch into larvae after several days. After several more days, the larvae assume a pelagic existence, known as a veliger that uses velium, or cilia, to swim and feed (Mottett 1979). After approximately three weeks, veligers settle to the substrate where they attach with byssal threads. After developing a foot, the scallops may move across the substrate or attach. After 4-8 weeks, the nearly transparent juveniles develop an ability to swim, and after a few months, shell pigmentation develops at a shell height of approximately 10-15 mm (0.5 inch). These juveniles feed on microscopic plankton. Weathervane scallops in Alaska become sexually mature at around age 3 or a shell height of approximately 76 mm (3 inch; Hennick 1973). Kruse (1994) reviewed several methods for calculating instantaneous natural mortality in weathervane scallops and found mortality ranged from 0.04 to 0.25 with a median estimate of 15%. An age-structured model for scallops in Kamishak Bay, Alaska estimated mortality to be 14% (Bechtol 2000).

Adult weathervane scallops are bivalves that lie on the right, or bottom, valve. The right valve is convex and the left, or top, valve is flat to convex (Keen and Coan 1974). Scallops are the only bivalve in Alaska capable of swimming, with propulsion achieved by rapid ejection of water from the shell interior. Formal studies on the swimming capabilities of weathervane scallops are limited. Older, larger scallops are thought to be less adept at swimming than juveniles due to a greater body mass relative to the water discharge capacity (Gould 1971). In comparison, the giant scallop *Placopecten magellanicus* makes repetitive swims but the frequency and distance covered decreases with each swim; the scallop's adductor muscle may require several hours to return to a pre-swimming physiological condition (Thompson et al. 1980). Movement is likely important to scallop spawning success. Stokesbury and Himmelman (1993) suggested spawning success was increased for the giant scallop by a clumped distribution, with small-scale aggregations, on the magnitude of centimeters, maintained by swimming. In addition, mobility allows scallops to return to an optimum habitat or evade predators (Stokesbury and Himmelman 1996).

STUDY AREA

The study area is located approximately at Cape St. Elias (144°20' W. longitude, 59°47' N. latitude) on the southern end of Kayak Island in the Gulf of Alaska (Figure 2). This area is subject to severe weather conditions and large ocean swells. Coastal currents primarily run westerly as part of a counter-clockwise gyre in the northern Gulf of Alaska, and maximum tidal exchanges are typically less than 5 m (15 ft). Bottom substrate in the study area is primarily sand and pebbles with some rock and mud; rocky reefs are present near Cape St. Elias. Mud and glacial flour are common in the nearshore marine waters as outfall from glacial rivers located east of Kayak Island. Depth contours run from southwest to northeast, approximately parallel to the Kayak Island shoreline. Bottom depths in the scallop beds gradually slope from approximately 55 m (30 fathoms) in the northwest to over 110 m (60 fathoms) in the southeast.

METHODS

Vessel and Gear

The state research vessel *Pandalus* surveyed the Kayak Island scallop beds during 27 May to 4 June 2000. The *Pandalus* has an overall length of 20 m (66 ft), a displacement of 100 mt, and is powered by a 365 hp diesel engine. Survey staff in 2000 included 3 biologists and 3 vessel crew.

The survey was conducted with a 2.4-m (8-ft) dredge having a ring bag consisting of 10.2-cm (4.0-inch) inside diameter rings. To facilitate retention of small scallops, the ring bag was fitted with a 3.8-cm (1.5-inch) mesh liner; scallop catchability with this dredge was assumed to be 1.0, such that all scallops larger than the liner stretch mesh were retained. Dredge weight was approximately 816 kg (1,800 lb).

Sample Design

The 2000 weathervane scallop survey was conducted east and west of Kayak Island, with the initial sample area based on previous survey results and commercial fishery data (Bechtol 2003; Figure 2; J. Barnhart, ADF&G, Kodiak, personal communication). Sampling stations were defined by overlaying a grid of 1,855-m (1.0-nmi) squares over a chart of the study area. A systematic design with two primary units was used in which every other station was designated for sampling. The primary sample unit was randomly selected to give an equal probability of selecting either unit. The vessel skipper, in cooperation with the project leader, determined the specific tow location within each sample station. The dredge was towed for a distance of approximately 1,855 m (1.0 nmi) within the sample station.

To define the scallop bed margin, additional stations were added when catches along the edge of the initial sample area achieved or exceeded a threshold level of 9 kg/nmi (20 lb/nmi). Selection of additional stations preserved the systematic survey pattern for the sampled area.

For animal populations with individuals that are randomly distributed, a single systematic sample provides good variance estimates. Because weathervane scallops have a patchy distribution and are not uniformly clustered within beds, a systematic sample tends to overestimate the population variance (Thompson 1992). However, similar to previous surveys (Bechtol and Bue 1998; Bechtol 2003), I decided to forego precision about the variance estimate in order to equally distribute sampling effort across the survey area and better define weathervane scallop bed boundaries.

Data Collection

The vessel skipper recorded the following information for each tow:

1. sequential tow number;
2. alphanumeric station code;
3. date;
4. start and stop locations (lat. and long.);
5. tow compass heading;
6. average vessel speed;
7. tow start and stop times;
8. distance towed;
9. maximum and minimum depths;
10. sea conditions;
11. scope used
12. gear performance.

Upon completion of each tow, the catch was washed clean of mud and separated into weathervane scallops, weathervane scallop shells, fish, Tanner crab, and other bycatch, including debris. Tanner crab were weighed in aggregate then sampled to determine carapace width, shell condition, and sex. Fish were weighed in aggregate, then enumerated by major species group. Debris, assorted invertebrates, and any remaining bycatch were weighed and their relative contribution visually estimated (e.g., 60% starfish and 40% rocks).

Weathervane Scallop Sampling

Total live weight and abundance of weathervane scallops, including broken shells with attached viscera, were recorded. Weathervane scallop shells and shell fragments without attached viscera were weighed and discarded. Empty weathervane scallop shells with both valves connected by an intact hinge ligament (referred to as “cluckers” or “clappers”), were retained, cleaned, measured for shell height, aged, labeled, and bagged for archival.

Twenty weathervane scallops were randomly selected, weighed, and shucked aboard the vessel. Their meats (i.e. the large adductor muscle, referred to as the “quick” by the fishing industry) were placed into a container, and their dorsal shells were cleaned, labeled, measured, aged, and placed in storage for later age determination. Several non-random samples of immature weathervane scallops from each tow were also shucked, cleaned, measured, aged, and stored for

representative size-at-age data. Shell heights of all weathervane scallops remaining from a tow were captured with an electronic measuring board to construct height frequency distributions. For some tows, such as number 00219 in the West Bed, a large scallop catch necessitated that only a subsample of the scallops be measured for heights with the remaining scallops discarded after collecting weight and abundance data.

Fresh weathervane scallop meat recovery was estimated each day from whole weight of the twenty scallops sampled from each tow and the weight of their shucked meats. Mean fresh meat recovery was estimated as pooled meat weight divided by pooled whole scallop weight.

Data Analysis

For each tow, weathervane scallop age and size composition data were pooled within beds to determine` population age and size compositions. Shell height-at-age, L_t, was modeled for aged scallops only with a von Bertalanffy growth equation (Ricker 1975), using the Microsoft Excel Solver utility to minimize sums of squares, by

$$L_t = L_\infty (1 - e^{-K(t-t_0)}) \quad , \tag{1}$$

where

L_∞ is the theoretical mean maximum size
K is the constant relative rate of growth,
t is age (time) in years, and
t_0 is the age of theoretical zero size.

All retained scallop shells were re-aged in the laboratory by a second age reader. Discrepancies in ages were resolved through re-aging and agreement by multiple age readers. Because the observation of scallops in spawning condition indicated the spawning season was still in progress, no scallops were assigned the age of "0" and all unaged scallops 35 mm or smaller in shell height were assigned as age 1. Based on height-at-age data pooled between the East Bed and the West Bed for aged scallop shells, ages were assigned to all unaged shell heights proportional to the aged shells in either 5 or 10-mm size classes, depending upon sample size in the size classes. Age composition within a bed was then determined by summing both the observed and assigned scallop ages. Prior to summarizing within a particular bed, scallop size and age data was standardized to counts per nautical mile and adjusted for scallops that were counted but not aged or measured.

The weathervane scallop population estimate derived from the 2000 Kayak Island survey was based on area-swept calculations (Gunderson 1993), similar to estimates for previous weathervane scallop surveys in southcentral Alaska (Hammarstrom and Merritt 1985; Bechtol and Bue 1998; Bechtol and Gustafson 2002). Mean catch per nautical mile ($\bar{c}$), it's variance (s^2), and 95% confidence interval (c.i.) within a bed were calculated by

$$\bar{c} = \frac{\sum_{i=1}^{n} \frac{c_i}{l_i}}{n} \quad , \tag{2}$$

and

$$s^2 = \frac{1}{n-1} \sum_{i=1}^{n} \left(\frac{c_i}{l_i} - \bar{c} \right)^2 \quad , \tag{3}$$

$$c.i. = \pm t_{95\%,\ n-1 d.f.} \frac{s}{\sqrt{n}} \quad , \tag{4}$$

where

c_i is the catch of a species, either as abundance or weight, in sample tow i,
l_i is the distance towed in nautical miles for sample tow i, and
n is the number of stations sampled.

An estimate of the population (P) was calculated by expanding $\bar{c}$ over the surveyed area as

$$P = \left(\frac{6{,}076}{8} \right) N \bar{c} \quad , \tag{5}$$

where

6,076 is the length in feet of a nautical mile,
8 is the width of the dredge in feet, and
N is the number of survey squares within a defined bed.

Variance of the surveyed population was estimated by (Nancy Gove, ADF&G, Anchorage, personal communication)

$$Var\left(\bar{C}\right) = \left(1 - \frac{8}{6{,}076} \right) \frac{s^2}{n} \quad , \tag{6}$$

$$Var\left(P\right) = \left(N \frac{6{,}076}{8} \right)^2 Var(\bar{C}) \quad . \tag{7}$$

GHLs were calculated independently as shucked scallop meats for the East Bed and the West Bed of Kayak Island. This calculation relied on the estimated scallop population biomass, estimated meat recovery, and the target harvest rate.

RESULTS

During the 2000 survey of the weathervane scallop beds located near Kayak Island, a total of 64 successful tows was completed, including 38 tows in the East Bed, 22 tows in the West Bed, and 4 exploratory area tows (Table 2; Figure 3). Tow duration among all survey tows lasted 14-19 minutes at vessel speeds of 6,420-8,350 m/h (3.5-4.5 nautical mile/h; nmi/h). Tow depths ranged from 46 to 147 m (25 to 80 fathoms) and cable scope (ratio of cable to bottom depth) on individual tows was between 2.7:1 and 4.4:1.

East Bed Catches

The 38 successful tows in the weathervane scallop bed east of Kayak Island retained a total catch of 2,239 kg (4,935 lb) of organisms and debris (Table 3). Individual tow catches ranged from 22 to 140 kg (48 to 308 lb). Debris comprised 924 kg (2,036 lb), or 41%, of the total catch, and ranged from 6 to 99% of the catch weight from individual tows. Tow depth ranged from 52 to 117 m (28 to 65 fathom).

Weathervane Scallops

Scallop Catches

Weathervane scallops were caught in 37 of the 38 tows in the East Bed (Table 3; Figure 4). The total weathervane scallop catch was 1,243 kg (2,740 lb), comprising 56% of the aggregate catch. Catches in individual tows ranged from 0 to 117 kg/nmi (0-258 lb/nmi), with eleven tows yielding catches of 45 kg/nmi (100 lb/nmi) or greater (Figure 5). Catch abundance among all stations ranged from 0 to 525 scallops/nmi, totaled 5,245 scallops, and averaged 138 scallops/nmi (Table 4). Weathervane scallops were most abundant in the central portion of the sampled area, which lay along approximately 64-92 m (35-50 fathoms) depth contours running parallel to the Kayak Island coastline (Figure 4).

Based on a threshold of 20 lb/nmi, the East Bed was represented by 25 tows (Table 5; Figure 4). Within the defined bed, mean catch and the 95% confidence interval was 48.6 ±11.0 kg/nmi (107.1 ±24.2 lb/nmi; 24 d.f.), and median catch was 45 kg/nmi (98 lb/nmi). Assuming a balanced survey design, the East Bed was calculated to encompass 50 square nmi. The area-swept population biomass estimate was 1,844,800 ±416,100 kg (4,067,100 ±917,400 lb). Based on mean catch abundance within the East Bed of 204.2 scallops/nmi, scallop population abundance within the defined bed was 7,753,400 scallops. Mean weight of individual scallops was 238 g (0.52 lb) within the East Bed.

Size, Age, and Growth

A total of 5,101 weathervane scallop shells was measured from the East Bed (Table 6). Shell heights ranged from 8-167 mm (0.3-6.6 inch). Evaluated as 5-mm size classes, standardized for tow distance and to account for counted but unmeasured shells (total n = 5,241), the most abundant shell height was 136-140 mm (5.4-5.5 inch), representing 25% of the sampled population (Table 6; Figure 6). In addition to the primary shell height mode at 121-155 mm (4.8-6.1 inch), minor modes were indicated at 21-40 mm (0.8-1.6 inch) and 86-105 mm (3.4-4.1 inch). Scallops l00 mm or smaller accounted for 14% of total scallop abundance.

A total of 607 weathervane scallops was aged from the East Bed (data not presented here). Weathervane scallops ranged from age 1 to age 18. A von Bertalanffy curve fit Kayak Island weathervane scallop shell height-at-age data well (Figure 7). Growth rate was greatest during the first four years of life and decreased rapidly to approximately 1 mm annually after age 13. Based on size-at-age data extrapolated to the shell height composition in the East Bed, the dominant cohort was age 11, representing 26% of the sampled population (Table 7; Figure 8). Four age classes, encompassing ages 10-13, comprised 72% of the sampled population. Age-10 and younger weathervane scallops comprised 38% of the population. Among younger scallops, cohort abundance was relatively strong for age-1 scallops, comprising 8% of the East Bed population abundance. The largest component, 23%, of the age-1 scallops was caught in tow 00251 at station L02 (Figure 3).

Sex and Maturity

Of the 609 weathervane scallops from the East Bed visually examined for sex and spawning status, 281 (46%) were determined to be male, 253 (42%) were female, and 75 (12%) could not be classified (Table 8). From the pool of 534 scallops for which sex was determined, 213 (76%) of the males and 132 (52%) of the females were in spawning condition. In the East Bed, spawning gonads were observed in males as young as age 2 and females as young as age 3.

Tanner Crab

Adult Tanner crab were not caught during the 2000 survey. However, juvenile Tanner crab were caught in 36 tows, or 95% of all completed tows in the East Bed (Tables 3 and 4; Figure 9). Tanner crab catch totaled 2.6 kg (5.7 lb) and 1,148 animals. Mean catch abundance of juvenile Tanner crab among tows was 31.9 crab/nmi. Tanner crab carapace width ranged from 7 to 45 mm (0.3 – 1.7 inch) with 15 mm (0.6 inch) being the most abundant size (Figure 10). Male crab comprised 52% of the catch.

Fishes

Fishes were caught in 37 tows, or 97% of all completed tows in the East Bed (Tables 3 and 4). The total fish catch was 56 kg (123 lb). Fish catches from individual tows ranged from 0-8 kg (0-18 lb), and mean fish catch was 1.5 kg (3.3 lb). The median catch rate was 0.9 kg (2 lb;

Figure 11). Eelpouts of the family Zoarcidae, Dover sole, and rex sole were the most abundant species captured in the East Bed (Table 9).

West Bed Catches

For the 22 successful tows in the weathervane scallop bed east of Kayak Island, the dredge retained a total of 2,471 kg (5,448 lb) of organisms and debris (Table 3). Individual tow catches ranged from 15 to 471 kg/nmi (33 to 1,039 lb/nmi). Debris comprised 524 kg/nmi (1,156 lb/nmi), or 21%, of the total catch, and ranged from 4 to 98% of the catch weight from individual tows. Tow depth ranged from 49 to 147 m (27 to 80 fathom).

Weathervane Scallops

Scallop Catches

Weathervane scallops were caught in 21 of the 22 tows in the West Bed (Table 3; Figure 4). Total weathervane scallop catch was 1,888 kg (4,162 lb), comprising 76% of the aggregate catch. Catches in individual tows ranged from 0 to 447 kg/nmi (0 to 986 lb/nmi; Figure 5). Catch abundance among all stations ranged from 0 to 2,140 scallops/nmi, totaled 9,701 scallops, and averaged 441.0 scallops/nmi (Table 4).

Based on the threshold of 9 kg/nmi (20 lb/nmi) of scallops, 16 tows were within the defined West Bed (Table 5; Figure 4). The defined West Bed exhibited less of a northeast-southwest orientation than was observed for the East Bed. Large catches of weathervane scallops were broadly distributed throughout the defined West Bed, which occurred at depths of 49-118 m (27-65 fathoms). Mean catch and 95% confidence interval within the West Bed was 117.0 ±70.0 kg/nmi (257.9 ±154.2 lb/nmi; 15 d.f.). Based on a balanced survey design, the West Bed was calculated to encompass 32 nmi. The area-swept population biomass estimate was 2,842,900 ±1,699,100 kg/nmi (6,267,500 ±3,745,900 lb/nmi) of whole scallops. Based on mean catch abundance within the West Bed of 598.6 scallops/nmi, population abundance within the defined bed was 14.5 million scallops. Mean weight of individual scallops was 195 g (0.43 lb) within the West Bed.

Size, Age, and Growth

A total of 5,726 weathervane scallop shells was measured from the West Bed (Table 6; Figure 6). Shell heights for all measured weathervane scallops ranged from 17-180 mm (0.7-7.1 inch). After extrapolating for unmeasured scallops (total n = 9,696), the most abundant shell height, evaluated as 5-mm size classes, was 126-130 mm, representing 25% of the sampled scallops. One major grouping, from 106-150 mm (4.2-5.9 inch), comprised 96% of the West Bed population. Small weathervane scallops, l00 mm or less, accounted for 2% of total scallop abundance.

A total of 384 weathervane scallops was aged from the West Bed (data not presented here). Ages ranged from 1 to 18. Based on size-at-age data extrapolated to shell height composition for the West Bed (total n = 9,699), the dominant cohort was age 11, representing 23% of the sampled population (Table 7; Figure 8). Ages 9-12 comprised 73% of the sampled population and age-10 and younger scallops comprised 52% of the population. Cohort strength was generally weak for ages younger than 6 and older than 13.

Sex and Maturity

Of the 383 weathervane scallops from the West Bed that were visually examined for sex and spawning status, 167 (44%) were determined to be male, 165 (43%) were females, and 51 (13%) could not be classified (Table 8). From the pool of 332 scallops for which sex was determined, 60% of the males and 48% of the females were in spawning condition. In the West Bed, spawning gonads were observed in age-3 and older males and females.

Tanner Crab

Adult Tanner crab were not caught during the 2000 survey. However, juvenile Tanner crab were caught in 18 tows, or 82% of all completed tows in the West Bed (Table 3; Figure 9). Tanner crab catch totaled 0.8 kg (1.8 lb) and 362 animals (Tables 3 and 4). Average catch abundance of juvenile Tanner crab among tows was 16.5 crab/nmi. Tanner crab carapace width ranged from 7 to 46 mm (0.3 – 1.8 inch) with 12 mm (0.5 inch) being the most abundant size (Figure 10). Male crab comprised 48% of the catch.

Fishes

Fishes were caught in all completed tows in the West Bed (Table 3). Total fish catch was 40 kg (87 lb). Fish catches from individual tows ranged from <1 to 7 kg/nmi (<1 to 15 lb/nmi), and mean fish catch was 1.8 kg/nmi (4.0 lb/nmi). The greatest fish catch of 7 kg/nmi (15 lb/nmi) occurred in tow 00221 at station K31 on the western edge of the West Bed (Figure 11). Flatfishes of the family Pleuronectidae, particularly rex sole and Dover sole, as well as eelpout were the most abundant fish caught in the West Bed (Table 9).

Exploratory Tows

For the 4 exploratory tows made west of Kayak Island, the dredge retained a total of 89 kg (196 lb) of organisms and debris (Table 3). Individual tow catches ranged from 13 to 28 kg/nmi (30 to 63 lb/nmi). Debris comprised 77 kg/nmi (170 lb/nmi), or 87%, of the total catch. Tow depth ranged from 46 to 82 m (25 to 45 fathom).

Weathervane Scallops

Weathervane scallops were caught in three of the four exploratory area tows (Table 3). Total weathervane scallop catch was 6 kg (12 lb), comprising 6% of the aggregate catch. Catches in individual tows ranged from 0 to 4 kg/nmi (0 to 9 lb/nmi). Catch abundance among all stations ranged from 0 to 32 scallops/nmi (Table 4). No major scallop aggregations were found among the exploratory tows.

A total of 82 weathervane scallop shells was measured from the exploratory tows (Table 6; Figure 6). Shell heights for all measured weathervane scallops ranged from 25-144 mm (1.0-5.7 inch). The most abundant shell heights, evaluated as 5-mm size classes, were in the 26-40 mm (1.0-1.6 inch) size classes, representing 41% of the sampled scallops. Small weathervane scallops, l00 mm or less, accounted for 69% of total scallop abundance. Weathervane scallops from the exploratory tows were neither aged nor examined for sex and gonad maturity.

Tanner Crab

Adult Tanner crab were not caught in the exploratory tows, but juvenile Tanner crab were caught in all completed tows (Table 3). Juvenile Tanner crab catch totaled 0.3 kg (0.7 lb) and 140 animals (Tables 3 and 4). Average catch abundance of juvenile Tanner crab among tows was 35 crab/nmi, with tow 00263 yielding the most Tanner crab (n=112). Tanner crab carapace width ranged from 8 to 34 mm (0.3 – 1.3 inch) with 13 mm (0.5 inch) being the most abundant size. Male crab comprised 57% of the catch.

Fishes

Fishes were caught in all completed tows in all exploratory tows (Table 3). Total fish catch was 6 kg (13 lb). Fish catches from individual tows ranged from 1 to 3 kg/nmi (2 to 6 lb/nmi), and mean fish catch was 1.4 kg/nmi (3.2 lb/nmi). Flatfishes of the family Pleuronectidae, particularly rex sole, flathead sole, and Dover sole, as well as eelpout, were the most abundant fish caught in the exploratory tows (Table 9).

Clucker Composition

A total of 73 cluckers, 43 from the East Bed and 30 from the West Bed, were sampled during the 2000 Kayak Island survey. Accurate shell heights were available for 69 cluckers and showed the most abundant size class was 126-130 mm (5.0-5.1 inch) for data pooled among beds (Figure 12). Age-12 was the most abundant clucker cohort.

Weathervane Scallop Harvest Guidelines

Scallop Meat Recovery

Mean daily meat recovery for all survey samples, weighted by the whole scallop weight sampled daily, was 7.35% (n=8 daily samples). The range of meat recovery among the daily samples was 5.33 - 10.73% (Table 10).

Recommended 2000 and 2001 Guideline Harvest Levels

The maximum guideline harvest range allowed for under regulation 5 AAC 38.221 is 0-22,727 kg (0-50,000 lb) of shucked meats). The population estimates for both the West Bed and the East Bed increased substantially over the 1998 survey estimates. However, we remained concerned with: (1) a general lack of young scallops recruiting into the population; (2) age composition dominated by ages 10 to 13 in the East Bed and ages 9 to 12 in the West Bed, indicating that good recruitment events may be infrequent; and (3) continued uncertainty over impacts of the unanticipated harvest in 1995. Based on the moderately distinct geographic separation between the major scallop aggregations in the East Bed and West Bed, it was recommended that each bed continue to be given an individual guideline harvest level that reflects the underlying population biomass. A variety of harvest scenarios were initially examined with a range of instantaneous harvest rates, ranging from 4% to 10%, considered for each scallop bed (Table 5). Prominent in this review was the fact that the East Bed, which had the most extensive harvest history, was 56% larger in defined total area than the West Bed, but mean survey catch rate was 40% greater in the West Bed than in the East Bed (Table 5; Figure 4). This implies that a greater amount of fishing effort would be needed to achieve a target harvest level in the East Bed relative to the West Bed.

The previous GHL for the East Bed was 6,000 lb of meats. The 2000 survey population estimate of 4.0 million lb of whole scallops was an increase of 113% over the 1998 survey estimate. After incorporating the 7.35% meat recovery rate (Table 10), the most pessimistic scenario examined, a 4% harvest rate, would yield a GHL increase of almost 100% over the GHL applied in 1998 and 1999. Given the East Bed harvest history, combined with observations of poor recruitment and uncertainty over the substantial increase in observed biomass in surveys two years apart, a maximum increase of 50% in the GHL over 1998 and 1999 is recommended. This results in a recommended GHL of 9,000 lb of meats, equating to a 3.0% harvest rate applied to the area-swept population biomass for the defined East Bed (Table 5).

The previous GHL for the West Bed was 14,000 lb of meats. The 2000 survey population estimate of 6.3 million lb of whole scallops was an increase of 168% over the 1998 survey estimate. After incorporating the 7.35% meat recovery rate (Table 10), the most pessimistic scenario examined, a 4% harvest rate, would yield a GHL increase of 32% over the GHL applied in 1998 and 1999. The current population can likely support a more intensive harvest rate. However, the West Bed fishery has a limited history and the 2000 survey effort was only the second fishery-independent survey conducted in the Kayak Island West Bed. Based on the greater survey catch rate in the West Bed, it is reasonable to have a somewhat increased harvest rate relative to GHL applied for the previous two years. However, the lack of recruitment in the

West Bed is disconcerting and, when coupled with the lack of prior information about this bed, a continued conservative approach is warranted. Given observations of poor recruitment and uncertainty over the substantial increase in observed biomass in surveys two years apart, a maximum increase of 50% in the GHL over 1998 and 1999 is recommended for the West Bed. This results in a recommended GHL of 21,000 lb of meats, equating to a 4.5% harvest rate applied to the area-swept population biomass for the defined East Bed (Table 5).

DISCUSSION

The Kayak Island scallop survey is conducted biennially, with the 2000 assessment used to set the fishery GHLs for 2000 and 2001. Defining a standardized boundary for the Kayak Island scallop bed remains a high survey priority, and the East Bed has been surveyed four times and the West Bed twice. It is recognized that actual scallop distribution extends beyond the "defined" scallop beds near Kayak Island (Figure 4). However, the use of a threshold catch rate on individual tows to define the scallop beds acknowledges that the scallop fishery will focus on areas of higher aggregation and that it is important from a stock dynamics aspect to prevent localized depletion within the scallop beds. Having bed-specific GHLs will provide a conservative approach to long-term yield from the individual beds. The uncertainty in establishing an appropriate harvest rate for each bed at Kayak Island results, to some extent, from: (1) reduced recruitment observed at Kayak Island relative to some other scallop beds in the northern Gulf of Alaska (Bechtol and Gustafson 2002); (2) the limited harvest history for these beds; and (3) a dramatic increase in survey biomass estimates from 1998 to 2000 (Bechtol 2003).

We do not understand the processes affecting recruitment, or how various aggregations within the surveyed bed contribute to reproductive success of the scallop population near Kayak Island. Despite using the same gear type and a similar survey design, little recruitment has been observed at both the East Bed and West Bed at Kayak Island. Some promise is shown in the abundance of age-1 scallops in the 2000 East Bed survey (Figure 8), particularly given the lower survey gear selectivity for younger scallops (Bechtol 2000). In contrast, the scallops observed in the exploratory tows indicate what might be a natural distribution of scallop larvae with only limited survival to older, larger scallops in these sub-optimal habitats. Still, recruitment in the defined scallop beds at Kayak Island differs sharply from that of the Kamishak Bay population in Cook Inlet where over half of the sampled population was younger than age 7, and age-3 and age-4 cohorts were abundant (Bechtol and Gustafson 2002). The lack of recruitment at Kayak Island has persisted since at least 1996 (Bechtol and Bue 1998; Bechtol 2003), suggesting a conservative approach should be taken in setting the Kayak GHL.

The ultimate determination of an appropriate harvest rate, and the corresponding GHL, should be based on available biological data, tempered by harvest experiences within a particular bed or harvest histories in comparable beds in other areas. Traditional fisheries approaches suggest that fishing mortality should be set at something less than natural mortality (Restrepo et al. 1998). Kruse (1994), when examining several methods for calculating instantaneous natural mortality in weathervane scallops, estimated M ranged from 0.04 to 0.25, with a median estimate of 15%. An age-structured model for scallops in Kamishak Bay estimated mortality to be 14% (Bechtol

2000). Mortality at Kayak Island scallops is likely similar and applied fishing mortality should be less than natural mortality.

The population biomass estimates of scallops at Kayak Island have increased among successive biennial surveys in the East Bed since 1996 and in the West Bed since 1998 (Bechtol and Bue 1998; Bechtol 2003). Although a true increase in biomass may have occurred, additional factors contributing to this increase may be: better survey conditions, particularly in terms of weather and sea conditions; and improved effectiveness of the survey vessel and experience of the captain and crew. Extensive scallop harvests from Kayak Island have only occurred since 1992, with the initial GHL based on area-swept estimates calculated inseason from commercial catch data (Berceli et al. 2003). There remain unknown biological implications for the Kayak Island scallop population as a result of the unanticipated harvest in 1995 by a vessel operating outside of the existing management structure. A retrospective analysis suggested the commercial fishing harvest rate was generally less than 4% for the Kamishak Bay scallop population, which has been commercially fished since 1984 (Bechtol 2000). The recommended GHLs of 9,000 lb of meats for the East Bed and 21,000 lb of meats for the West Bed result in fishing mortalities well below a natural mortality that is likely around 14 to 15%. These GHLs incorporate the greater catch rates observed in the 2000 survey while compensating some for the lack of recruitment by keeping overall harvest well below potential natural mortality of 14-15%. Provided that a stock collapse is not apparent, setting a maximum increase or decrease of 50% in the GHL established by successive biennial surveys provides a reasonable decision rule. This approach will buffer against survey anomalies and also provide stability to the fishery. However, to protect this resource and provide for sustained annual yield, it will be important to continue to monitor this population using information from fishery sampling and fishery-independent surveys.

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Table 1. Commercial guideline harvest level, effort, and harvest for the weathervane scallop fishery in the Prince William Sound Management Area, 1992-2001.

Year	GHL[a/] (meat lb)	Season (hours)	Number of Vessels	Harvest (meat lb)	Comments
1992	64,000	NA	4	208,836	
1993	50,000	67	7	63,068	
1994	Fishery rescheduled to 1995.				Season start date changed.
1995	50,000	390	2	108,000	60,000 lb illegal harvest.
1996	Closed due to 1995 overharvest.			0	
1997	17,200	141	1	18,000	
1998					
East	6,000	26	2	6,210	First year of split GHL.
West	14,000	78	2	13,440	
1999					
East	6,000	54	2	NA	
West	14,000	84	2	NA	
2000					
East	9,000				b/
West	21,000				b/
2001					
East	9,000				b/
West	21,000				b/

a/ GHL = guideline harvest level; separate GHLs first established for East and West beds in 1998.
b/ Confidential data.

Table 2. Vessel log of dredge tows made during a weathervane scallop survey near Kayak Island, Alaska, 2000.

Tow number	Station	Date	Tow start Latitude	Tow start Longitude	Course (True)	Speed (nautical miles/h)	Duration (minutes)	Distance (nautical miles)	Tow depth (fathoms) Minimum	Tow depth (fathoms) Maximum	Scope (fathoms)
00201	M31	5/27	59.72º	144.90º	050º	4.37	14	1.02	51.2	57.7	225
00202	M33	5/27	59.72º	144.83º	047º	4.00	15	1.00	42.0	46.5	150
00203	M35	5/27	59.72º	144.76º	054º	4.04	15	1.01	40.5	43.7	150
00204	K35	5/27	59.75º	144.77º	053º	3.70	17	1.01	29.7	33.1	125
00205	K33	5/27	59.75º	144.83º	043º	4.12	15	1.03	34.7	38.5	125
00206	G33	5/27	59.83º	144.81º	233º	4.14	15	1.00	70.0	80.0	225
00207	I33	5/27	59.78º	144.83º	038º	4.19	15	1.02	43.5	45.0	125
00208	K07	5/28	59.75º	144.39º	043º	4.13	15	1.01	52.1	55.7	200
00209	I09	5/28	59.79º	144.33º	042º	4.12	15	1.03	43.2	46.0	175
00210	I07	5/28	59.79º	144.37º	230º	4.20	15	1.03	42.4	45.1	150
00211	I11	5/28	59.79º	144.26º	039º	4.00	15	1.00	45.0	48.1	165
00212	I13	5/28	59.79º	144.19º	040º	4.04	15	1.01	47.5	50.1	175
00213	G09	5/28	59.83º	144.31º	224º	4.17	15	1.03	35.1	37.0	125
00214	G11	5/28	59.83º	144.23º	222º	4.26	15	1.03	37.2	39.0	150
00215	G13	5/28	59.82º	144.20º	043º	4.04	15	1.01	40.0	41.8	150
00216	F12	5/28	59.84º	144.22º	044º	4.08	15	1.02	35.2	36.7	135
00217	G35	5/29	59.82º	144.76º	041º	4.21	15	1.04	40.2	40.5	150
00218	I35	5/29	59.78º	144.77º	036º	3.93	15	1.00	33.8	35.0	125
00219	L32	5/29	59.74º	144.87º	043º	4.19	15	1.03	41.7	49.0	150
00220	F36	5/30	59.85º	144.70º	224º	4.12	15	1.03	38.4	39.5	125
00221	K31	5/30	59.76º	144.87º	228º	4.16	15	1.04	60.7	64.5	200
00222	L36	5/30	59.73º	144.73º	051º	4.12	15	1.03	32.0	40.4	130
00223	K03	5/30	59.76º	144.51º	224º	4.08	15	1.02	52.0	57.1	200
00224	K05	5/30	59.76º	144.45º	216º	4.20	15	1.05	51.4	57.3	175
00225	J06	5/30	59.77º	144.43º	046º	4.12	15	1.03	45.4	49.7	175

- Continued –

Table 2. (page 2 of 3)

Tow number	Station	Date	Tow start Latitude	Tow start Longitude	Course made good	Speed (nautical miles/h)	Duration (minutes)	Distance (nautical miles)	Tow depth (fathoms) Minimum	Tow depth (fathoms) Maximum	Scope (fathoms)
00226	H08	5/30	59.80º	144.36º	046º	4.00	15	1.00	37.6	40.2	135
00227	E13	5/30	59.85º	144.20º	051º	4.00	15	1.00	34.0	34.7	125
00228	F14	5/30	59.83	144.16	049º	4.00	15	1.00	38.3	39.5	135
00229	E11	5/30	59.87	144.23	225º	3.91	16	1.01	30.4	32.0	125
00230	F10	5/30	59.83	144.29	042º	4.16	15	1.04	32.7	34.2	125
00231	D14	5/31	59.88	144.14	222º	4.20	15	1.05	31.6	33.3	125
00232	D12	5/31	59.87	144.23	045º	4.04	15	1.01	30.0	30.9	125
00233	E09	5/31	59.87	144.30	224º	4.10	16	1.06	28.3	29.4	125
00234	F08	5/31	59.83	144.36	045º	3.95	15	1.00	30.5	31.6	125
00235	G07	5/31	59.83	144.37	225º	3.79	16	1.01	32.2	34.2	125
00236	H06	5/31	59.80	144.43	045º	4.08	15	1.02	35.0	37.3	125
00237	H14	5/31	59.81	144.14	226º	4.04	15	1.01	46.3	47.7	175
00238	G15	5/31	59.82	144.13	043º	4.10	16	1.06	43.6	45.2	175
00239	I15	5/31	59.80	144.10	225º	4.16	15	1.04	50.5	52.3	185
00240	J14	5/31	59.78	144.14	223º	4.24	15	1.06	53.0	54.7	200
00241	J12	5/31	59.78	144.21	223º	4.04	15	1.01	50.5	52.7	200
00242	H12	5/31	59.80	144.23	061º	4.04	15	1.01	43.5	44.2	165
00243	H10	5/31	59.80	144.29	057º	4.08	15	1.02	40.4	41.9	150
00244	J10	5/31	59.77	144.29	036º	4.04	15	1.01	48.3	51.6	175
00245	J08	6/1	59.78	144.34	225º	3.96	15	1.01	46.0	49.5	200
00246	K09	6/1	59.75	144.32	043º	4.18	15	1.01	52.3	55.5	200
00247	J04	6/1	59.77	144.50	048º	4.17	15	1.03	43.5	47.3	175
00248	I03	6/1	59.79	144.53	044º	4.22	15	1.02	34.7	38.0	150
00249	I05	6/1	59.79	144.46	060º	4.15	15	1.02	40.2	42.2	160
00250	L04	6/1	59.74	144.50	059º	4.16	15	1.04	60.2	64.8	225

- Continued –

Table 2. (page 3 of 3)

Tow number	Station	Date	Tow start Latitude	Tow start Longitude	Course made good	Speed (nautical miles/h)	Duration (minutes)	Distance (nautical miles)	Tow depth (fathoms) Minimum	Tow depth (fathoms) Maximum	Scope (fathoms)
00251	L02	6/1	59.74	144.56	051º	4.07	15	1.00	58.6	63.0	225
00252	N34	6/1	59.70	144.80	058º	4.00	15	1.00	46.6	50.2	175
00253	N32	6/1	59.70	144.86	060º	3.80	15	0.95	47.8	50.0	200
00254	F34	6/2	59.84	144.80	086º	4.08	15	1.02	54.0	74.0	250
00255	H34	6/2	59.81	144.80	092º	4.00	15	1.00	39.0	47.5	175
00256	H36	6/2	59.81	144.73	094º	4.04	15	1.01	32.5	35.4	150
00257	L34	6/3	59.74	144.80	071º	3.84	15	0.96	34.0	37.5	150
00258	J32	6/3	59.77	144.86	066º	4.29	15	1.06	44.1	58.5	200
00259	J34	6/3	59.77	144.80	091º	3.46	18	1.01	32.1	33.5	125
00260	J36	6/3	59.74	144.73	086º	3.96	15	0.99	26.8	30.0	125
00261	Exp1	6/3	60.28	146.12	185º	4.50	18	1.36	30.5	42.5	100
00262	Exp2	6/3	60.29	146.06	115º	4.30	18	1.29	25.2	30.9	90
00263	Exp3	6/3	60.25	146.42	254º	4.07	19	1.29	28.4	30.1	100
00264	Exp4	6/4	60.33	146.60	236º	4.08	15	1.02	39.5	44.5	125

Table 3. Catch weight during a weathervane scallop survey near Kayak Island, Alaska, 2000.

East Bed

Tow number	Whole scallops	Scallop shells	Tanner crabs	Fishes	Debris/ Other	Total catch
	Pounds per nautical mile					
00208	21.8	0.0	0.1	0.5	25.7	48.1
00209	97.1	0.2	<0.1	0.2	15.5	113.0
00210	120.4	0.0	0.2	0.4	21.4	142.4
00211	98.0	0.0	<0.1	2.0	74.0	174.0
00212	134.7	1.0	<0.1	2.0	43.6	181.2
00213	120.4	0.4	0.3	7.8	40.8	169.7
00214	75.7	1.9	0.1	0.5	11.7	89.9
00215	110.9	0.0	0.1	1.0	33.7	145.7
00216	139.2	1.0	0.4	3.9	25.5	170.0
00223	98.0	1.0	0.1	0.5	19.6	119.2
00224	53.3	1.0	0.1	1.0	19.0	74.4
00225	54.4	1.0	0.1	1.0	9.7	66.1
00226	154.0	1.0	0.1	8.0	16.0	179.1
00227	78.0	2.0	0.1	4.0	48.0	132.1
00228	208.0	1.0	0.1	6.0	52.0	267.1
00229	2.0	0.2	0.1	2.0	103.0	107.2
00230	92.3	1.9	0.1	7.7	61.5	163.6
00231	0.5	0.5	0.3	1.0	133.3	135.5
00232	0.1	0.2	0.2	7.9	69.3	77.7
00233	0.0	0.0	0.1	5.7	135.8	141.6
00234	0.1	0.0	0.3	0.1	48.0	48.5
00235	0.2	0.0	0.6	17.8	51.5	70.1
00236	2.0	0.2	0.6	2.0	45.1	49.8
00237	91.1	0.5	<0.1	0.4	25.7	117.7
00238	90.6	0.4	<0.1	0.5	28.3	119.7
00239	12.5	0.5	0.0	0.0	136.5	149.5
00240	5.7	0.5	<0.1	1.9	104.0	112.0
00241	13.9	4.0	<0.1	2.0	59.4	79.2
00242	150.5	0.2	0.1	11.9	45.6	208.3
00243	209.8	0.3	0.0	7.8	13.7	231.7
00244	17.8	0.5	<0.1	0.1	45.5	64.0
00245	120.8	0.5	<0.1	0.5	25.7	147.6
00246	4.0	0.5	<0.1	0.2	112.9	117.6
00247	258.3	1.0	0.3	0.2	48.5	308.3
00248	3.9	0.5	0.5	7.8	188.2	201.0
00249	41.2	0.5	0.3	1.0	25.5	68.5
00250	21.2	1.9	0.2	3.8	28.8	56.0
00251	38.0	4.0	<0.1	2.0	44.0	88.0
Total	2,740.1	30.1	5.7	122.8	2,036.4	4,935.1
Mean	72.1	0.8	0.2	3.3	53.6	129.9
Percent	55.5%	0.6%	0.1%	2.5%	41.3%	100.0%

- Continued -

Table 3. (page 2 of 2)

West Bed

Tow number	Whole scallops	Scallop shells	Tanner crabs	Fishes	Debris/ Other	Total catch
	Pounds per nautical mile					
00201	27.5	1.0	<0.1	3.9	60.8	93.2
00202	290.0	0.5	<0.1	4.0	28.0	322.5
00203	4.0	2.0	<0.1	4.0	33.7	43.6
00204	65.3	2.0	<0.1	1.0	15.8	84.2
00205	693.2	5.8	0.2	5.8	31.1	736.2
00206	4.0	0.0	0.0	2.0	264.1	270.1
00207	641.2	1.0	0.1	2.0	49.0	693.2
00217	157.7	0.5	0.5	1.9	29.0	189.6
00218	374.0	2.0	0.1	0.3	14.0	390.4
00219	986.4	7.8	0.2	7.8	36.9	1,039.0
00220	13.6	1.0	0.4	0.5	17.5	33.0
00221	25.0	0.3	<0.1	15.4	71.2	111.8
00222	0.0	0.0	0.0	3.9	56.3	60.2
00252	12.0	0.5	0.0	0.4	30.0	42.9
00253	54.7	0.2	0.1	2.1	31.6	88.7
00254	2.0	0.0	<0.1	5.9	190.2	198.0
00255	56.0	0.5	<0.1	2.0	20.0	78.5
00256	37.6	7.9	0.1	1.0	13.1	59.7
00257	341.7	6.3	0.1	4.2	64.6	416.7
00258	267.9	1.9	<0.1	15.1	52.8	337.8
00259	61.4	0.5	<0.1	4.0	15.8	81.7
00260	46.5	0.2	0.0	0.3	30.3	77.3
Total	4,161.6	41.7	1.8	87.3	1,155.8	5,448.2
Mean	189.2	2.2	0.1	4.0	52.5	247.6
Percent	76.4%	0.8%	0.0%	1.6%	21.2%	100.0%

Exploratory Areas

Tow number	Whole scallops	Scallop shells	Tanner crabs	Fishes	Debris/ Other	Total catch
	Pounds per nautical mile					
00261	8.8	0.0	0.1	2.9	36.8	48.6
00262	<0.1	0.0	<0.1	6.2	23.3	29.5
00263	1.6	0.2	0.6	1.6	58.9	62.7
00264	2.0	0.0	<0.1	2.0	51.2	55.1
Total	12.3	0.2	0.7	12.7	170.2	196.0
Mean	3.1	0.2	0.2	3.2	42.5	49.0
Percent	6.3%	0.1%	0.4%	6.5%	86.8%	100.0%

Table 4. Catch abundance enumerated during the 2000 scallop survey at Kayak Island.

East Bed

Tow number	Weathervane scallops	Tanner crab	Fishes	Other	Total
	Animals per 1.0 nautical mile				
00208	106.9	17.8	5.9	0.0	130.7
00209	153.4	2.9	4.9	0.0	161.2
00210	191.3	35.9	10.7	1.0	238.8
00211	166.0	5.0	8.0	0.0	179.0
00212	265.3	6.9	11.9	0.0	284.2
00213	181.6	63.1	9.7	1.0	255.3
00214	121.4	12.6	1.9	0.0	135.9
00215	189.1	25.7	15.8	0.0	230.7
00216	237.3	81.4	21.6	0.0	340.2
00223	183.3	20.6	7.8	0.0	211.8
00224	130.5	22.9	5.7	0.0	159.0
00225	102.9	10.7	8.7	0.0	122.3
00226	255.0	18.0	11.0	0.0	284.0
00227	122.0	25.0	7.0	2.0	156.0
00228	360.0	28.0	13.0	0.0	401.0
00229	6.9	17.8	33.7	0.0	58.4
00230	131.7	25.0	12.5	0.0	169.2
00231	2.9	55.2	27.6	0.0	85.7
00232	2.0	32.7	31.7	0.0	66.3
00233	0.0	18.9	24.5	0.0	43.4
00234	1.0	63.0	24.0	0.0	88.0
00235	1.0	128.7	14.9	0.0	144.6
00236	3.9	120.6	17.6	0.0	142.2
00237	258.4	5.0	7.9	1.0	272.3
00238	153.8	1.9	1.9	0.0	157.5
00239	22.1	0.0	0.0	1.0	23.1
00240	10.4	0.9	5.7	0.9	17.9
00241	25.7	1.0	8.9	0.0	35.6
00242	264.4	11.9	9.9	1.0	287.1
00243	369.6	0.0	3.9	0.0	373.5
00244	41.6	8.9	2.0	0.0	52.5
00245	211.9	6.9	2.0	0.0	220.8
00246	16.8	6.9	1.0	0.0	24.8
00247	525.2	64.1	2.9	0.0	592.2
00248	5.9	92.2	57.8	4.9	160.8
00249	166.7	63.7	12.7	0.0	243.1
00250	82.7	37.5	13.5	0.0	133.7
00251	174.0	9.0	16.0	1.0	200.0
Total	5,244.5	1,148.3	476.3	13.7	6,882.9
Mean	138.0	31.9	12.9	0.4	181.1
Percent	15,121.5	1,093.3	127.5	0.8	14,404.8

– Continued –

Table 4. (page 2 of 2)

West Bed

Tow number	Weathervane scallops	Tanner crab	Fishes	Other	Total
	Animals per 1.0 nautical mile				
00201	155.9	6.9	2.9	0.0	165.7
00202	810.0	7.0	12.0	0.0	829.0
00203	4.0	2.0	19.8	0.0	25.7
00204	116.8	1.0	9.9	0.0	127.7
00205	1,437.9	45.6	17.5	0.0	1,501.0
00206	7.0	0.0	14.0	1.0	22.0
00207	1,454.9	12.7	23.5	13.7	1,504.9
00217	455.8	101.0	12.5	3.8	573.1
00218	790.0	11.0	11.0	3.0	815.0
00219	2,139.8	35.0	16.5	6.8	2,198.1
00220	65.0	87.4	7.8	1.9	162.1
00221	55.8	1.0	16.3	1.0	74.0
00222	0.0	0.0	22.3	0.0	22.3
00252	33.0	0.0	4.0	0.0	37.0
00253	144.2	11.6	13.7	0.0	169.5
00254	14.7	1.0	10.8	0.0	26.5
00255	250.0	7.0	4.0	2.0	263.0
00256	101.0	10.9	9.9	2.0	123.8
00257	733.6	12.5	31.3	11.5	788.8
00258	579.3	6.6	17.9	5.7	609.5
00259	258.4	2.0	11.9	4.0	276.2
00260	93.9	0.0	2.0	4.0	100.0
Total	9,701.0	362.0	291.5	60.4	10,414.9
Mean	441.0	16.5	13.3	2.7	473.4
Percent	336,319.4	765.1	51.8	14.4	350,999.0

Exploratory Areas

Tow number	Weathervane scallops	Tanner crab	Fishes	Other	Total
	Animals per 1.0 nautical mile				
00261	22.8	18.4	11.8	0.0	52.9
00262	0.0	8.5	18.6	0.8	27.9
00263	31.8	111.6	38.0	0.8	182.2
00264	27.5	1.0	46.1	2.9	77.5
Total	82.0	139.5	114.4	4.5	340.5
Mean	20.5	34.9	28.6	1.1	85.1
Percent	200.4	2,668.7	259.0	1.6	4,595.5

Table 5. Scallop population biomass, abundance, and potential harvest levels for the East Bed and West Bed at Kayak Island, 2000.

East Bed			West Bed		
Tow number	Biomass (lb/nmi)	Abundance (scallops/nmi)	Tow number	Biomass (lb/nmi)	Abundance (scallops/nmi)
00247	258.3	525.2	00219	986.4	2139.8
00243	209.8	369.6	00205	693.2	1437.9
00228	208.0	360.0	00207	641.2	1454.9
00226	154.0	255.0	00218	374.0	790.0
00242	150.5	264.4	00257	341.7	733.6
00216	139.2	237.3	00202	290.0	810.0
00212	134.7	265.3	00258	267.9	579.3
00245	120.8	211.9	00217	157.7	455.8
00210	120.4	191.3	00204	65.3	116.8
00213	120.4	181.6	00259	61.4	258.4
00215	110.9	189.1	00255	56	250
00223	98.0	183.3	00253	54.7	144.2
00211	98.0	166.0	00260	46.5	93.9
00209	97.1	153.4	00256	37.6	101.0
00230	92.3	131.7	00201	27.5	155.9
00237	91.1	258.4	00221	25.0	55.8
00238	90.6	153.8			
00227	78.0	122.0			
00214	75.7	121.4			
00225	54.4	102.9			
00224	53.3	130.5			
00249	41.2	166.7			
00251	38.0	174.0			
00208	21.8	106.9			
00250	21.2	82.7			
Mean Catch	107.1	204.2	Mean Catch	257.9	598.6
Variance	3,4929.5	9,907.1	Variance	83,806.1	307587.5
Est. Population [a/]	4,067,142	7,753,437	Est. Population [a/]	6,267,516	14,547,922
Est. Meats [b/]	298,822		Est. Meats [b/]	460,488	

	Meat Harvest			Meat Harvest	
Harvest Rate	(lb)	(kg)	Harvest Rate	(lb)	(kg)
3%	8,965	4,066	3%	13,815	6,266
4%	11,953	5,422	4%	18,420	8,355
5%	14,941	6,777	5%	23,024	10,444
6%	17,929	8,133	6%	27,629	12,533
7%	20,918	9,488	7%	32,234	14,621
8%	23,906	10,844	8%	36,839	16,710
9%	26,894	12,199	9%	41,444	18,799
10%	29,882	13,554	10%	46,049	20,888

a/ The population estimate uses a survey design that samples half of the stations in a defined bed.
b/ Based on an estimated meat recovery of 7.35%.

Table 6. Size frequency distribution of weathervane scallops captured during a survey of the East Bed, West Bed, and exploratory stations near Kayak Island, 2000.

East Bed

Height (mm)	Tow Number														
	00208	00209	00210	00211	00212	00213	00214	00215	00216	00223	00224	00225	00226	00227	00228
<21	1	0	0	0	3	0	0	1	1	0	0	0	0	0	0
25	5	0	2	3	8	0	0	1	5	0	0	3	0	0	0
30	20	0	1	1	3	0	0	1	19	1	0	7	0	0	5
35	28	1	7	1	2	0	1	6	25	0	0	1	2	0	5
40	11	0	3	0	0	0	0	2	4	0	0	0	1	0	4
45	5	0	0	0	0	0	0	2	2	0	0	0	2	0	1
50	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1
70	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
75	0	0	0	0	0	0	1	1	2	0	0	0	2	0	3
80	0	0	0	0	2	0	1	2	3	0	0	0	0	1	0
85	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0
95	0	0	0	0	2	0	2	0	7	1	0	0	7	1	11
100	0	0	1	0	2	0	1	0	11	0	0	0	2	0	10
105	0	0	0	0	4	0	0	0	4	1	0	1	4	0	3
110	0	0	0	0	3	1	0	0	3	0	0	0	0	0	0
115	0	0	0	0	2	0	0	0	3	0	0	0	1	0	0
120	0	1	0	1	6	0	0	0	0	0	0	0	2	0	0
125	3	2	3	4	27	0	0	0	5	1	0	3	11	0	1
130	1	22	17	29	64	2	7	8	34	2	1	11	30	3	13
135	7	32	31	47	92	5	18	27	79	6	3	10	65	0	56
140	8	58	84	48	85	3	33	57	125	4	9	27	94	2	117
145	5	18	9	11	67	5	36	43	82	2	1	24	49	7	32
150	7	12	22	17	25	3	13	32	69	1	2	11	57	3	79
155	1	4	6	2	23	0	2	4	22	2	1	5	19	2	16
160	1	3	4	1	5	1	2	3	4	1	0	1	5	0	0
165	0	0	2	0	3	0	0	0	1	0	0	0	0	0	1
170	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	105	153	191	166	430	19	118	189	514	22	16	103	357	20	360
Percent	2.0	2.9	3.6	3.2	8.2	0.4	2.3	3.6	9.8	0.4	0.3	2.0	6.8	0.4	6.9

- Continued -

Table 6. (page 2 of 5)

East Bed (continued)

Height (mm)	Tow Number														
	00229	00230	00231	00232	00234	00235	00236	00237	00238	00239	00240	00241	00242	00243	00244
<21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
30	0	0	0	0	0	0	0	0	1	0	1	0	1	0	2
35	1	0	0	1	0	0	1	0	0	0	0	2	0	0	5
40	0	0	3	0	0	0	0	0	1	0	0	0	0	0	1
45	3	1	0	1	0	1	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
90	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
95	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0
100	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
105	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
120	0	0	0	0	0	0	1	3	0	0	0	1	3	9	0
125	0	1	0	0	0	0	0	24	8	9	0	3	4	16	2
130	0	9	0	0	0	0	0	64	20	7	1	4	38	66	6
135	1	17	0	0	0	0	0	74	30	4	5	6	78	136	4
140	0	31	0	0	0	0	0	59	48	1	1	2	85	96	6
145	1	38	0	0	0	0	0	19	27	1	1	2	33	26	5
150	1	21	0	0	0	0	0	9	11	0	1	1	16	15	1
155	0	8	0	0	0	0	0	2	3	0	0	1	4	2	0
160	0	2	0	0	0	0	0	2	0	0	0	0	3	3	1
165	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	132	3	2	1	1	4	258	154	22	10	26	264	370	41
Percent	0.1	2.5	0.1	0.0	0.0	0.0	0.1	4.9	2.9	0.4	0.2	0.5	5.0	7.1	0.8

- Continued -

Table 6. (page 3 of 5)

East Bed (continued)

Height (mm)	Tow Number								
	00245	00246	00247	00248	00249	00250	00251	Total	Percent
<21	1	1	0	0	0	2	1	11	<0.1
25	1	1	0	0	0	6	9	47	0.9
30	7	1	0	0	1	17	26	114	2.2
35	2	3	0	0	8	15	53	169	3.2
40	0	2	0	0	4	3	6	44	0.8
45	0	1	0	0	3	2	2	25	0.5
50	0	1	0	0	0	1	2	8	0.2
55	0	1	2	0	0	0	2	4	0.1
60	1	1	0	0	0	0	5	10	0.2
65	0	0	0	0	1	0	2	7	0.1
70	0	0	2	0	3	1	0	11	0.2
75	0	0	0	0	8	0	0	17	0.3
80	0	0	0	0	1	0	1	15	0.3
85	0	1	7	0	0	0	0	15	0.3
90	0	0	18	0	11	0	0	34	0.6
95	0	0	56	0	33	0	0	123	2.4
100	0	0	24	0	28	2	0	84	1.6
105	0	1	4	0	16	0	0	39	0.7
110	0	0	5	0	6	0	1	19	0.4
115	0	0	5	0	3	0	0	15	0.3
120	2	0	11	0	5	3	0	47	0.9
125	6	1	16	0	9	2	3	162	3.1
130	30	2	38	0	6	7	2	542	10.3
135	58	1	82	3	8	4	12	1,002	19.1
140	45	0	129	1	6	7	24	1,295	24.7
145	31	1	75	2	8	2	2	664	12.7
150	18	0	24	0	0	7	15	490	9.4
155	9	0	24	0	0	2	5	167	3.2
160	2	0	2	0	0	0	1	46	0.9
165	0	1	2	0	0	1	0	12	0.2
170	0	0	0	0	0	0	0	2	<0.1
175	0	0	0	0	0	0	0	0	0.0
>175	0	0	0	0	0	0	0	0	0.0
Total	212	17	525	6	167	83	174	5,241	100.0
Percent	4.0	0.3	10.0	0.1	3.2	1.6	3.3	100.0	

- Continued -

Table 6. (page 4 of 5)

West Bed

Height (mm)	00208	00209	00210	00211	00212	00213	00214	00215	00216	00223	00224	00225	00226	00227	00228
<21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0
30	0	0	0	0	0	0	0	1	2	0	3	0	0	3	0
35	0	0	0	0	2	0	0	0	0	0	2	0	0	1	0
40	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
60	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	2	0	0	3	0	0	0	0
75	0	0	0	0	2	0	0	3	0	0	10	0	0	0	0
80	0	0	0	0	2	0	0	0	2	0	6	0	0	0	0
85	0	0	0	0	2	0	0	2	9	0	1	0	0	0	0
90	0	0	0	0	12	0	0	2	18	0	2	0	0	0	0
95	0	0	0	0	38	0	0	2	14	0	2	0	0	0	0
100	0	0	0	4	21	0	0	2	0	0	5	0	0	1	0
105	0	1	1	0	27	0	0	7	2	0	5	0	0	1	0
110	1	12	0	0	12	0	6	48	18	43	18	0	1	0	0
115	3	37	0	0	44	1	20	87	27	104	7	0	2	4	0
120	8	142	0	4	79	0	99	125	80	178	7	1	9	13	2
125	25	248	1	18	148	1	273	104	141	368	5	1	8	34	3
130	40	221	1	29	320	0	378	59	244	565	8	3	7	37	2
135	50	95	0	34	330	0	346	7	146	460	8	6	4	31	2
140	18	32	1	16	224	1	277	1	75	302	6	3	0	14	3
145	11	16	0	11	94	1	26	0	5	58	0	1	0	2	1
150	1	5	0	2	46	2	24	0	2	50	4	4	0	0	2
155	0	1	0	0	29	0	4	0	2	8	0	1	0	0	0
160	0	0	0	0	4	0	0	0	2	0	1	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>175	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Total	156	810	4	117	1,438	7	1,453	454	790	2,140	102	19	33	144	15
Percent	1.6	8.4	0.0	1.2	14.8	0.1	15.0	4.7	8.1	22.1	1.1	0.2	0.3	1.5	0.2

- Continued -

Table 6. (page 5 of 5)

Height (mm)	West Bed (continued)								Experimental Stations				
	00255	00256	00257	00258	00259	00260	Total	Percent	00261	00263	00264	Total	Percent
<21	0	0	2	0	0	0	2	0.0	0	0	0	0	0.0
25	0	1	0	0	0	0	4	0.0	1	0	0	1	0.9
30	0	1	0	0	0	0	10	0.1	2	2	9	13	16.3
35	0	1	2	0	0	0	8	0.1	1	7	6	14	16.6
40	0	0	0	0	0	0	5	0.0	0	5	1	6	7.8
45	0	0	2	0	0	0	2	0.0	0	2	0	2	2.8
50	1	1	0	0	0	0	5	0.1	0	2	0	2	1.9
55	1	0	0	0	0	0	2	0.0	0	0	4	4	4.8
60	0	0	0	0	0	0	1	0.0	0	0	2	2	2.4
65	0	0	0	0	0	0	0	0.0	0	1	1	2	2.1
70	0	0	0	0	0	0	5	0.0	0	3	1	4	5.0
75	0	1	0	0	0	0	16	0.2	0	2	0	2	2.8
80	0	1	0	0	0	0	11	0.1	0	4	0	4	4.7
85	0	0	3	0	1	0	18	0.2	0	1	0	1	0.9
90	0	1	3	0	1	0	39	0.4	0	0	0	0	0.0
95	0	1	3	0	4	0	64	0.7	0	0	0	0	0.0
100	0	0	7	0	4	0	44	0.4	0	0	0	0	0.0
105	0	5	2	0	0	1	51	0.5	0	0	0	0	0.0
110	5	5	15	2	0	1	187	1.9	0	2	0	2	1.9
115	13	17	54	12	3	4	439	4.5	0	0	0	0	0.0
120	46	16	100	19	16	7	950	9.8	3	0	0	3	3.6
125	72	18	173	61	46	20	1,765	18.2	1	0	0	1	1.8
130	57	26	164	179	77	24	2,441	25.2	6	0	1	7	8.4
135	43	4	106	144	61	27	1,903	19.6	2	1	0	3	3.6
140	8	0	64	106	34	8	1,192	12.3	5	0	2	7	8.7
145	2	2	27	43	4	1	305	3.1	1	0	1	2	3.0
150	2	0	7	7	6	0	164	1.7	0	0	0	0	0.0
155	0	0	2	5	2	0	54	0.6	0	0	0	0	0.0
160	0	0	0	0	0	0	7	0.1	0	0	0	0	0.0
165	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
170	0	0	0	0	0	0	4	0.0	0	0	0	0	0.0
175	0	0	0	0	0	0	0	0.0	0	0	0	0	0.0
>175	0	0	0	0	0	0	1	0.0	0	0	0	0	0.0
Total	250	100	734	579	258	94	9,696		23	32	27	82	23
Percent	2.6	1.0	7.6	6.0	2.7	1.0	100.0		27.8	38.7	33.5	100.0	27.8

Table 7. Age composition of weathervane scallops based on size-at-age extrapolations for Kayak Island survey data, 2000.

East Bed

	Scallop Age Class (years)[a/]																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Tow	Number of Scallops																		
00208	69	3	0	0	0	0	1	0	2	7	15	3	3	1	1	0	0	0	105
00209	1	0	0	0	0	0	0	3	3	39	57	38	3	4	6	0	0	0	153
00210	13	0	1	0	0	0	0	2	3	37	50	44	32	3	6	1	1	0	191
00211	5	1	0	0	0	0	4	6	5	53	49	18	20	5	0	0	0	0	166
00212	17	2	1	4	2	3	9	16	19	86	178	50	19	13	10	2	0	0	430
00213	0	0	0	0	0	1	0	1	3	5	1	5	2	1	1	0	0	0	19
00214	1	3	1	2	0	1	0	0	4	23	49	20	11	0	2	2	0	0	118
00215	13	0	3	0	0	0	1	0	0	14	82	37	27	3	6	3	1	0	189
00216	56	6	11	12	2	2	2	9	14	44	170	102	31	19	23	8	3	2	514
00223	1	0	1	1	0	0	0	0	2	3	6	4	2	0	0	1	1	0	22
00224	0	0	0	0	0	0	1	2	2	2	3	3	3	1	0	0	0	0	16
00225	11	0	0	1	0	0	3	0	2	15	22	32	13	3	1	0	1	0	103
00226	5	1	10	3	4	1	6	16	18	25	75	119	49	14	9	1	0	1	357
00227	0	1	2	0	0	0	0	0	1	1	8	4	3	0	0	0	0	0	20
00228	15	5	14	7	2	2	0	7	9	56	64	119	37	3	14	4	2	0	360
00229	4	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	7
00230	1	0	3	0	1	1	0	0	7	12	23	40	36	3	2	3	0	1	132
00231	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
00232	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
00234	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
00235	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
00236	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4
00237	0	0	0	1	0	1	9	11	23	32	78	47	54	3	0	0	0	0	258
00238	2	1	0	0	0	0	6	6	8	9	52	30	33	4	0	0	1	2	154
00239	1	0	0	0	0	0	0	0	2	4	7	9	0	0	0	0	0	0	22
00240	1	1	0	0	0	0	0	0	0	3	4	2	0	0	0	0	0	0	10

- Continued –

Table 7. (page 2 of 3)

East Bed (continued)

	Scallop Age Class (years)[a/]																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Tow	Number of Scallops																		
00241	2	2	2	0	0	0	1	3	1	3	8	3	0	1	0	0	0	0	26
00242	1	0	0	0	0	0	1	8	33	50	72	48	40	5	6	1	0	1	264
00243	0	0	1	0	0	0	3	7	31	77	103	111	13	17	5	1	1	0	370
00244	13	1	1	1	0	0	0	0	2	10	7	3	0	1	2	0	0	0	41
00245	11	1	0	0	0	0	0	0	7	58	34	82	15	1	3	0	0	0	212
00246	8	2	1	0	0	0	2	0	1	1	1	1	0	0	0	0	0	1	17
00247	0	7	73	27	2	5	13	13	0	100	80	87	109	4	5	0	0	0	525
00248	0	0	0	0	0	0	0	0	0	0	4	1	1	0	0	0	0	0	6
00249	16	10	39	33	12	11	5	7	0	8	13	9	5	0	0	0	0	0	167
00250	46	1	0	2	0	0	5	5	2	5	5	2	4	5	2	0	0	0	83
00251	98	10	1	0	1	0	1	2	1	10	19	19	3	2	6	1	0	0	174
Total	418	58	165	94	25	28	71	123	203	791	1,339	1,090	566	114	109	28	11	7	5,241
Percent	8.0	1.1	3.1	1.8	0.5	0.5	1.4	2.3	3.9	15.1	25.6	20.8	10.8	2.2	2.1	0.5	0.2	0.1	100.0

Table 7. (page 3 of 3)

West Bed

	Scallop Age Class (years)[a/]																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Tow	Number of Scallops																		
00201	0	0	0	1	1	0	11	15	20	37	45	19	4	3	1	0	0	0	156
00202	0	0	2	3	9	7	39	124	167	125	188	123	17	1	4	1	0	0	810
00203	0	0	0	1	0	0	0	0	0	0	2	0	0	1	0	0	0	0	4
00204	0	0	1	3	0	0	2	0	18	29	12	42	11	0	0	0	0	0	117
00205	6	6	54	23	10	19	69	104	123	289	236	255	205	25	4	6	4	2	1,438
00206	1	0	0	1	0	0	0	1	0	2	0	1	1	0	0	0	0	0	7
00207	0	0	0	4	10	10	73	113	335	366	313	188	34	4	2	0	0	0	1,453
00217	3	9	8	4	23	36	23	72	68	47	84	76	4	0	0	0	0	0	456
00218	2	11	34	0	9	27	61	77	80	102	187	159	30	7	0	0	2	0	790
00219	0	0	4	12	19	46	77	58	325	333	584	588	74	0	0	8	12	0	2,140
00220	6	9	16	3	4	7	13	9	4	8	10	9	6	1	0	0	0	0	102
00221	0	0	0	0	1	0	0	3	1	3	2	4	3	1	1	0	1	0	19
00252	0	1	0	1	1	2	3	10	5	2	3	3	1	0	1	0	0	0	33
00253	6	0	0	1	1	2	1	21	3	31	40	34	3	0	0	0	0	0	144
00254	0	0	0	0	0	0	2	0	2	3	2	3	1	2	0	0	0	0	15
00255	0	2	0	1	5	12	22	44	9	24	54	67	8	2	0	0	0	0	250
00256	3	3	3	1	2	9	11	13	11	7	18	13	8	0	0	0	0	0	101
00257	5	2	12	10	5	8	99	141	129	55	167	55	37	7	0	2	0	0	734
00258	0	0	0	0	0	0	5	78	106	63	153	137	28	3	3	2	0	0	579
00259	0	1	7	1	1	0	1	10	50	55	66	44	16	3	1	1	1	0	258
00260	0	0	0	0	0	0	1	6	11	25	30	15	4	1	0	0	0	0	94
Total	32	43	140	69	101	186	513	899	1,467	1,607	2,196	1,835	494	61	17	19	20	2	9,699
Percent	0.3	0.4	1.4	0.7	1.0	1.9	5.3	9.3	15.1	16.6	22.6	18.9	5.1	0.6	0.2	0.2	0.2	0.0	100.0

a/ Tows lacking scallop samples are excluded from table.

Table 8. Sex composition and maturity of weathervane scallops sampled from a dredge survey near Kayak Ialand, Alaska, 2000.

East Bed	Sex (number of scallops)				
Maturity	Unknown	Male	Female	Total	Percent
Spawning	0	213	132	345	56.7
Nonspawning	75	68	121	264	43.3
Total	75	281	253	609	100.0
Percent	12.3	46.1	41.6	100.0	

West Bed	Sex (number of scallops)				
Maturity	Unknown	Male	Female	Total	Percent
Spawning	0	101	79	180	47.0
Nonspawning	51	66	86	203	53.0
Total	51	167	165	383	100.0
Percent	13.3	43.6	43.1	100.0	

Table 9. Fish catch by area during the Kayak Island scallop survey, 2000.

Common Name	Scientific name	East	West	Exploratory	Total
Arrowtooth Flounder	*Atheresthes stomias*	33	7	4	45
Flathead Sole	*Hippolossoides elassodon*	24	14	13	51
Dover Sole	*Microstomus pacificus*	133	64	15	212
Rex Sole	*Glyptocepahlus zachirus*	70	98	35	204
Butter Sole	*Isopsetta isolepis*		1	1	2
English Sole	*Parophrys vetulus*	2	8	4	14
Lingcod	*Ophiodon elongatus*		1		1
Rougheye Rockfish	*Sebastes aleutianus*	2	1		3
Sculpin	Family Cottidae	4	11	9	24
Prickleback	Family Stichaeidae	16	14	1	31
Wrymouth	Family Cryptacanthodidae	9	4	1	14
Walleye Pollock	*Theragra chalcogramma*	4	1		5
Eulachon	*Thaleichthys pacificus*	12	11	1	23
Capelin	*Mallosus villosus*	1			1
Skate	Genera Raja and Bathyraja	8	2		10
Sablefish	*Anoplopoma fimbria*		1	1	2
Eelpout	Family Zoarcidae	136	49	13	198
Searcher	Family Bathymasteridae	5	3		8
Snailfish	Family Liparidae		2	4	6
Starsnout	family Agonidae	14	1	12	27
Sturgeon Poacher	family Agonidae	2			2
Wolfeel	*Anarrhichthys ocellatus*	1			1
Total		476	292	114	882

Table 10. Whole weight, meat weight, and average meat recovery of weathervane scallops sampled from a dredge survey near Kayak Island, Alaska, 2000.

Date	Number of Scallops	Weight (kg) Whole	Weight (kg) Meat	Percent Recovery
5/27/2000	111	48	4.7	9.69
5/28/2000	180	106	6.7	6.28
5/29/2000	61	36	1.9	5.33
5/30/2000	174	104	7.3	7.04
5/31/2000	138	86	5.8	6.72
6/1/2000	146	68	5.1	7.55
6/2/2000	55	22	1.8	8.12
6/3/2000	80	38	4.1	10.73
Total	945	508	37.3	7.35[a/]

[a/] Total mean recovery calculated as daily recovery weighted by daily whole scallop weight.

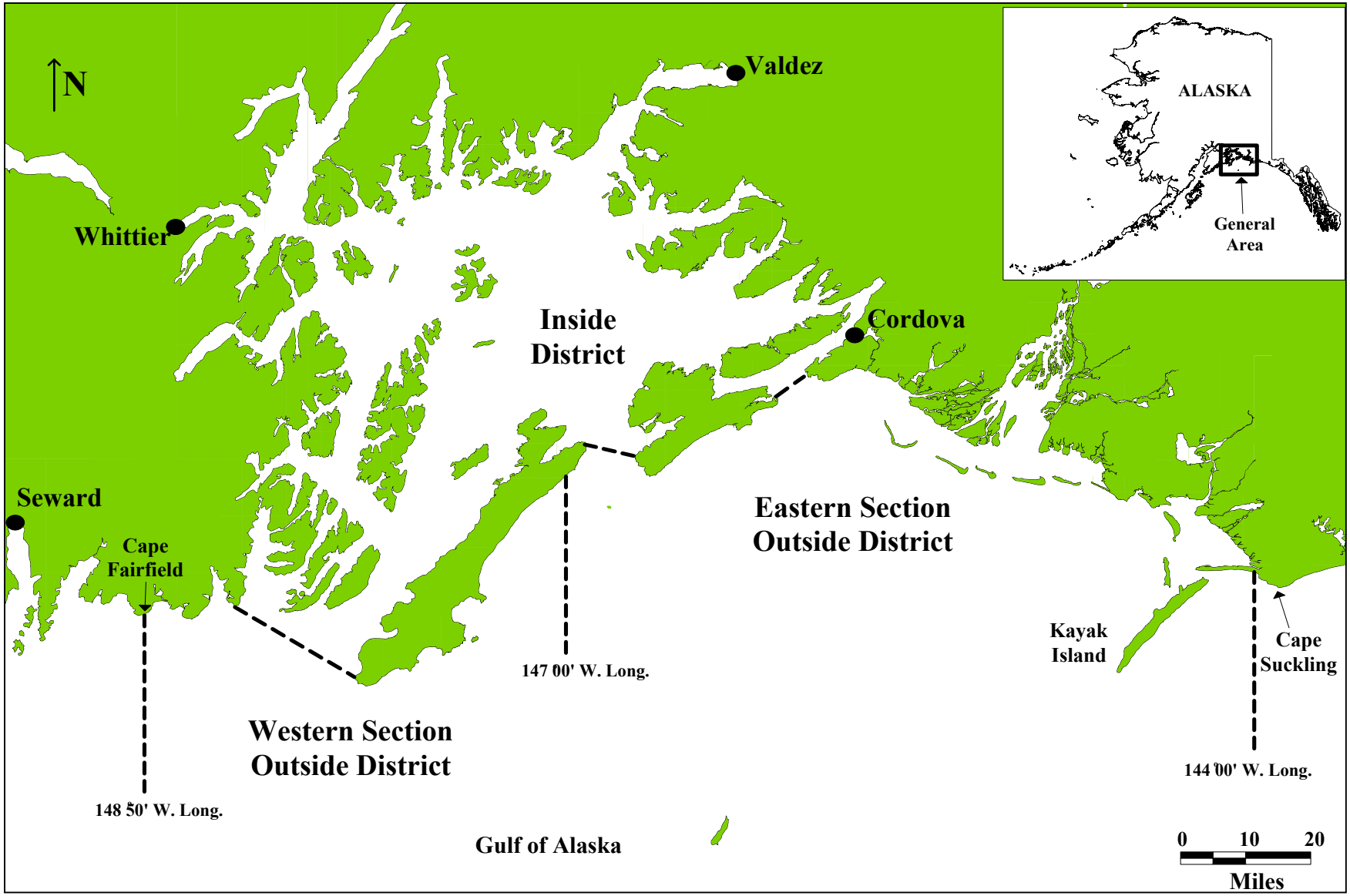

Figure 1. Location of Kayak Island within the Eastern Section of the Outside District in the Prince William Sound Management Area.

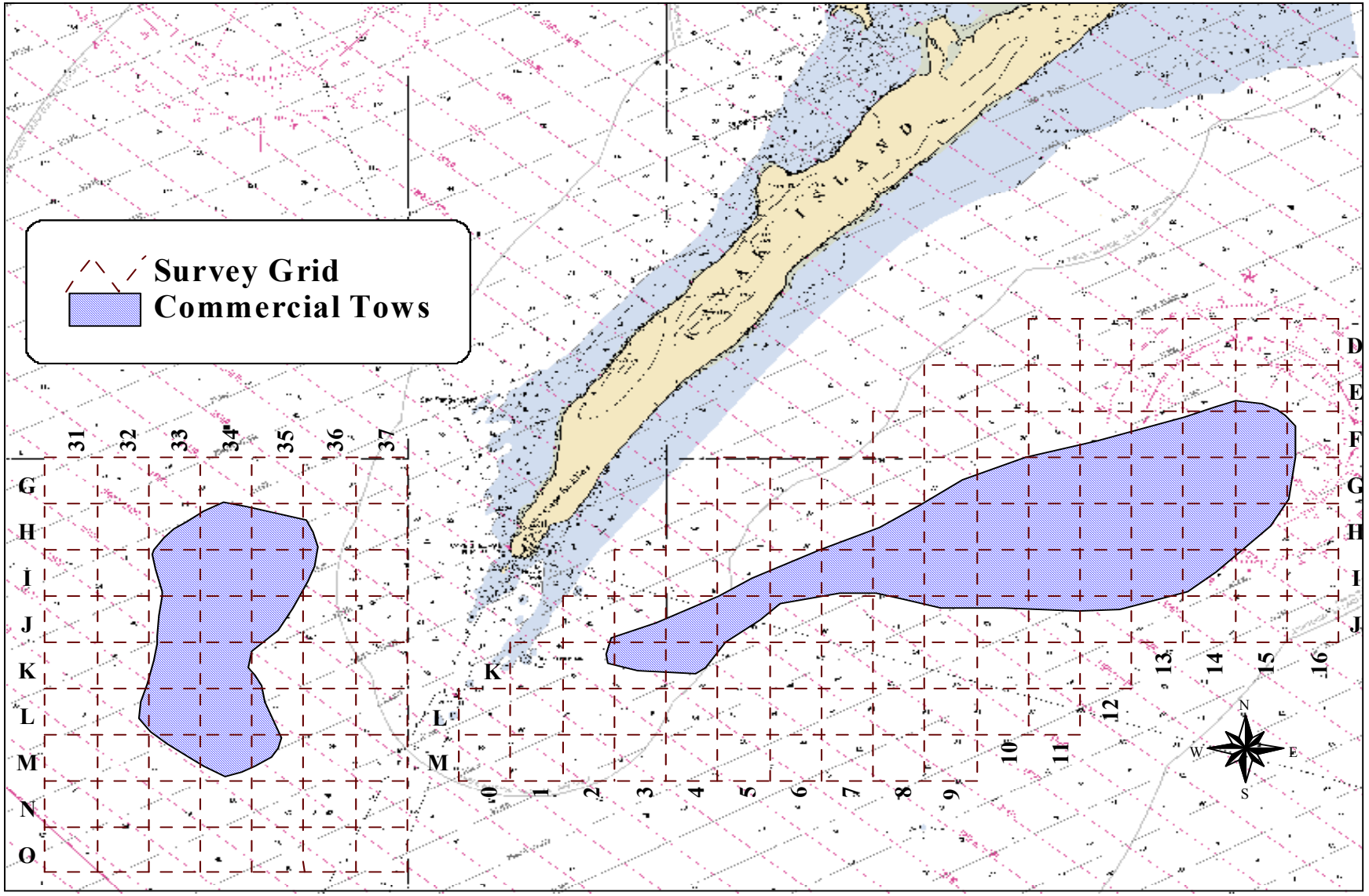

Figure 2. General survey area showing 95% bounds of the commercial fishery tows (hatched pattern) and the preliminary survey grid.

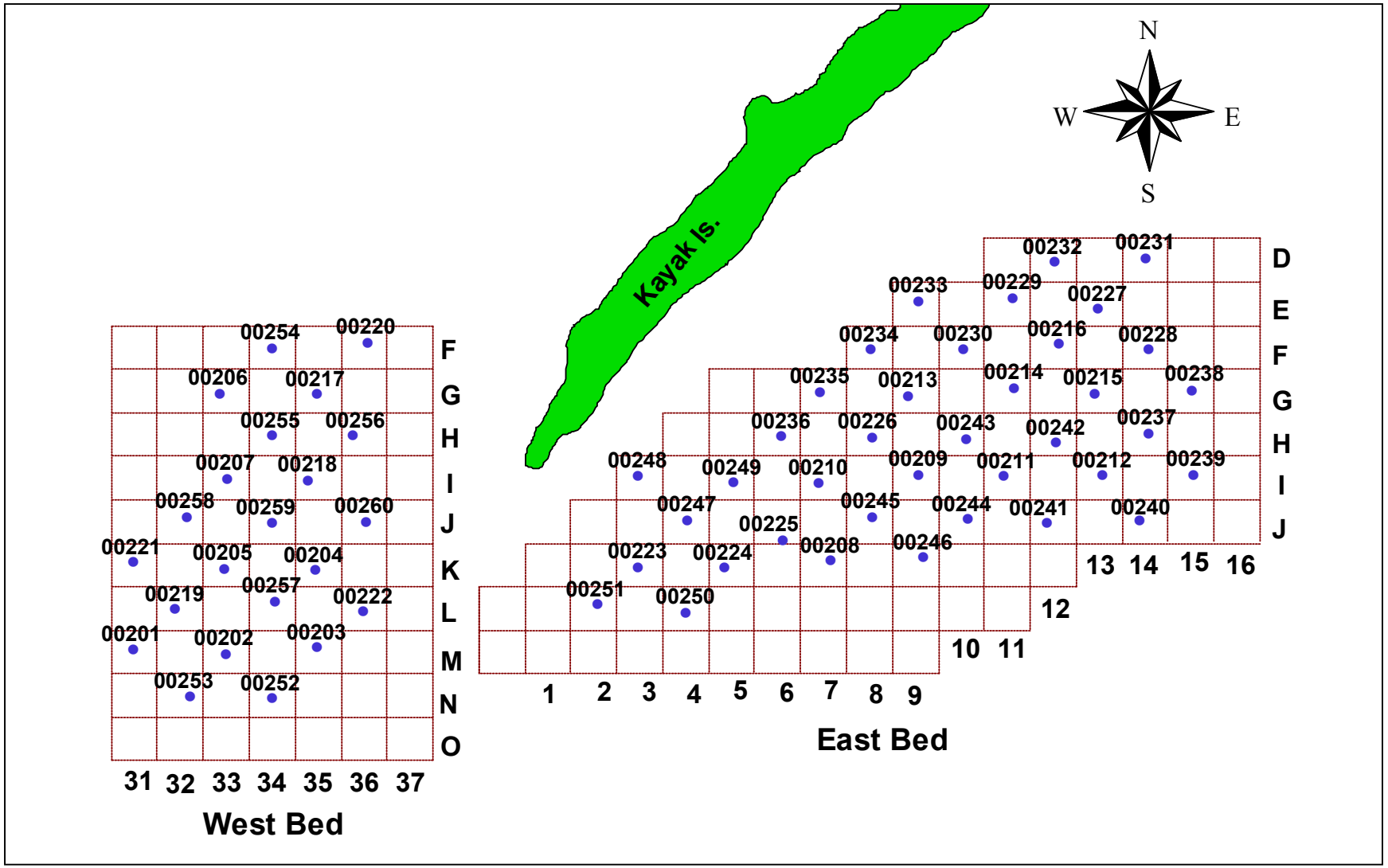

Figure 3. Mid-points of dredge tows, identified by tow number, against the preliminary survey grid for a weathervane scallop survey near Kayak Island, Alaska, 2000.

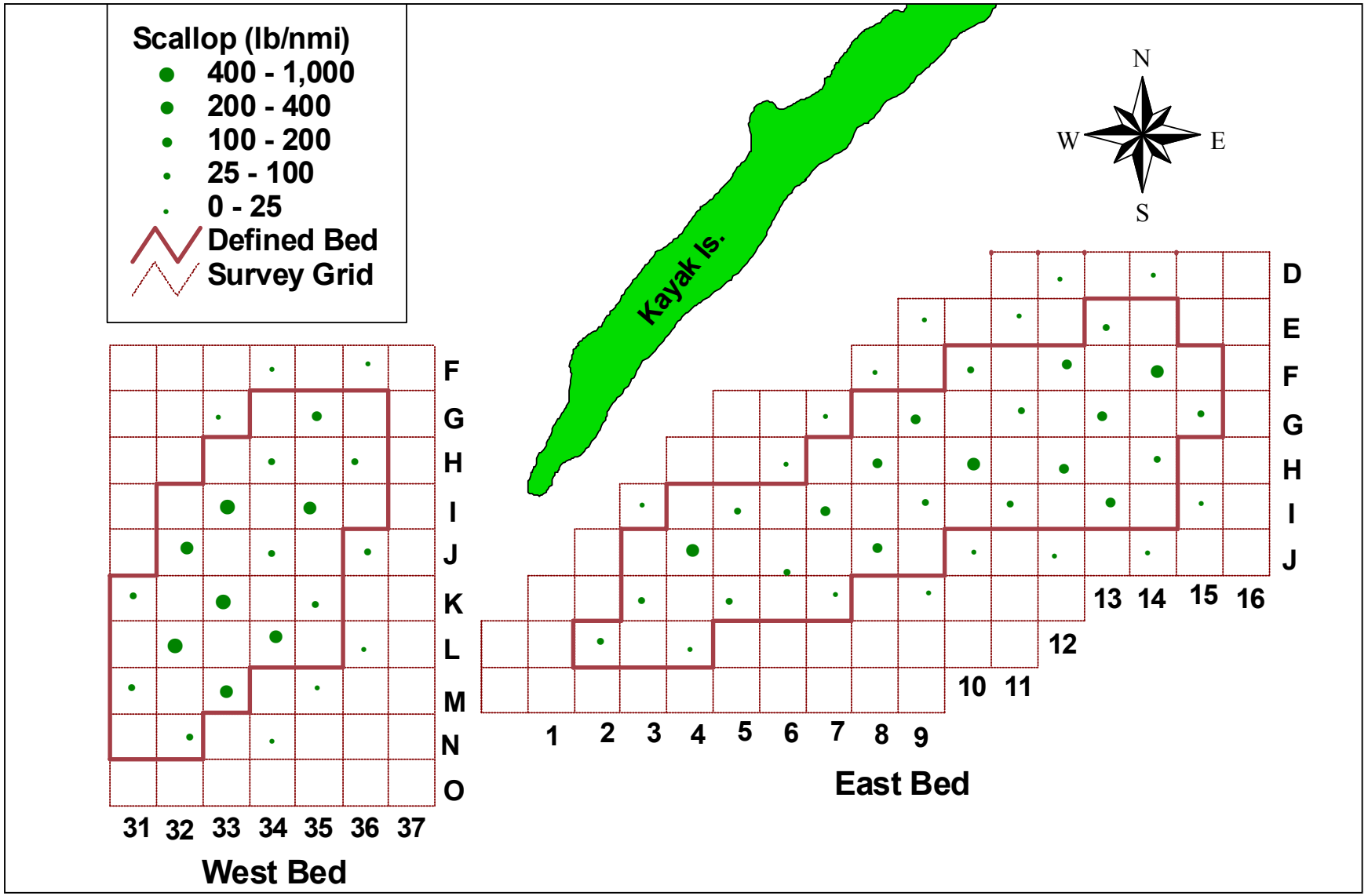

Figure 4. Weathervane scallop catch weight by survey tow near Kayak Island, Alaska, 2000.

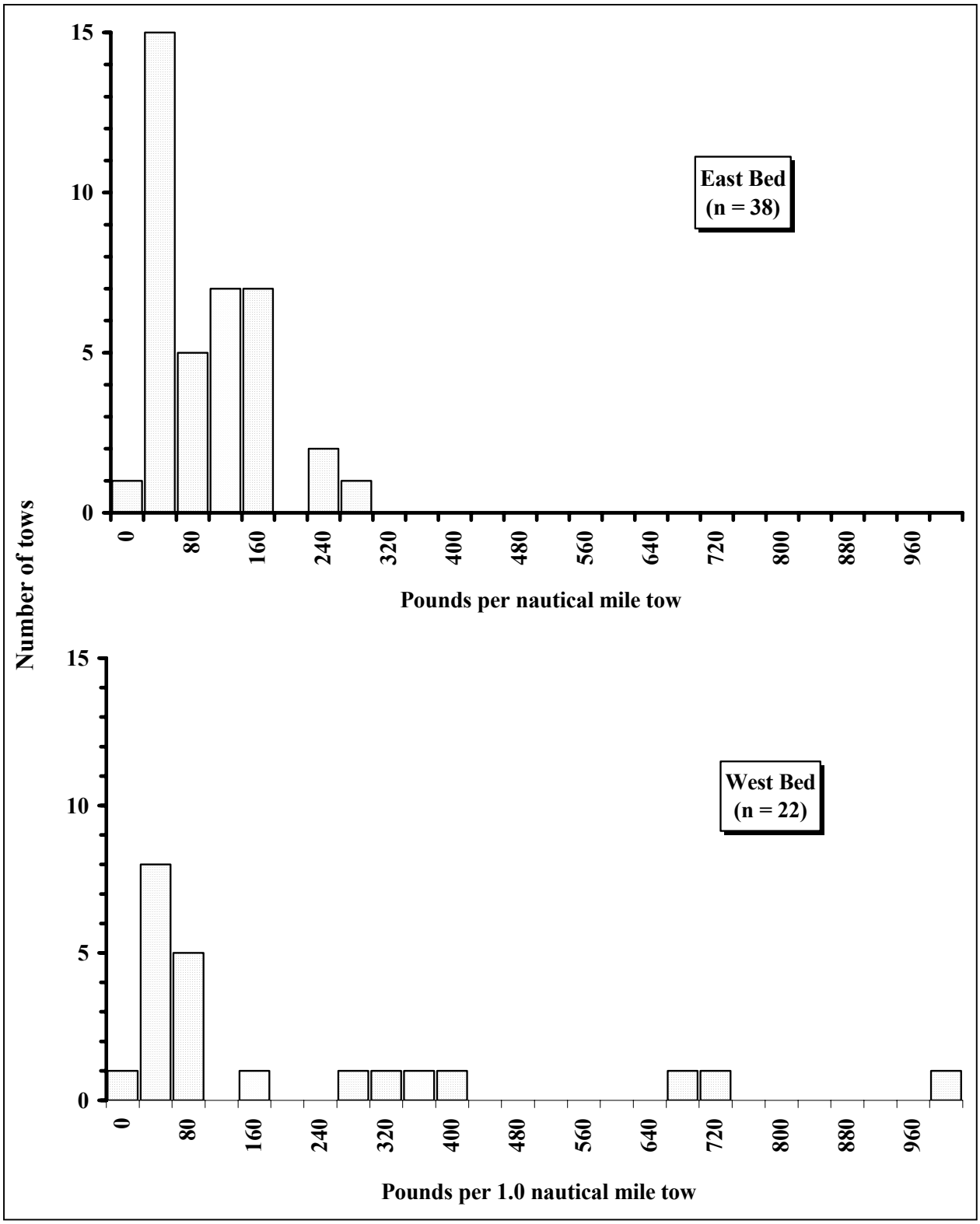

Figure 5. Frequency distribution of tow catch weights of weathervane scallops during a dredge survey near Kayak Island, Alaska, 2000.

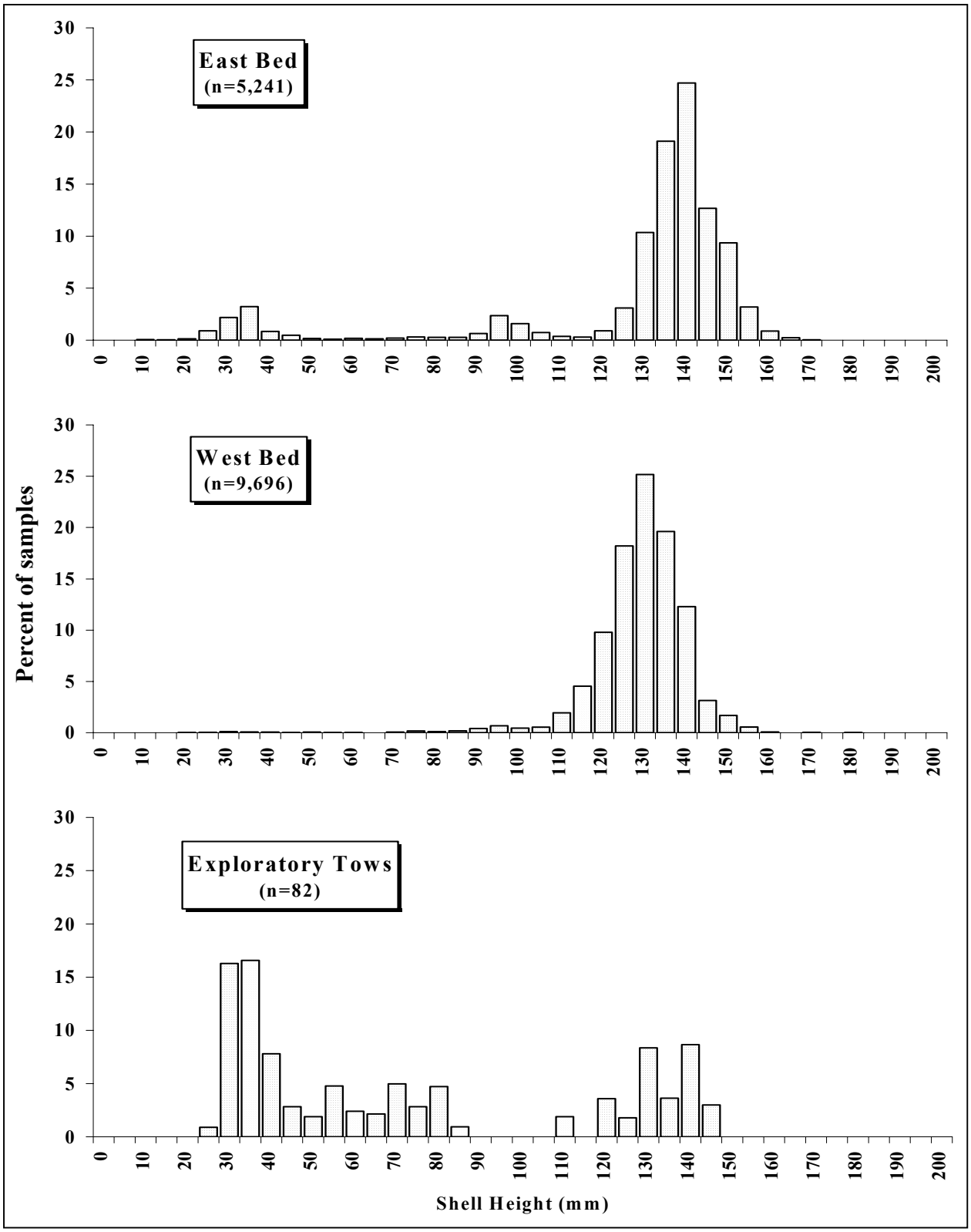

Figure 6. Shell height composition of weathervane scallops caught in a dredge survey near Kayak Island, Alaska, 2000.

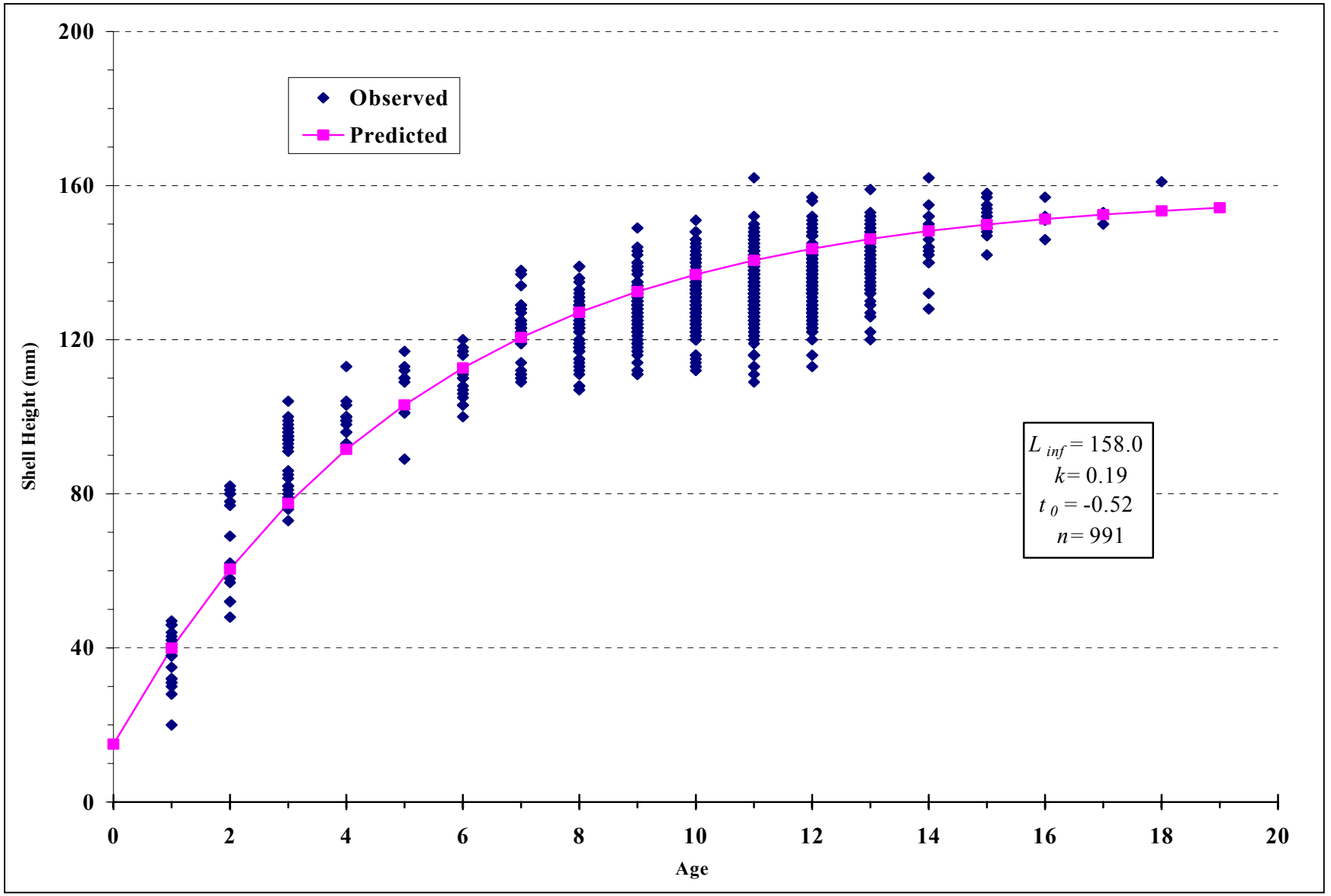

Figure 7. Von Bertalanffy growth curve showing shell height-at-age for weathervane scallops from the Kayak Island survey, 2000.

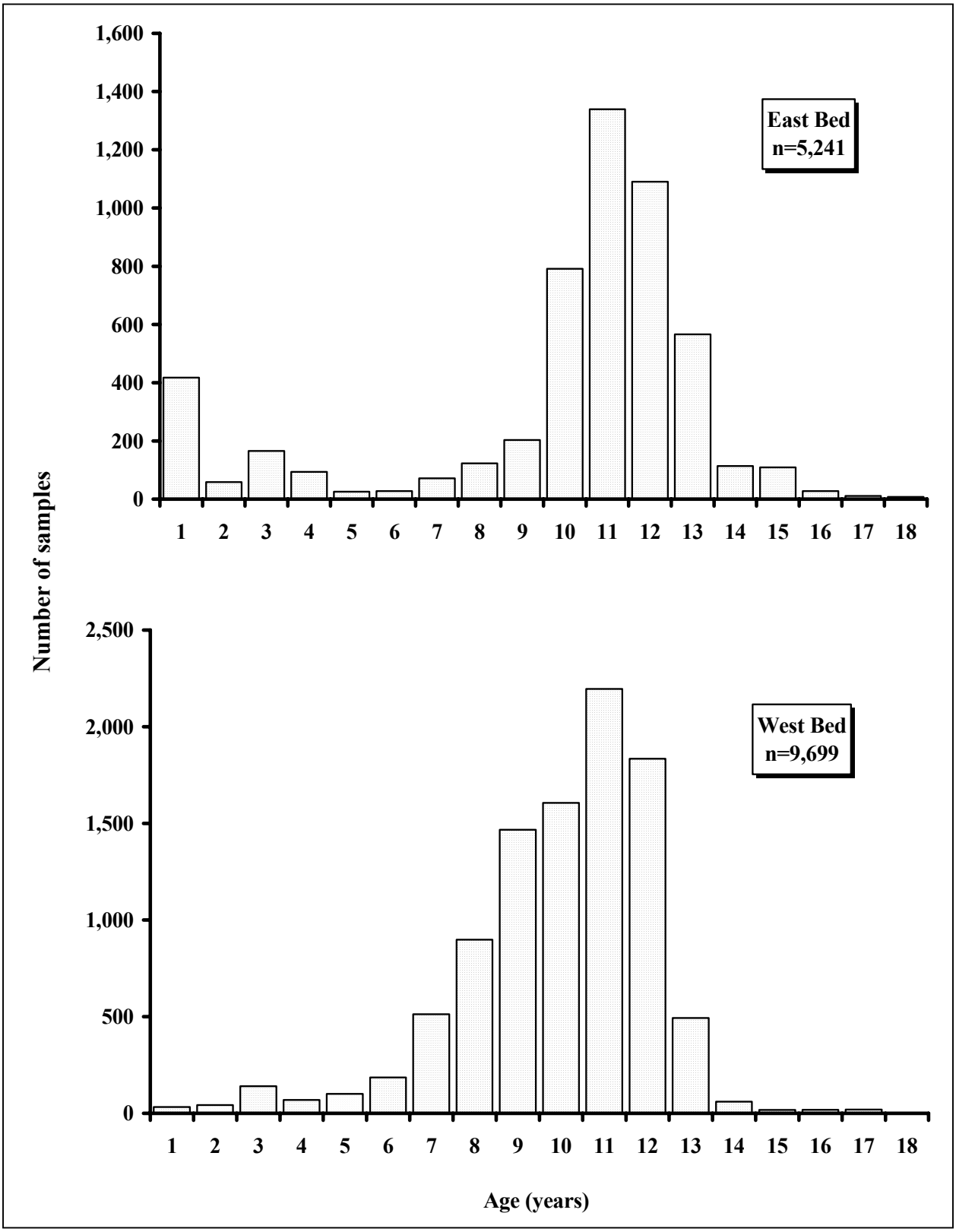

Figure 8. Age composition of weathervane scallops in a survey near Kayak Island, Alaska, 2000.

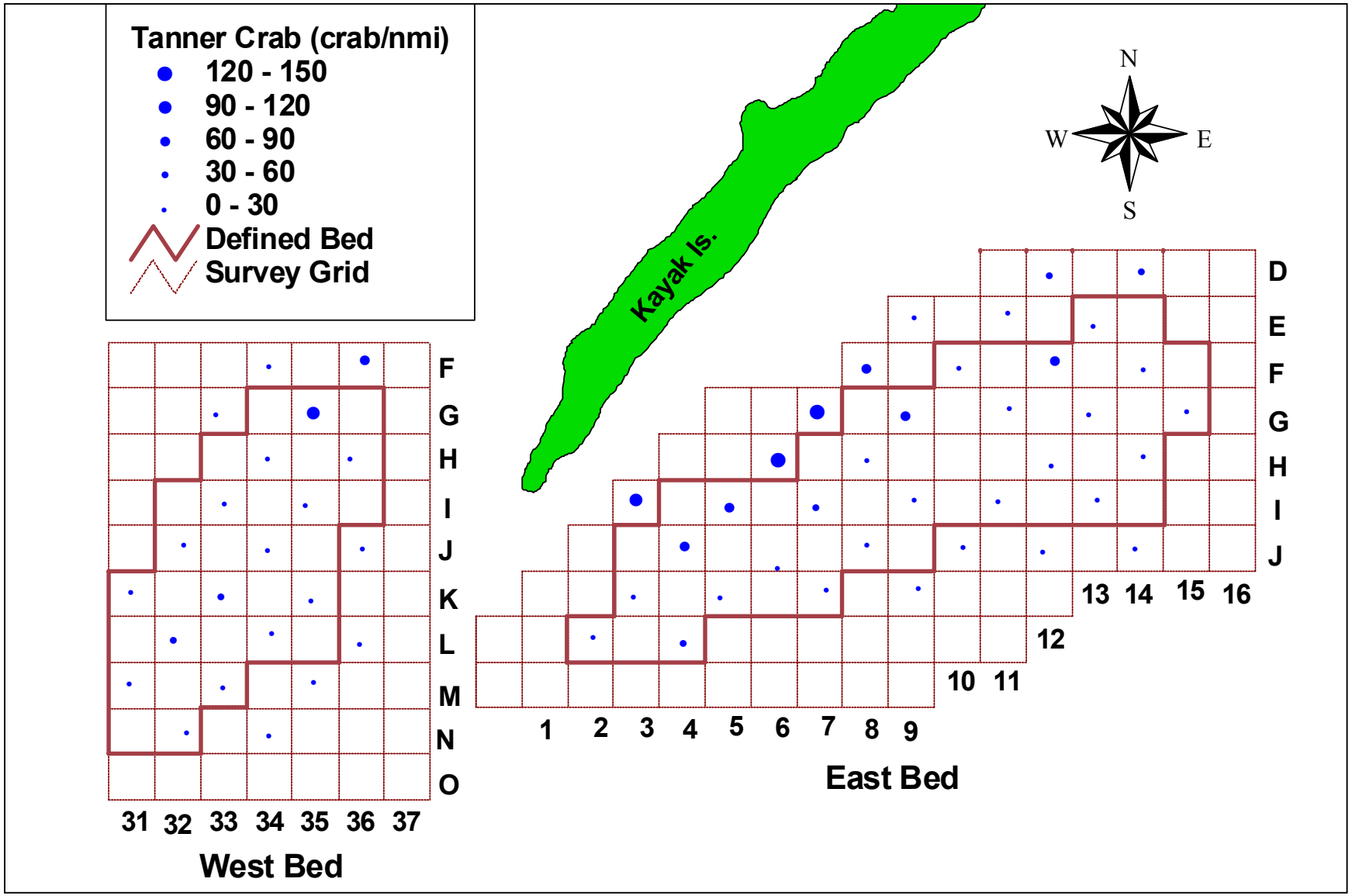

Figure 9. Tanner crab catches during the weathervane scallop survey at Kayak Island, 2000.

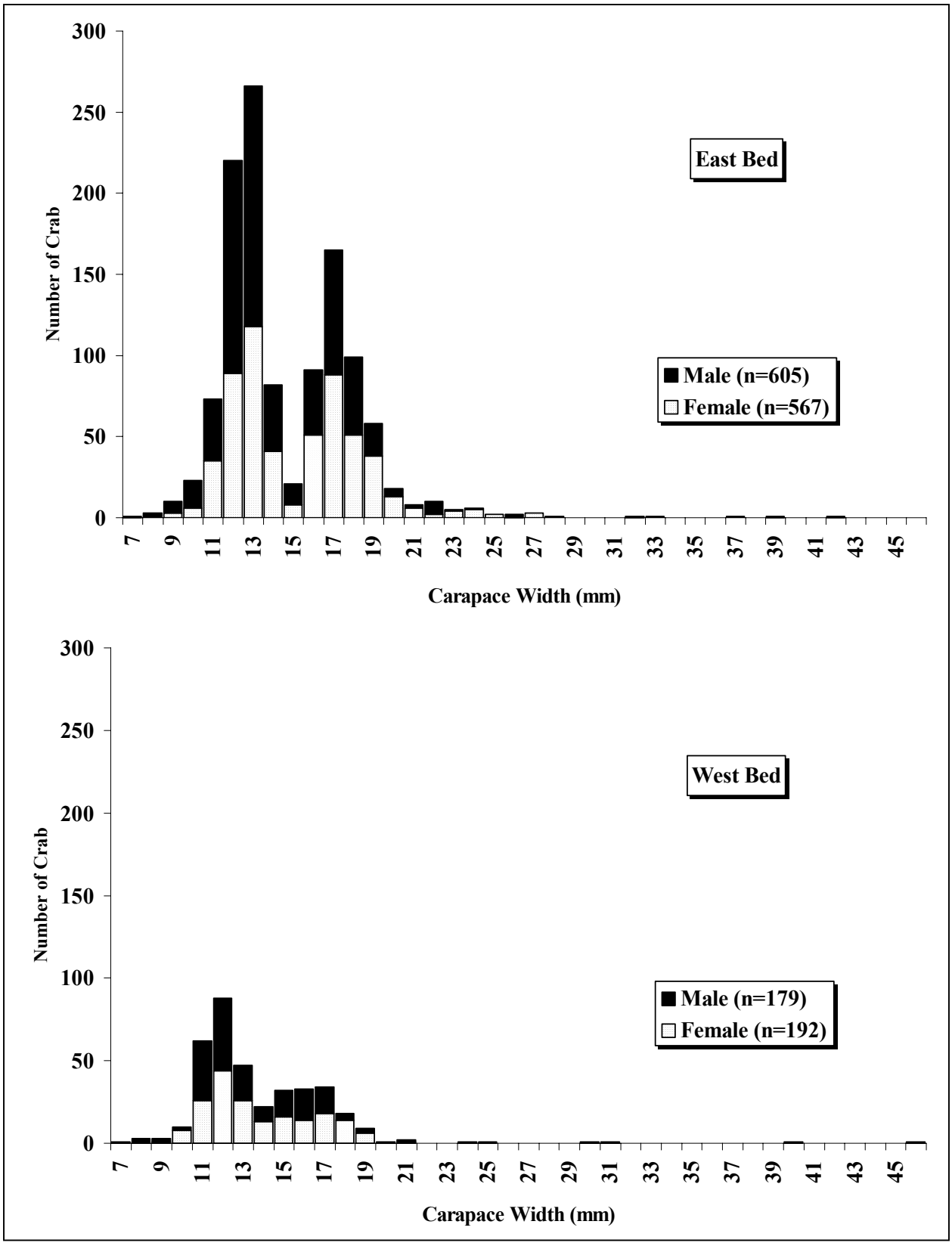

Figure 10. Carapace width of Tanner crab caught in a scallop survey near Kayak Island, 2000.

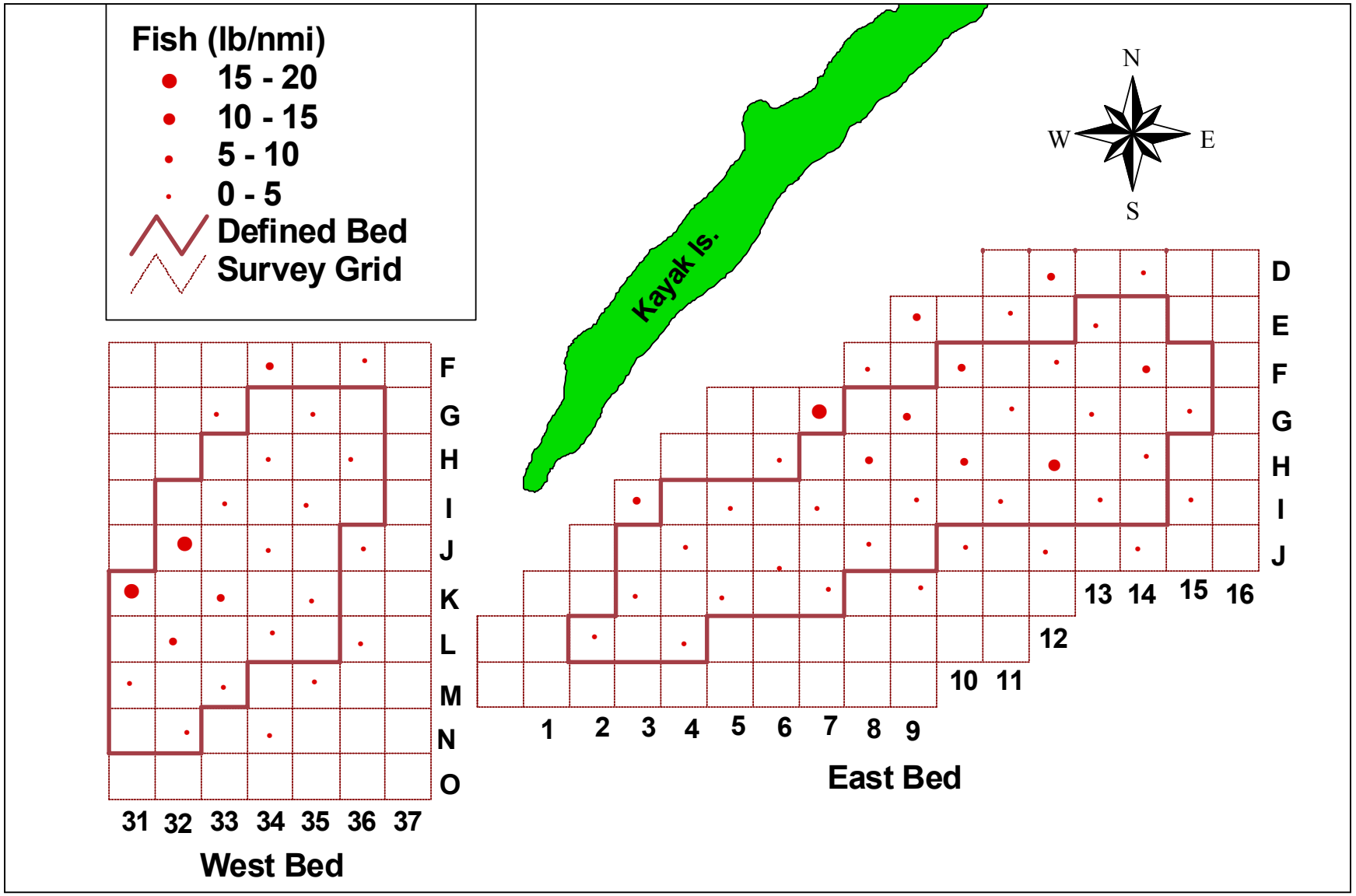

Figure 11. Fish catches during the weathervane scallop survey at Kayak Island, 2000.

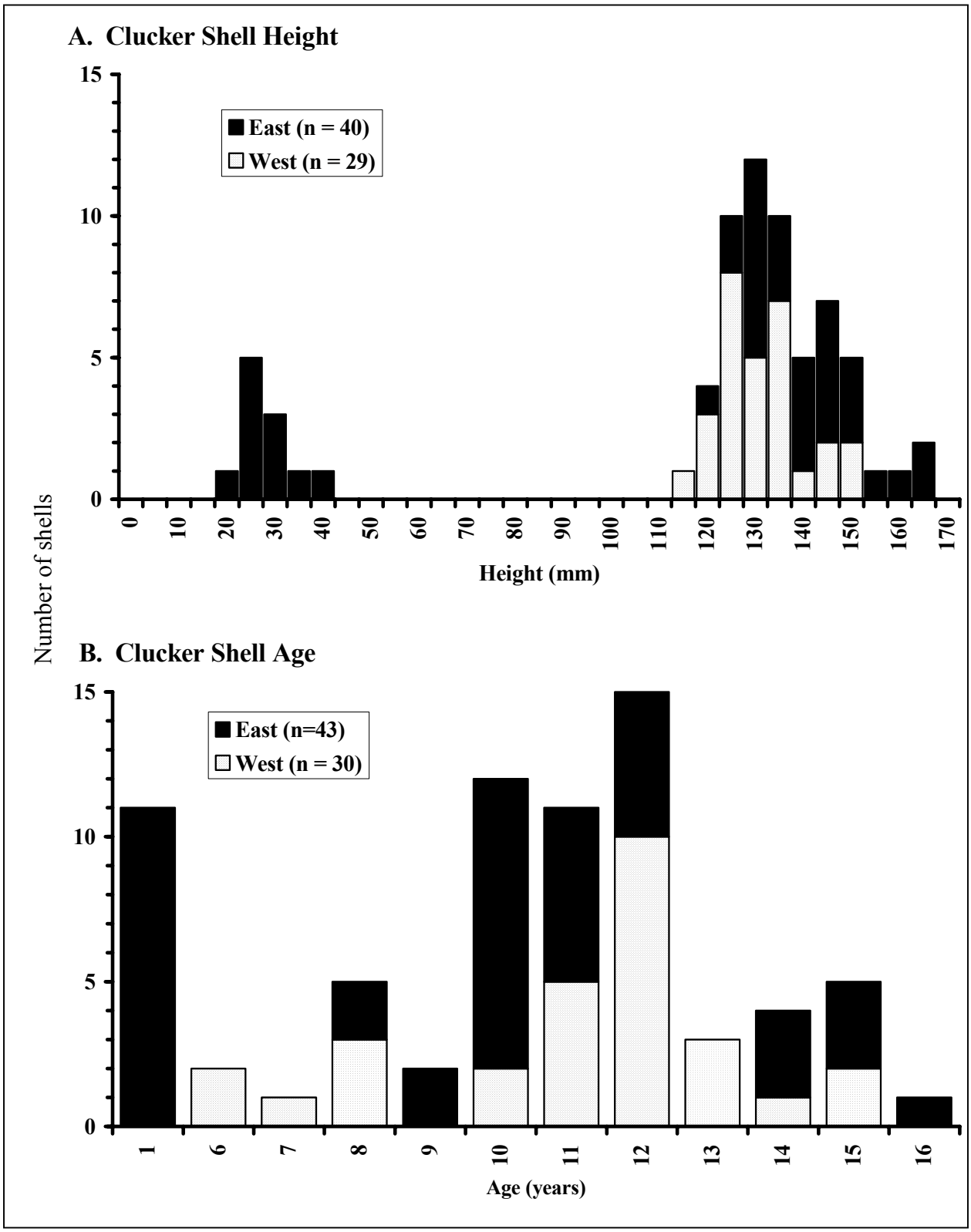

Figure 12. Shell height (A) and age (B) composition of scallop cluckers sampled in a scallop survey near Kayak Island, 2000.