Regional Information Report No. 4K18-07

Special Project Plan: 2018 Large-Mesh Bottom Trawl Survey of Crab and Groundfish for Kodiak, Chignik, South Peninsula, and Eastern Aleutian Districts

by

Michael Knutson

May 2018

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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SPECIAL PROJECT PLAN: 2018 LARGE-MESH BOTTOM TRAWL SURVEY OF CRAB AND GROUNDFISH FOR KODIAK, CHIGNIK, SOUTH PENINSULA, AND EASTERN ALEUTIAN DISTRICTS

by
Michael Knutson
Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

May 2018

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Michael Knutson
Alaska Department of Fish and Game, Division of Commercial Fisheries,
351 Research Court, Kodiak, AK 99615, USA

This document should be cited as follows:
Knutson, M. 2018. Special project plan: 2018 large-mesh bottom trawl survey of crab and groundfish for Kodiak, Chignik, South Peninsula, and Eastern Aleutian districts. Alaska Department of Fish and Game, Regional Information Report 4K18-07, Kodiak.

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ABSTRACT

This report specifies special project objectives and methods and presents survey schedule and station boundaries of Alaska Department of Fish and Game's (ADF&G) 2018 Kodiak, Chignik, South Peninsula, and Eastern Aleutian districts large-mesh bottom trawl survey of crab and groundfish. This special project plan is used in conjunction with the large-mesh bottom trawl survey operational plan (Spalinger 2015), which describes standard large-mesh trawl survey sampling. Special projects for 2018 include sampling shrimp and forage fish using small-mesh trawl gear in Pavlof and Chiniak bays, collecting otoliths and associated biological data from walleye pollock *Gadus chalcogrammus*, and monitoring sea stars for wasting disease throughout the survey.

Key words: Tanner crab, shellfish, groundfish, trawl survey, Kodiak, South Peninsula, Chignik, Eastern Aleutian, special projects

INTRODUCTION

From mid-June through mid-September 2018, the Alaska Department of Fish and Game (ADF&G) will conduct a bottom trawl survey in areas of known Tanner crab *Chionoecetes bairdi* habitat around Kodiak Island and south of the Alaska Peninsula from Cape Douglas to False Pass, as well as around the Eastern Aleutian Islands using a fixed-grid station design (Figure 1). Survey data is used to estimate relative abundance, sex composition, and maturity of Tanner crab and red king crab *Paralithodes camtschaticus*, as well as determine spatial distribution, species composition, density, and size frequency distribution of groundfish species. Standard sampling methods during the bottom trawl survey are described in the operational plan (Spalinger 2015). This report details sampling methods for special projects, survey schedule, and station boundaries for the 2018 large-mesh bottom trawl survey. Additional equipment required for special projects are detailed in appendix A.

OBJECTIVES

Objectives for special projects during the 2018 large-mesh bottom trawl survey are:

1. Conduct small-mesh hauls in Pavlof and Chiniak bays, sampling shrimp and forage fish to continue the small-mesh time series in those areas.
2. Collect otoliths and associated biological information from walleye pollock every other day throughout the duration of the survey.
3. Monitor sea stars for external signs of wasting disease throughout the survey.

METHODS

SURVEY AREA

The 28.3m ADF&G research vessel (R/V) *Resolution* will conduct survey hauls using a 400-mesh eastern otter trawl in the Kodiak, Chignik, South Peninsula, and Eastern Aleutian Tanner crab districts (Figure 1, Appendices B1–B14). This area includes waters of the Pacific Ocean south of the latitude of Cape Douglas (58°51.10' N lat.), west of 149°W long., and east of 172°W long., and Bering Sea waters south of 54°36.00' N lat. and east of 172°W long. The 2018 survey will include an additional 5 stations in Beaver Inlet that are surveyed on a triennial basis (Appendix B14). The 2018 large-mesh bottom trawl survey will cover 374 stations representing approximately 13,238 km^2.

PAVLOF AND CHINIAK BAY SMALL-MESH HAULS

Since 1973, either ADF&G or the National Marine Fisheries Service (NMFS) have conducted small-mesh bottom trawl surveys in the Kodiak, Chignik, and South Peninsula districts using a high-opening box trawl. This survey has been conducted annually in Pavlof Bay, Chiniak Bay, and other areas. In 2015, funding was reduced to a level where an independent small mesh survey was no longer possible. To maintain the Pavlof Bay small-mesh data time series, and provide a baseline to monitor shrimp populations, the R/V *Resolution* will perform a limited number of small-mesh hauls during the 2018 large-mesh survey.

Towards the end of the South Peninsula large-mesh survey leg, vessel staff will remove and store the large-mesh trawl net and replace it with small-mesh trawl survey gear. Up to 8 hauls will be conducted in randomly-selected small-mesh survey stations in Pavlof Bay (Figure 2) and the catch will be sampled according to small-mesh bottom trawl survey methods (Jackson 2003). Upon completion of those hauls, the large-mesh survey gear will be reinstalled, and the large-mesh survey will continue.

After completion of the large-mesh survey, the large-mesh trawl net will again be removed and replaced by small-mesh gear. Up to 8 hauls will then be conducted in randomly-selected small-mesh survey stations in Chiniak Bay (Figure 3) during 2 separate day trips. Catch from those hauls will be sampled according to small-mesh survey methods (Jackson 2003).

WALLEYE POLLOCK OTOLITH COLLECTION

Approximately 600 otoliths will be collected from walleye pollock throughout the 2018 survey (Spalinger 2015). To obtain a sample representative of the survey area, 20 fish will be sampled every other day. Haul number, fish length, and fish sex will be recorded electronically on deck and otoliths will be removed and stored in vials containing the specimen number. At the conclusion of the survey, data and otoliths will be provided to NMFS.

SEA STAR WASTING DISEASE MONITORING

Sea stars along the northeast coast of the Pacific Ocean are dying in large numbers from a wasting disease possibly caused by a densovirus (Hewson et al. 2014). External signs of the disease include skin lesions, tissue decay surrounding the lesions which leads to limb loss, body fragmentation, and death (Appendix C1). Monitoring groups have documented wasting disease symptoms in numerous species (Appendix C2) geographically ranging from Baja California, Mexico to Kachemak Bay, Alaska. Most observations of the disease have been from shorebased investigators in intertidal areas or subtidal areas accessible to divers.

During the 2018 trawl survey, sea stars in the subsample will be examined for symptoms of wasting disease including:

1. Lesions;
2. Deflated appearance;
3. Extreme twisting of rays;
4. Arm loss; and
5. Disintegration (Appendix C1).

If symptomatic animals are observed, information will be recorded on the sea star wasting disease log (Appendix C3) and a photo will be taken. Haul number, species name, number of animals affected, and the file name of the photo will be recorded on the log. At the end of the survey the disease log and photos will be delivered to the lead trawl survey biologist. Observations will be reported to the Pacific Rocky Intertidal Monitoring group at http://www.eeb.ucsc.edu/pacificrockyintertidal/data-products/sea-star-wasting/. Photos will be sent to seastarwasting@googlegroups.com.

DATA FORM CUSTODY

The cruise leader will ensure all samples and data forms are completed and removed from the research vessel after each survey leg, including downloading electronically collected data to the vessel's dryhold computer and creating backup copies of all electronic data by copying to an external hard drive, USB flash drive, or other location. For projects continuing on to the next survey leg, data forms will be organized, labeled, and dried. Forms will be stored according to project and ordered sequentially by haul. Sampling logs will be completed and kept with data forms for reference. Data removed from the vessel will be taken directly to the lead trawl survey biologist.

PERSONNEL AND SURVEY SCHEDULE

R/V Resolution crew - Captain Denis Cox Jr., Kurt Pedersen, Gary Wilson

	Chiniak Bay *June 14 and 15*	*Marmot Bay* *June 19-June 23*	*Eastside Kodiak, and Alitak* *June 27-July 13*	*South Peninsula, Unalaska, and Chignik* *July 20-Aug 24*
Cruise Leader:	Kally Spalinger	Kally Spalinger	Michael Knutson	Kally Spalinger (First half) Natura Richardson (Second half)
Biological Crew:	Collin Hakkinen Sherry Barker Joy Brooks Michael Knutson Nat Nichols	Collin Hakkinen Sherry Barker Joy Brooks Michael Knutson Mark Stichert	Collin Hakkinen Sherry Barker Joy Brooks	Collin Hakkinen Sherry Barker Joy Brooks

	Westside Kodiak and Shelikof Strait *Sept 4-Sept 14*	*Chiniak Bay small-mesh* *Sept 19 and 20*
Cruise Leader:	Kally Spalinger	Kally Spalinger
Biological Crew:	Collin Hakkinen Sherry Barker Joy Brooks	Collin Hakkinen Sherry Barker Joy Brooks

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Hewson, I., J. B. Button, B. M. Gudenkauf, B. Miner, A. L. Newton, J. K. Gaydon, J. Wynne, C. L. Groves, G. Hendler, M. Murray, S. Fradkin, M. Breitbart, E. Fahsbender, K. D. Lafferty, A. M. Kilpatrick, C. M. Miner, P. Raimondi, L. Lahner, C. S. Friedman, S. Daniels, M. Haulena, J. Marliave, C. A. Burge, M. E. Eisenlord, and C. D. Harvell. 2014. Densovirus associated with sea-star wasting disease and mass mortality. Proceedings of the National Academy of Sciences 111(48): 17278–17283.

Jackson, D. R. 2003. Project operational plan: Small-mesh bottom trawl survey of shrimp and forage fishes: Kodiak, Chignik, and South Peninsula districts. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K03-47, Kodiak.

Spalinger, K. 2015. Operational plan: Large-mesh bottom trawl survey of crab and groundfish: Kodiak, Chignik, South Peninsula, and Eastern Aleutian management districts–standard protocol 2015–2019. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.4K.2015.20, Kodiak.

FIGURES

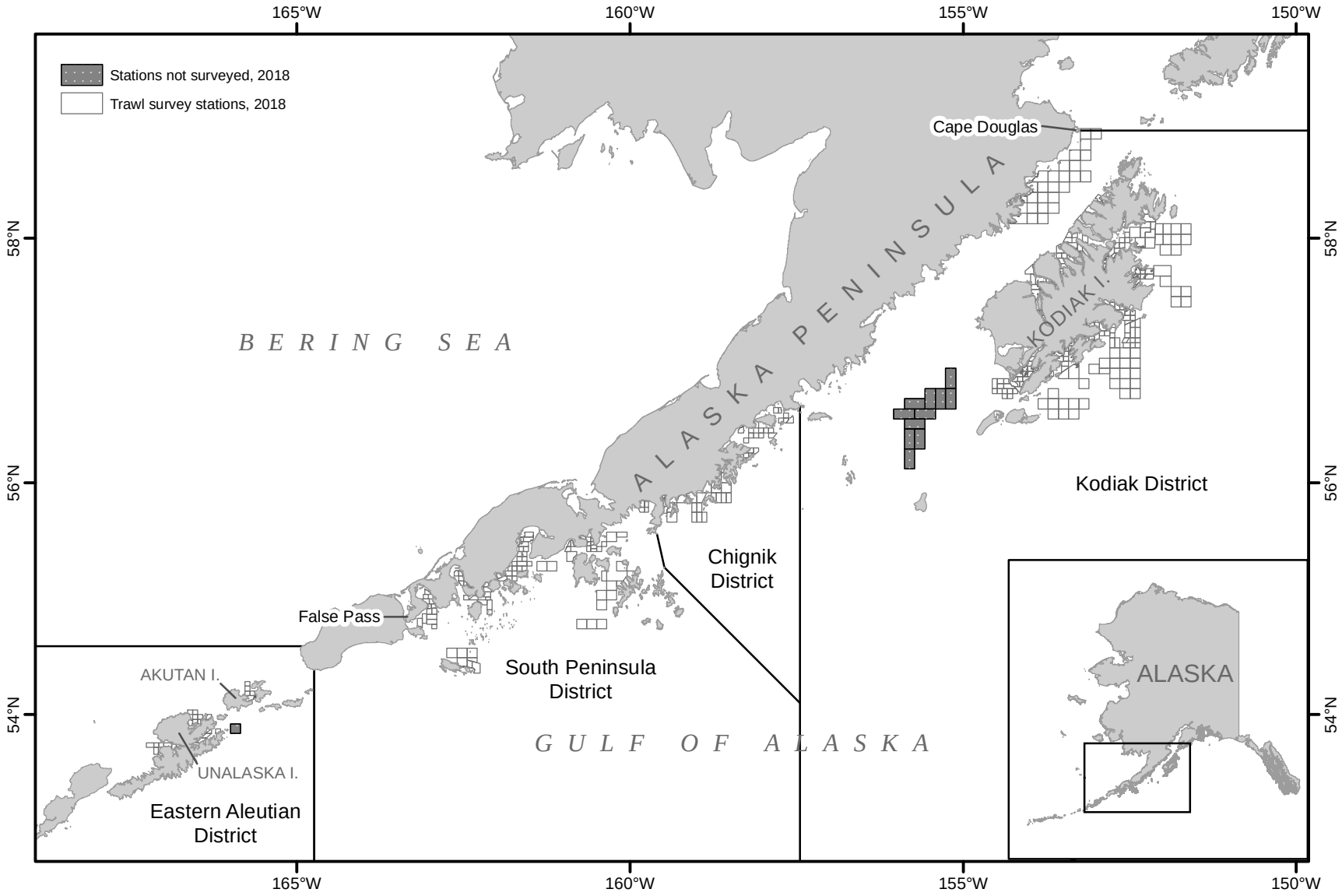


Figure 1.–Kodiak, Chignik, South Peninsula, and Eastern Aleutian districts large-mesh bottom trawl survey stations, 2018.

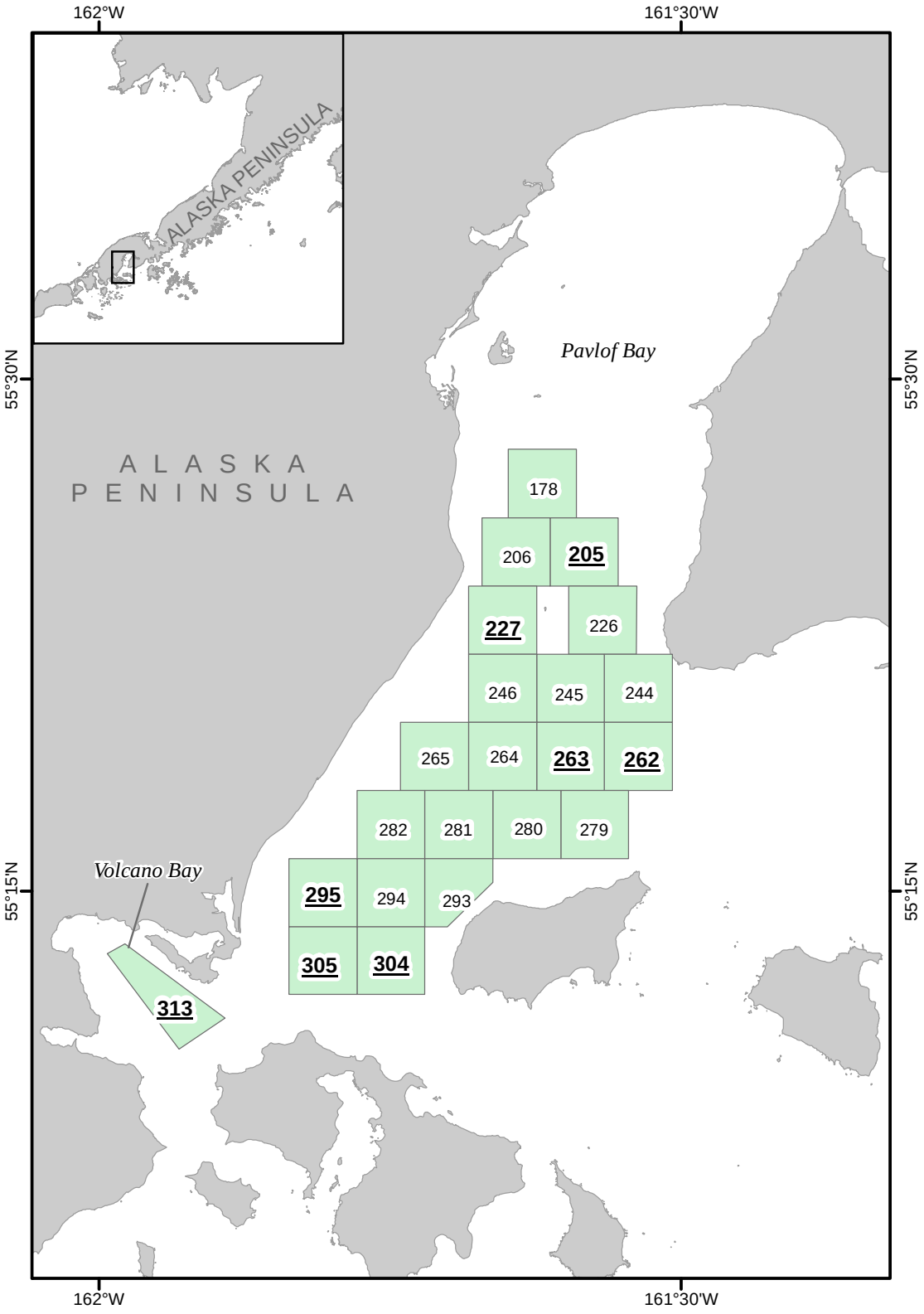


Figure 2.–Small-mesh trawl survey stations in Pavlof Bay. Stations in **bold** and underlined text will be towed in 2018.

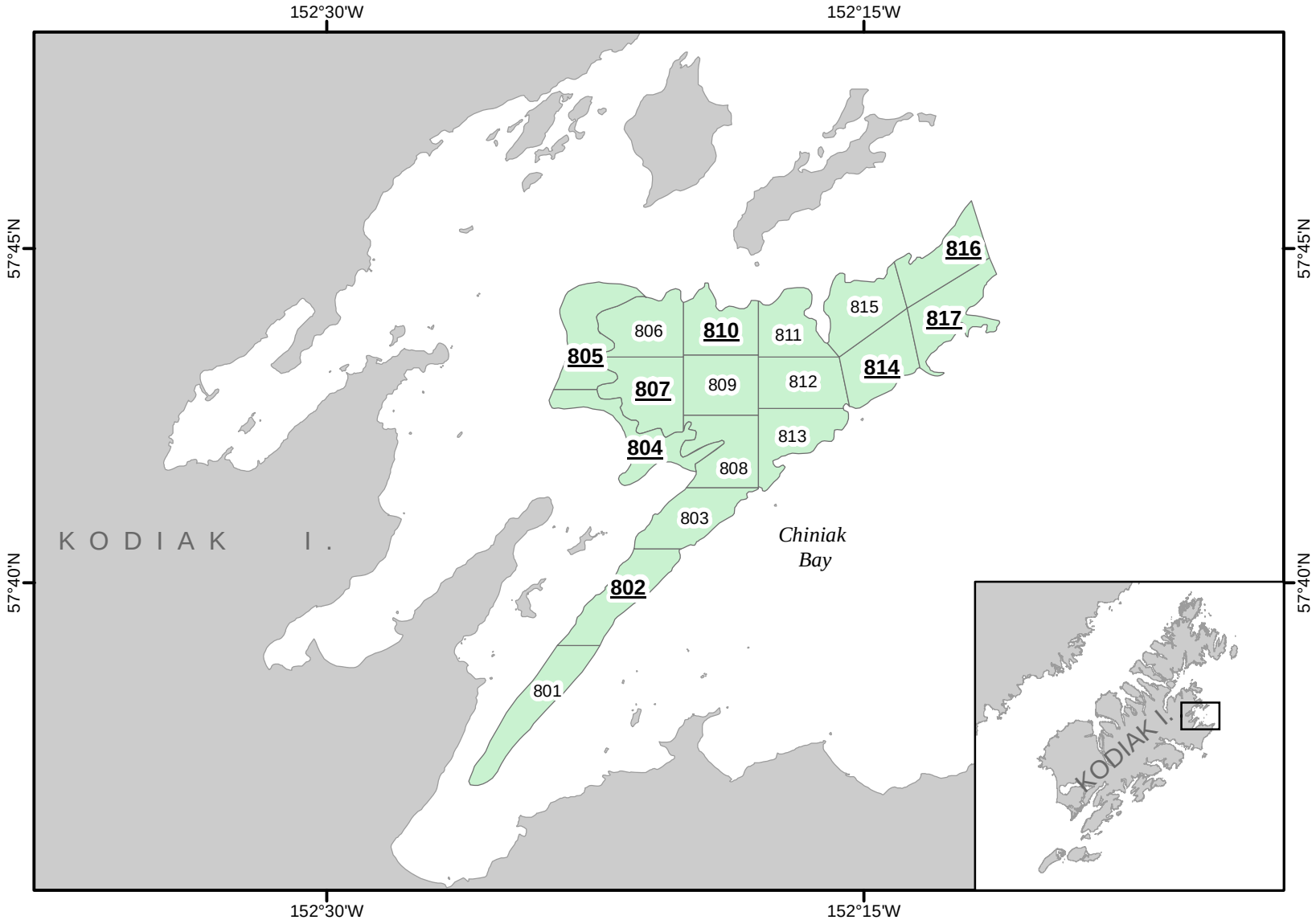


Figure 3.–Small-mesh trawl survey stations in Chiniak Bay. Stations in **bold** and underlined text will be towed in 2018.

APPENDIX A. SPECIAL PROJECT EQUIPMENT CHECKLIST

Appendix A1.–Special Project Equipment Checklist

Pavlof/Chiniak small-mesh hauls

- Small-mesh trawl nets (2)
- Marel M60 platform scale
- 1-gallon Ziploc bags
- 1-quart Ziploc bags
- Small-mesh on-deck forms
- Electronic shrimp measurement database
- Digital camera

Walleye pollock otolith collection

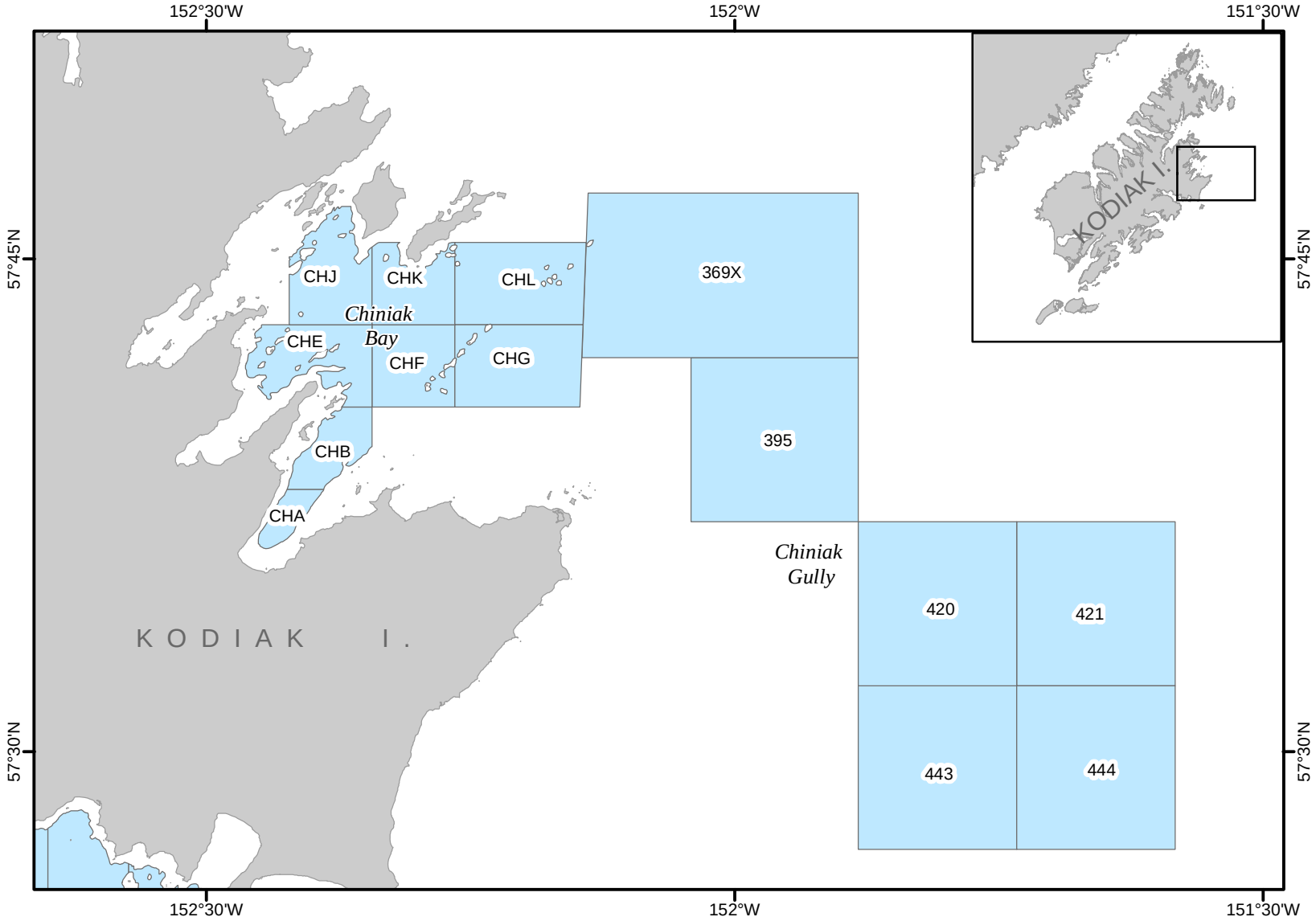
- Otolith vials containing specimen number
- Electronic data recording forms
- Hard-copy specimen forms
- Victorinox knives
- Forceps

Sea star wasting disease monitoring

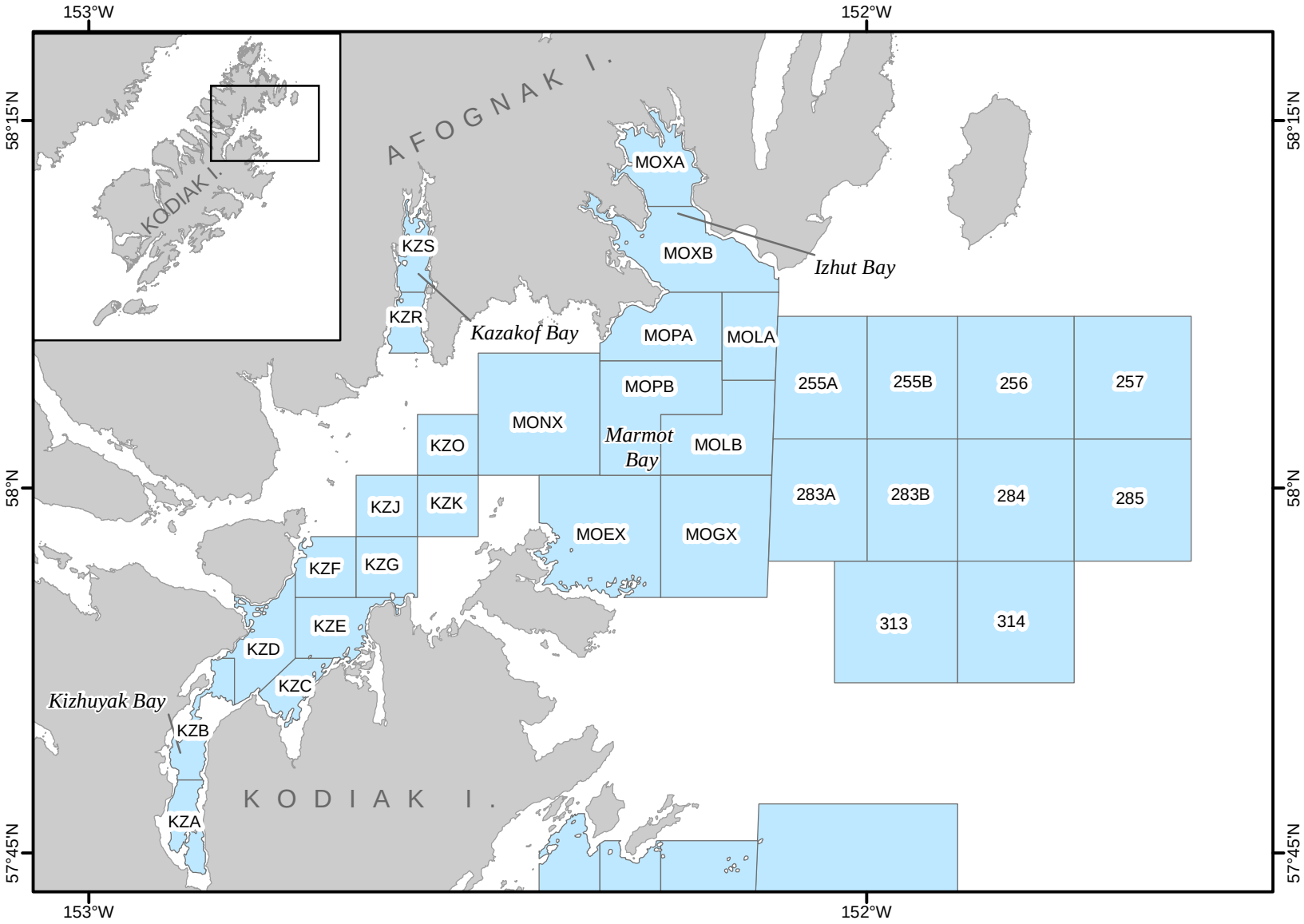
- Sea star wasting disease log
- Digital camera

APPENDIX B. TRAWL SURVEY STATION MAPS

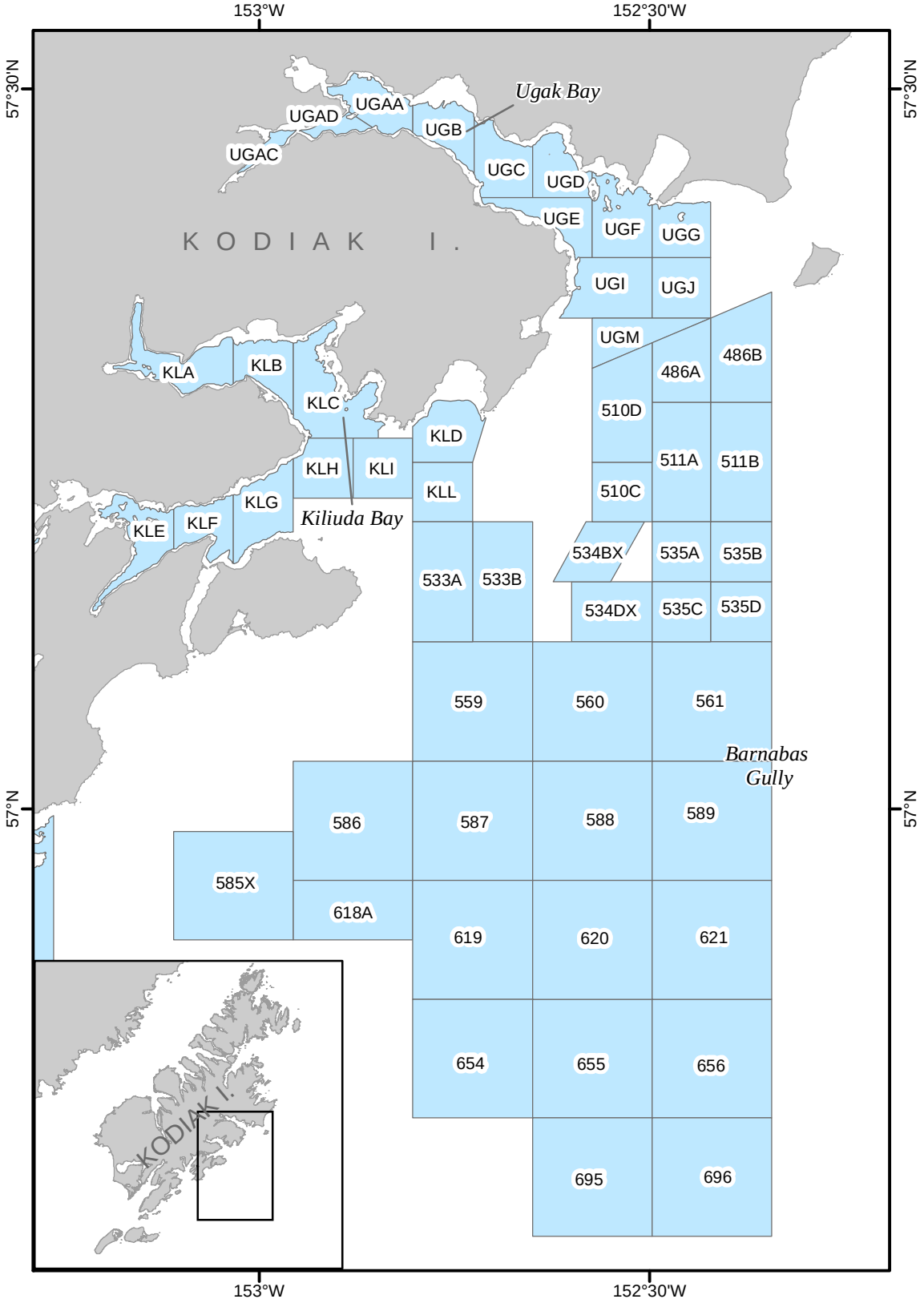
Appendix B1.–Station boundaries and names, Chiniak Bay and Chiniak Gully, 2018 Kodiak District trawl survey.



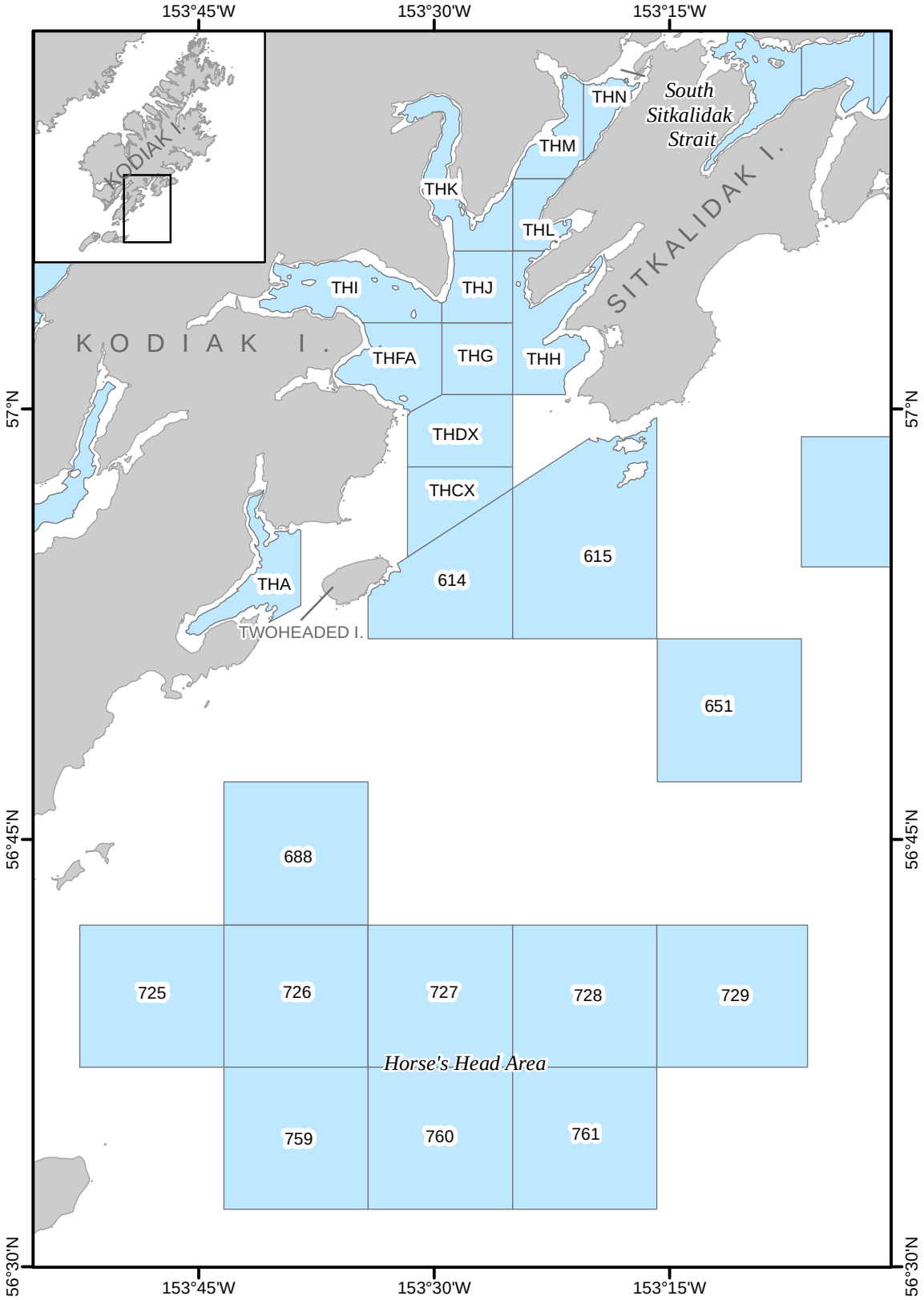
Appendix B2.–Station boundaries and names, Izhut, Kazakof, Kizhuyak, and Marmot bays, 2018 Kodiak District trawl survey.



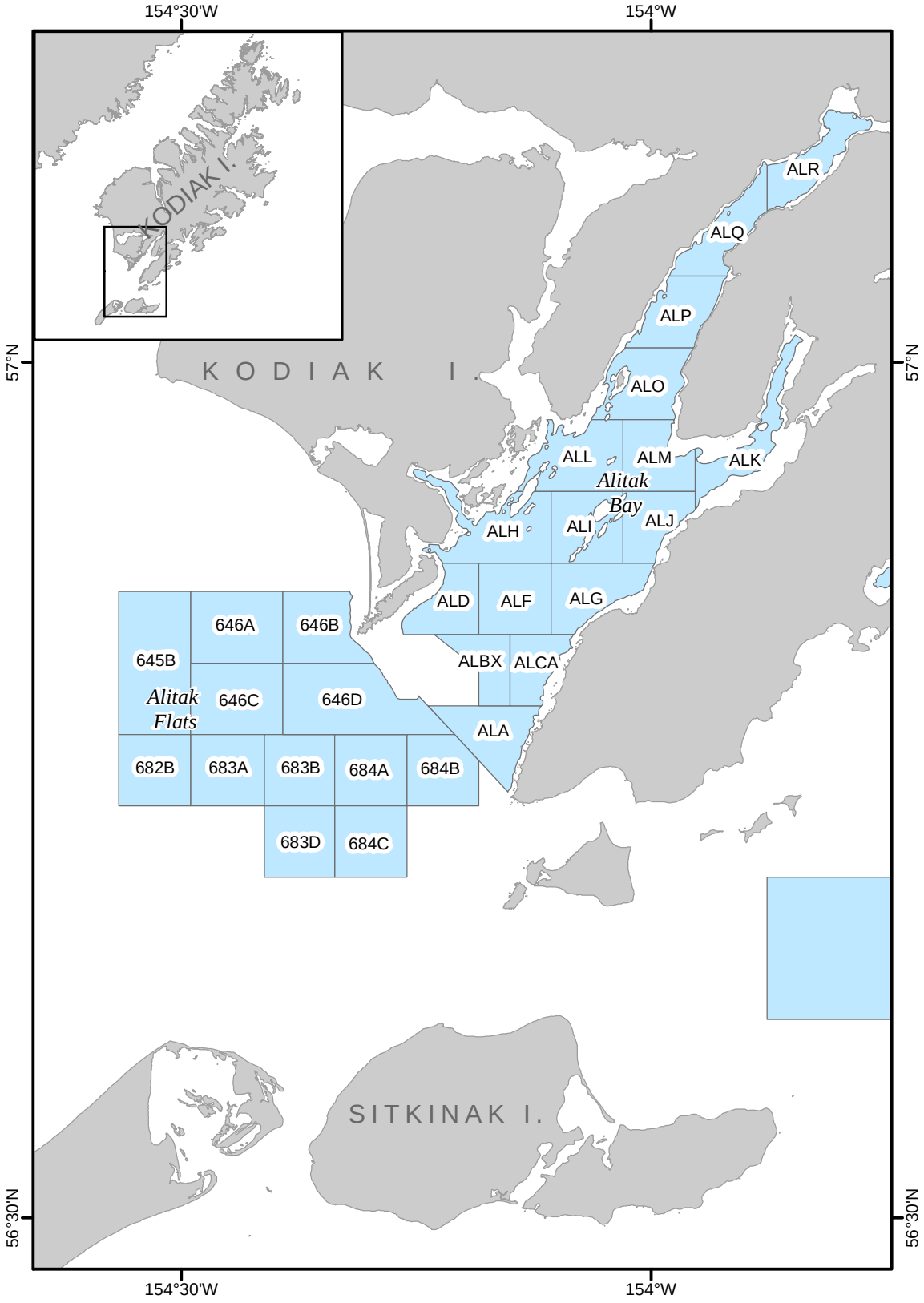
Appendix B3.–Station boundaries and names, Ugak Bay, Kiliuda Bay, and Barnabas Gully, 2018 Kodiak District trawl survey.



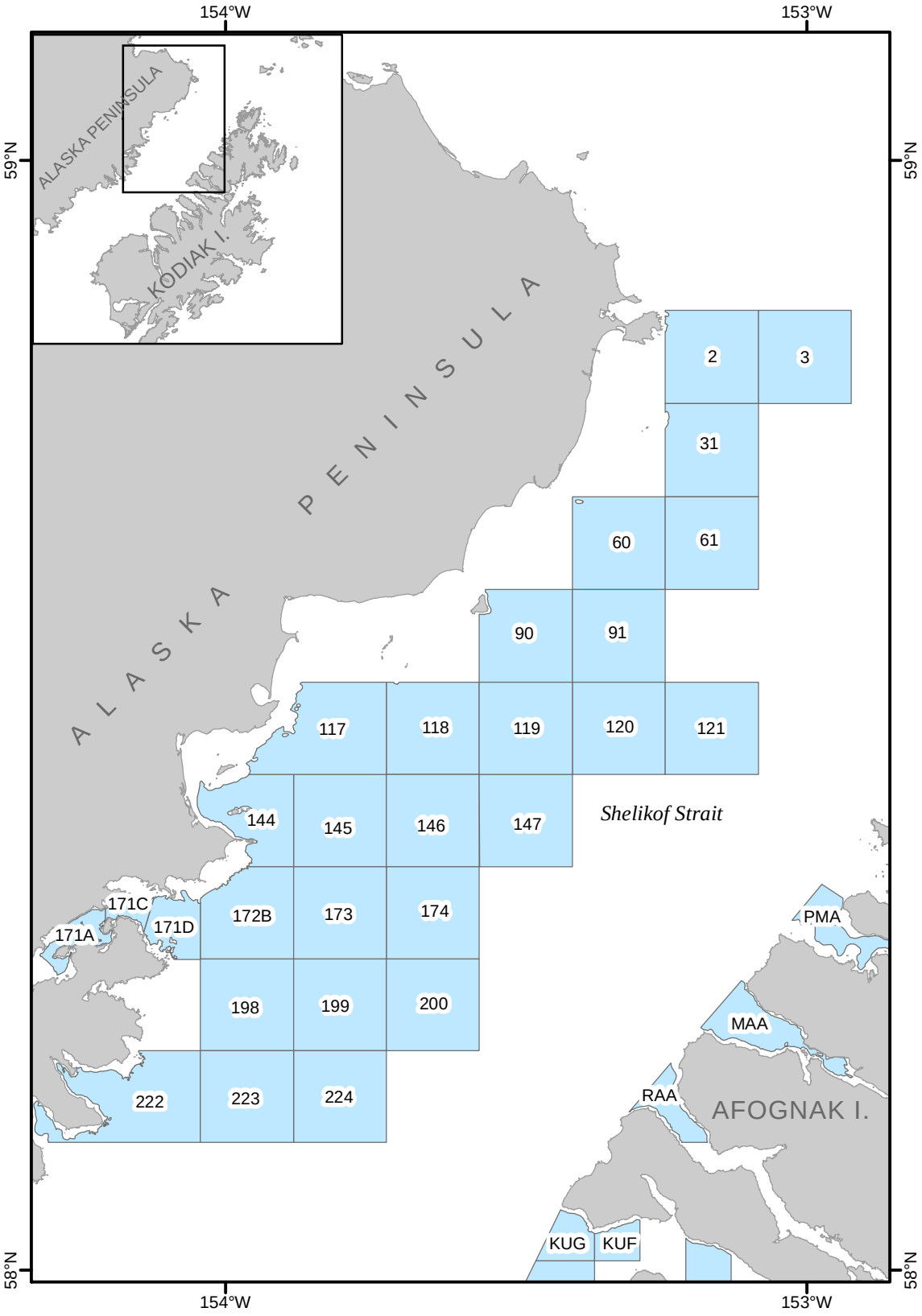
Appendix B4.–Station boundaries and names, South Sitkalidak Strait, Twoheaded Island, and Horse's Head area, 2018 Kodiak District trawl survey.



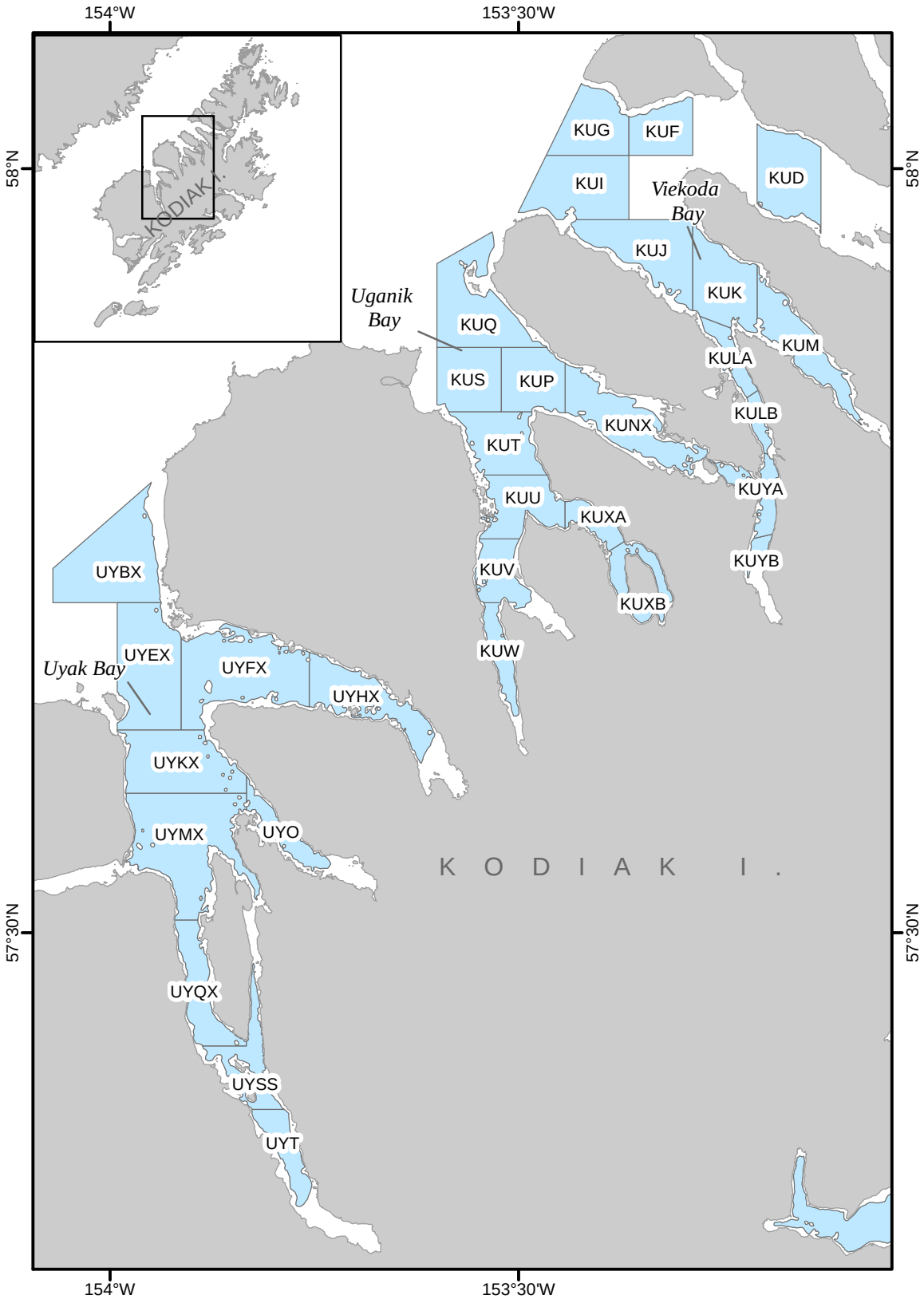
Appendix B5.–Station boundaries and names, Alitak Bay and Alitak Flats, 2018 Kodiak District trawl survey.



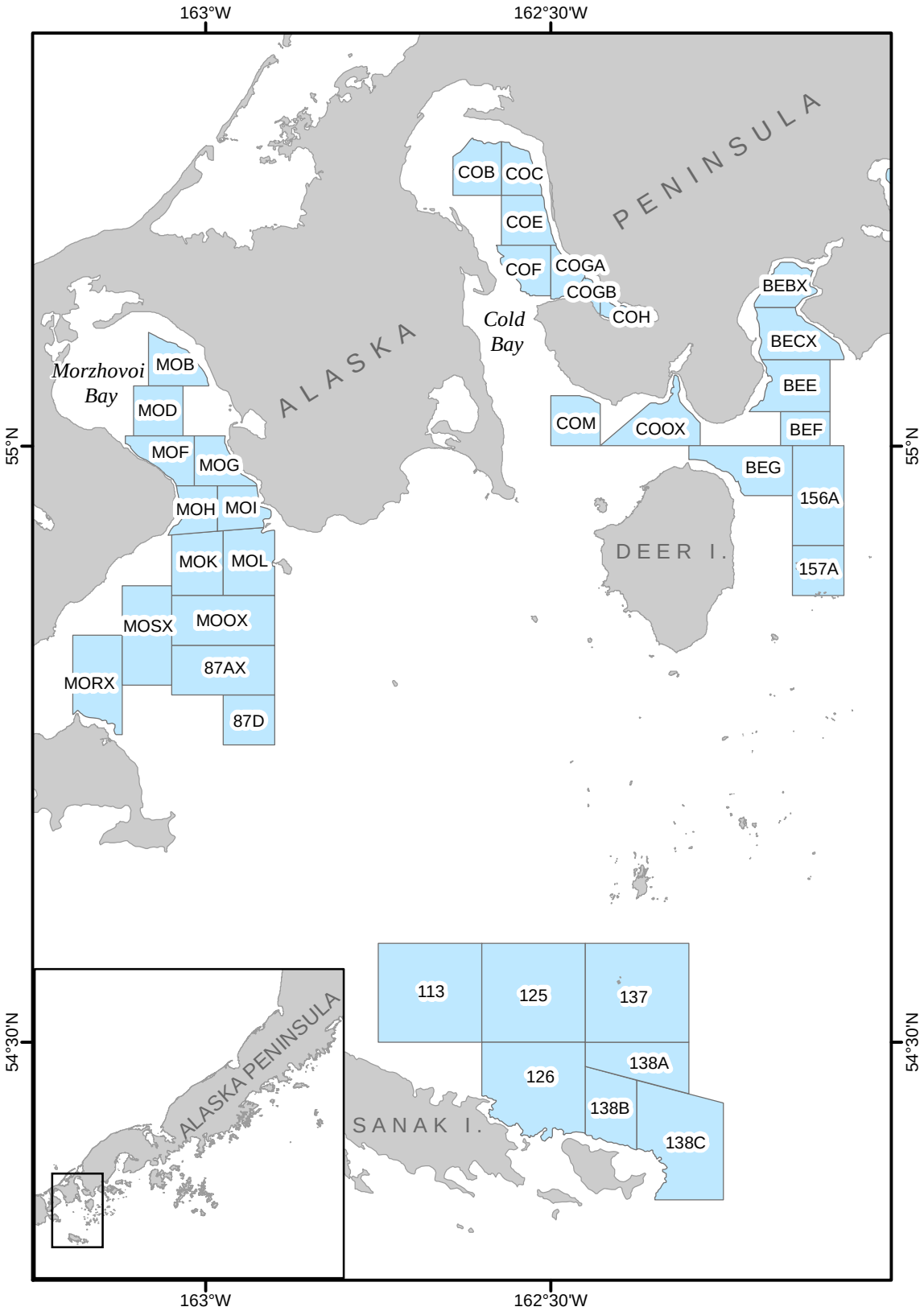
Appendix B6.–Station boundaries and names, Shelikof Strait and Afognak Island, 2018 Kodiak District trawl survey.



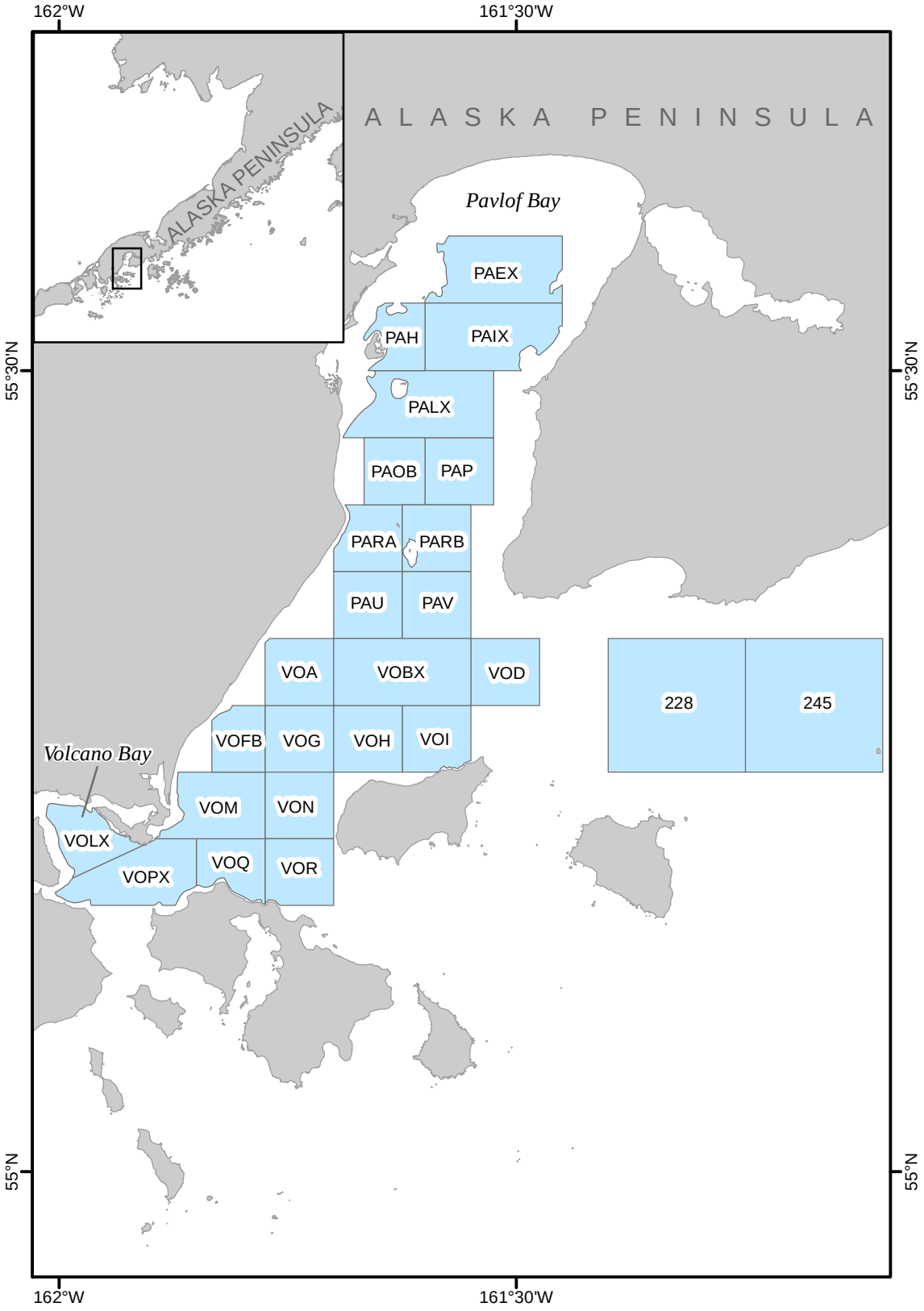
Appendix B7.–Station boundaries and names, Uyak, Uganik, and Viekoda bays, 2018 Kodiak District trawl survey.



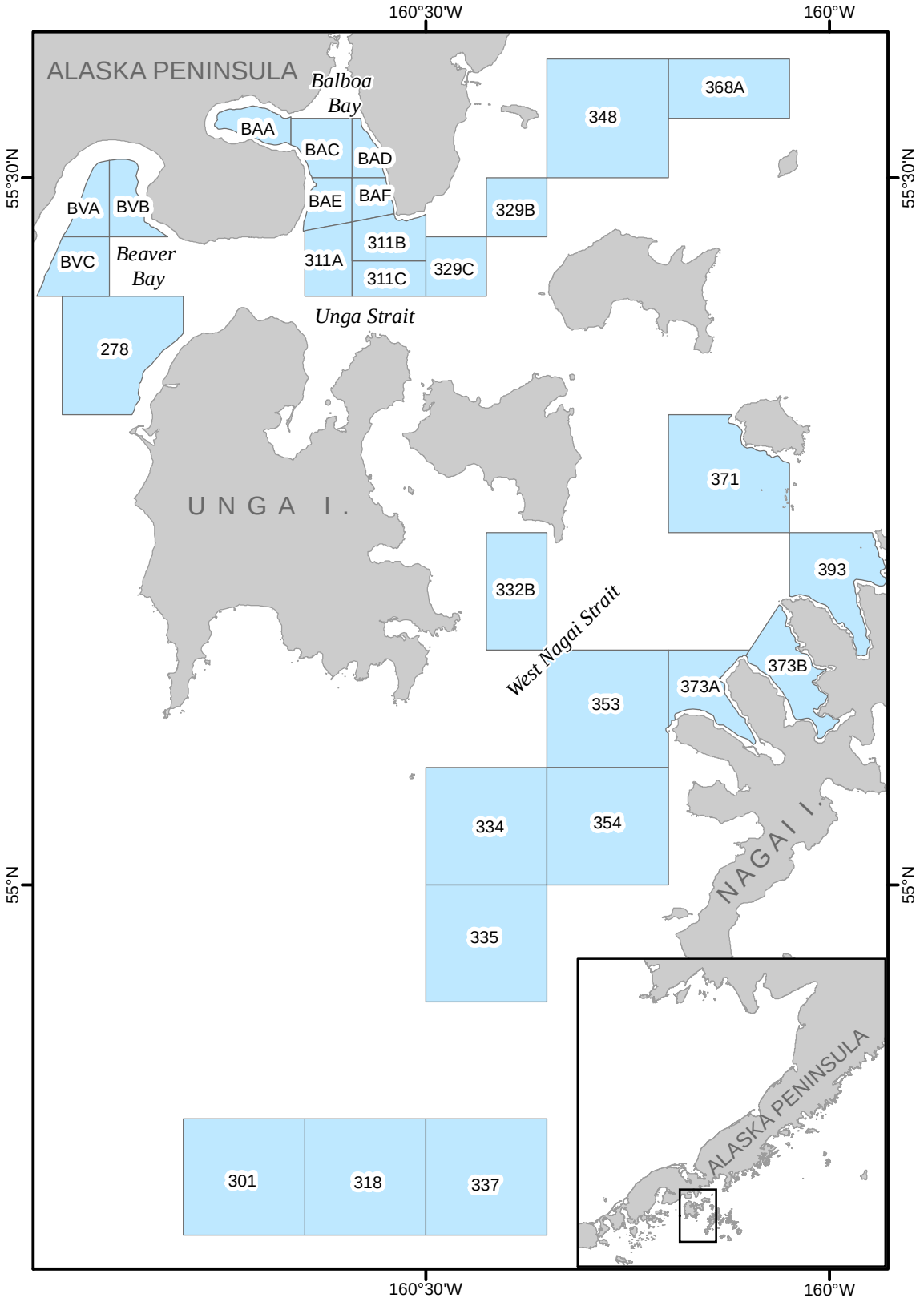
Appendix B8.–Station boundaries and names, Morzhovoi Bay, Cold Bay, Deer Island, and Sanak Island, 2018 South Peninsula District trawl survey.



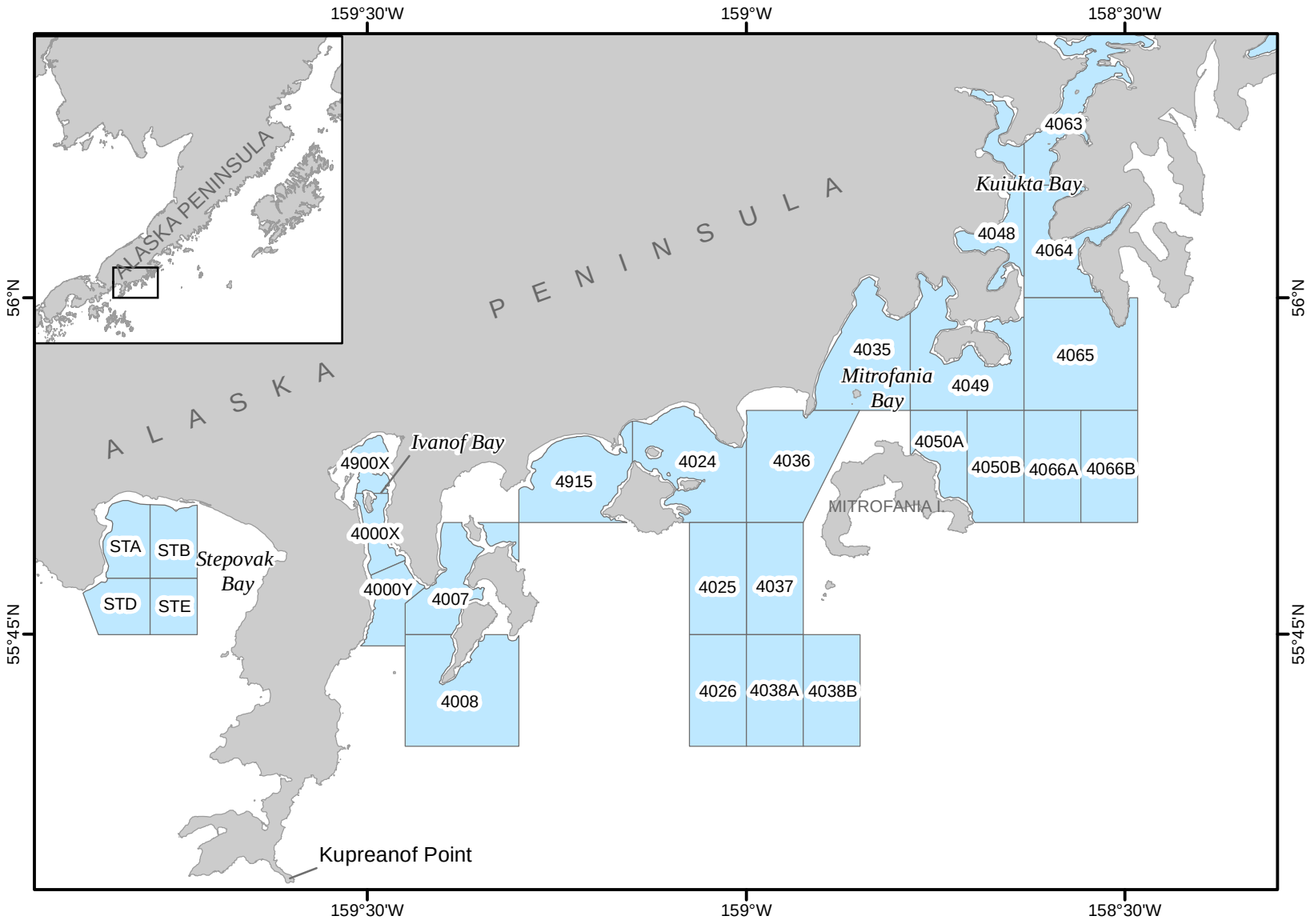
Appendix B9.–Station boundaries and names, Pavlof and Volcano bays, 2018 South Peninsula District trawl survey.



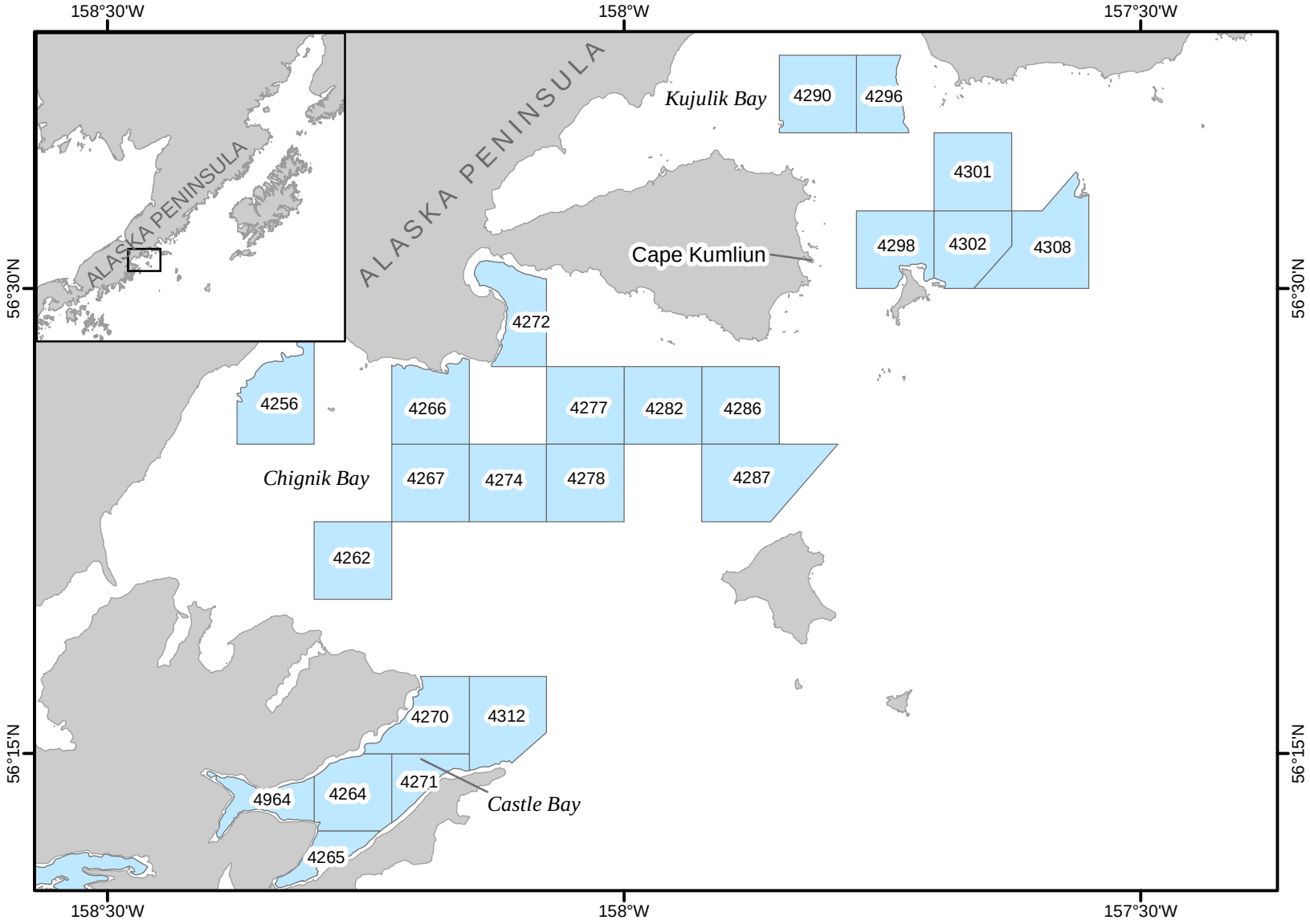
Appendix B10.–Station boundaries and names, Unga Strait, Beaver Bay, Balboa Bay, and West Nagai Strait, 2018 South Peninsula District trawl survey.



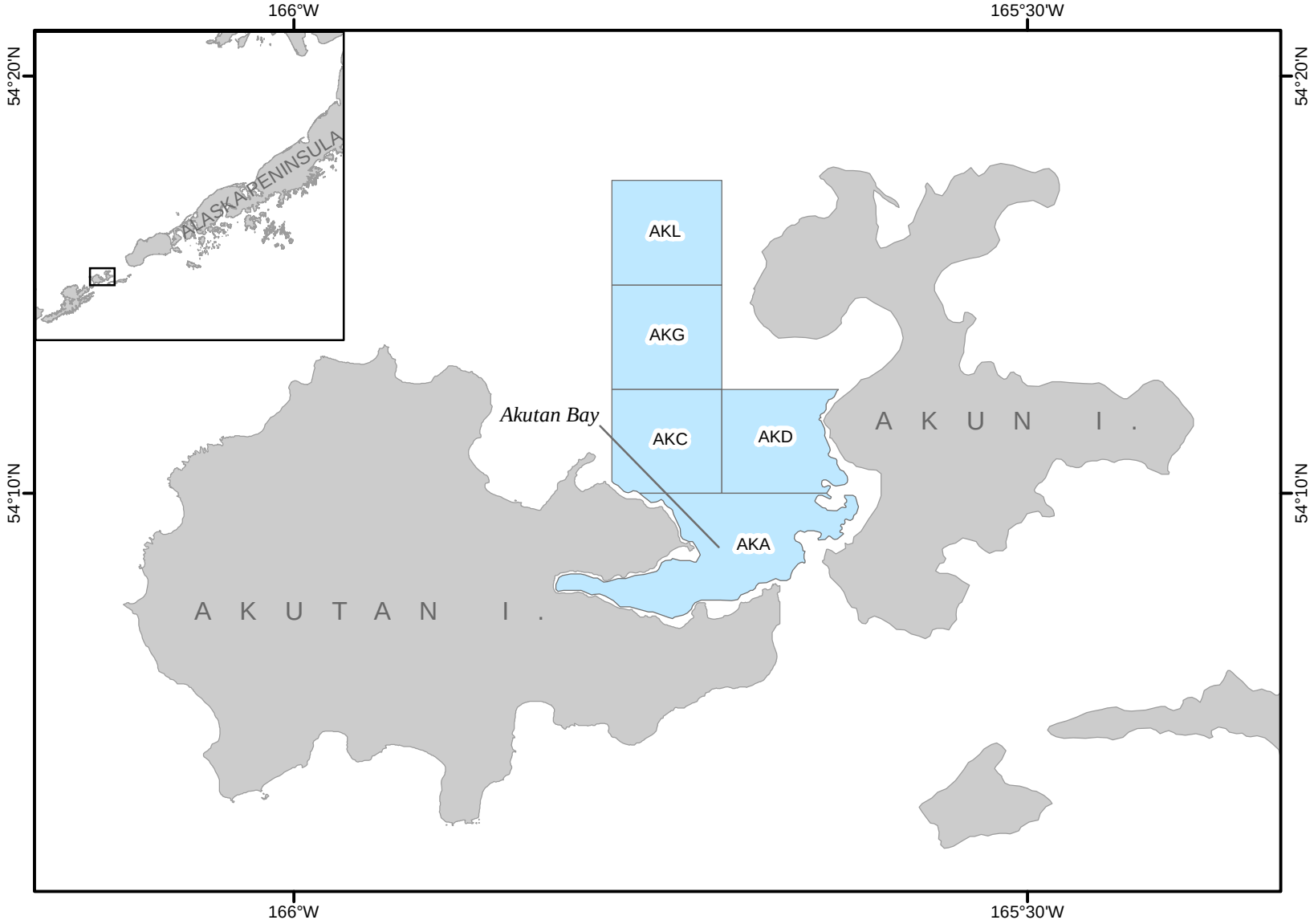
Appendix B11.–Station boundaries and names, Stepovak, Ivanof, Mitrofania, and Kuiukta bays, 2018 South Peninsula and Chignik District trawl surveys.



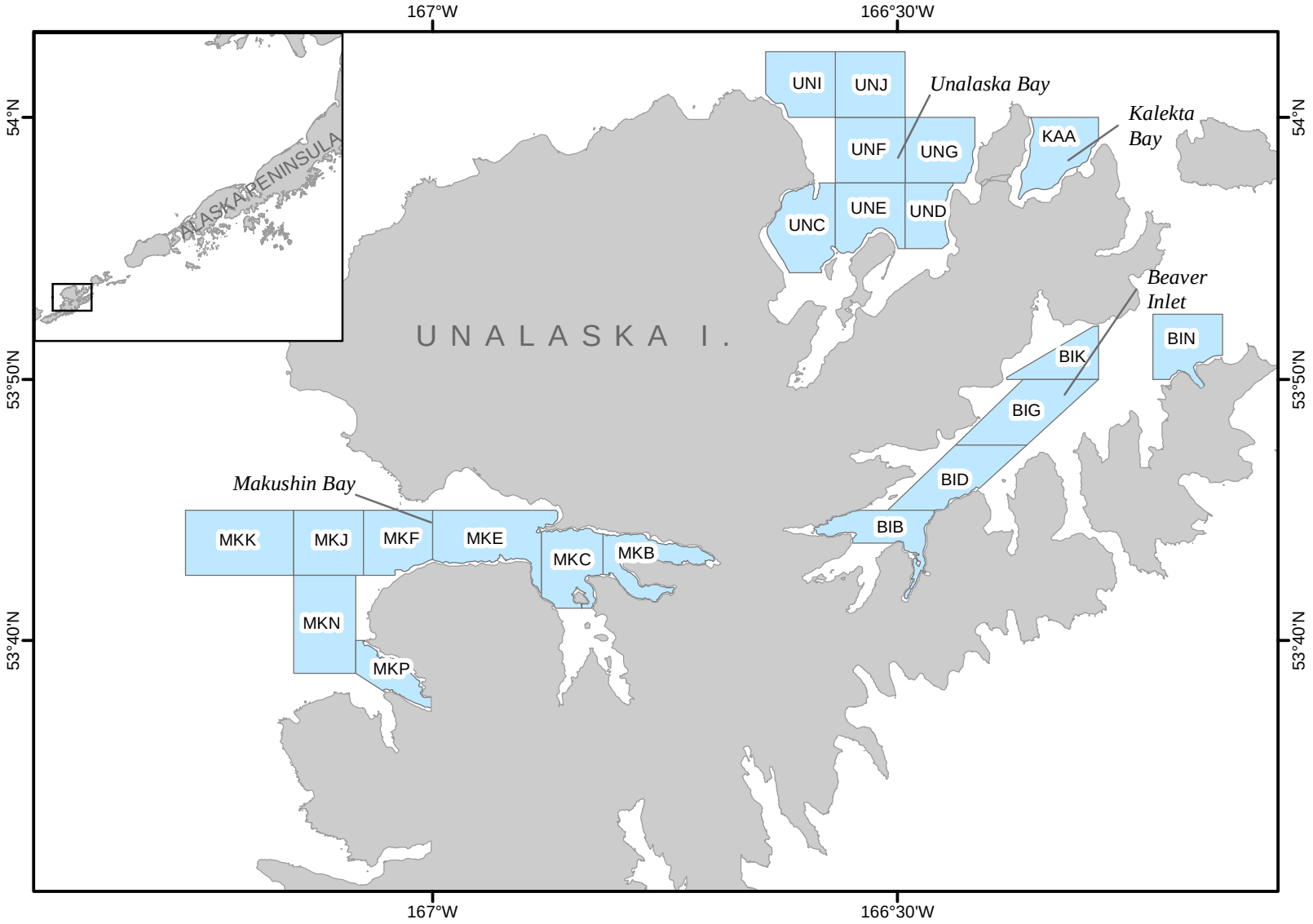
Appendix B12.–Station boundaries and names, Kujulik, Chignik, and Castle bays, 2018 Chignik District trawl survey.



Appendix B13.–Station boundaries and names, Akutan Bay, 2018 Eastern Aleutian District trawl survey.



Appendix B14.–Station boundaries and names, Makushin, Unalaska, and Kalekta bays and Beaver Inlet, 2018 Eastern Aleutian District trawl survey.



APPENDIX C. SEA STAR WASTING DISEASE MONITORING

Appendix C1.–Examples of “mild” and “severe” wasting/injury likely due to sea star wasting disease.

Examples of “mild” and “severe” wasting/injury likely due to sea star wasting syndrome

Note: The following photos are intended to be used as a guide for identifying signs of wasting across many species of sea stars. Sea stars respond to many types of stress in a similar manner, so the tissue degradation and injuries shown in these photos may not be due to sea star wasting syndrome. However, all photos are from areas where SSWS was prevalent and thus likely responsible for the conditions shown.

Pisaster ochraceus

Mild Photo: Kayla Balmer

Photos: Melissa Miner

Severe Photo: John Ugerotz

-continued-

Evasterias troschelii

Mild

Photo:
Mark Nayer

Photos:
Jan Kocian

Severe

Photos: Jeff Harris

Examples of Mild and Severe Disease
Last updated 2014-12-11

pacificrockyintertidal.org
seastarwasting.org

Pycnopodia helianthoides

Mild

Note emaciated
appearance

Severe

Photos: Mark Nayer

-continued-

Pisaster giganteus

Mild

Severe

Photos: Leanne Foster

Examples of Mild and Severe Disease
Last updated 2014-12-11

pacificrockyintertidal.org
seastarwasting.org

Pisaster brevispinus

Mild

Photos:
Mark Nayer

Severe

Photos:
Ken Bondy

-continued-

Examples of Mild and Severe Disease
Last updated 2014-12-11

pacificrockyintertidal.org
seastarwasting.org

Dermasterias imbricata

Mild

Photos:
Mark Nayer

Severe

Photo:
Ethan Flanagan

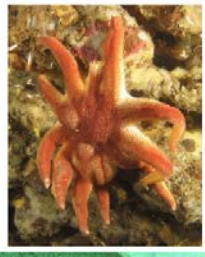
Photo:
Nate Fletcher

Examples of Mild and Severe Disease
Last updated 2014-12-11

pacificrockyintertidal.org
seastarwasting.org

Solaster spp.

Mild



Photos:
Mark
Nayer

Severe

Photo: Mark Nayer

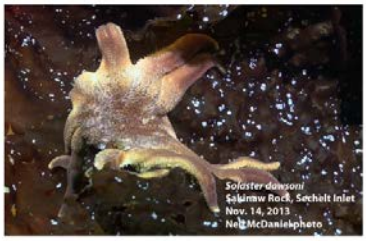


Photo: Neil McDaniel

-continued-

Orthasterias koehleri

Mild

Photos: Feiro Marine Life Center

Severe

No photo available

Leptasterias spp

Mild

Photo: Steve Fradkin

Severe

Photos: Melissa Miner

-continued-

Patiria (Asterina) miniata

Mild

- No photo available

Severe

Photo: Ryan Berger

Pteraster spp.

Mild

Photo: Mark Nayer

Severe

Photo: Jackie Hildering

-continued-

Crossaster papposus

mild

severe

Photos: Neil McDaniel

Henricia spp.

Mild

Photo: Linda Larsen

Note tissue degradation on single (uppermost) arm. Lighter patches on central disk are normal coloration pattern for this species of Henricia

Severe

Photo: Wendy Steffensen

-continued-

Appendix C2.–Sea Star Species affected by wasting disease.

Sea Star Species Affected by Wasting Syndrome:

(updated 8/23/16)

High Mortality

Solaster dawsoni (morning sun star)
Evasterias troschelii (mottled star)
Pisaster brevispinus (giant pink star)
Pisaster ochraceus (ochre/purple star)
Pycnopodia helianthoides (sunflower star)

Some Mortality

Patiria (Asterina) miniata (bat star)
Dermasterias imbricata (leather star)
Solaster stimpsoni (striped sun star)
Orthasterias koehleri (rainbow star)
Pisaster giganteus (giant star)
Henricia spp. (blood star)
Leptasterias spp (six-armed star)
Luidia foliolata (sand star)

Likely affected, mortality level not well documented

Astropecten spp. (sand star)
Mediaster aequalis (vermilion star)
Linckia columbiae (fragile star)
Pteraster tesselatus (slime star)
Pteraster militaris (wrinkled star)
Lophaster furcilliger vexator (crested star)
Crossaster papposus (rose star)
Astrometis sertulifera (fragile rainbow star)
Stylasterias forreri (velcro star)

Appendix C3.–Sea Star Wasting Disease log.

Sea Star Wasting Disease Log				
Haul	Species	Number affected	Photograph taken?	Photo name