

Appendix I Metadata ArcGIS

METADATA TABLE					
Map Name	Format	Scale/Resolution	Source/Owner	Description	Date
Base map (Base layers used to create all maps)					
CAFF_Boundary	Polygon	1:100.000.000	CAFF	The Arctic as defined by CAFF	2009
Country_In	Polyline	1:50.000.000	ESRI Data & Maps	Generalized boundaries of the world's countries	2008
Only_Oceans	Polygon	-	Olson & Dinerstein	World oceans from The Global 200: Priority eco-regions for global conservation	2010
Base map Arctic area					
World Major Rivers	Polygon	1:15.000.000	ESRI Data & Maps	Major rivers including names	2010
Bathy_Ocean	Raster	Cell size, 1 arc-minute	Blijleven & van Dijk	Bathymetry of Arctic waters	2011
Bathy_Land	Raster	Cell size, 1 arc-minute	Blijleven & van Dijk	Bathymetry of Arctic land	2011
Sub-populations	Polygon	-	Kasser & Wiedmer	Walrus sub-population range	2011
Atlantic Walrus distribution					
JPG's Distribution - Summer distribution East Greenland - Summer distribution North Water - Summer distribution Norway Russia - Summer distribution Canada - West Greenland - Winter distribution East Greenland - Winter distribution North Water - Winter distribution Norway Russia - Winter Distribution Atlantic Walrus Canada - West Greenland		-	Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995	Maps of sub-species summer and winter distribution	
JPG's Haul-outs - Haul-outs - Fox Basin - Haul-outs - Hudson Bay - Haul-outs - Baffin Island - Haul-outs - Devon Island - Haul-outs - Newfoundland		-	Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995	Maps of terrestrial haul-out sites	

- Haul-outs - East Greenland - Haul-outs - West Greenland - Haul-outs - West Greenland II - Haul-outs - Franz Joseph Land - Haul-outs - Spitsbergen I - Haul-outs - Spitsbergen II - Haul-outs - West Russia			Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Born <i>et al.</i> , 1995 Norwegian Polar Institute 1995 Norwegian Polar Institute 1995 Gavrilo, 2011		
AtlanticWalrus_Winter	Polygon	-	Kasser & Wiedmer	Atlantic Walrus winter distribution	2011
AtlanticWalrus_Summer	Polygon	-	Kasser & Wiedmer	Atlantic Walrus summer distribution	2011
AtlanticWalrus_Haulouts	Point	-	Kasser & Wiedmer	Current Atlantic Walrus haul-outs	2011
AtlanticWalrus_Haulouts_Historic	Point	-	Kasser & Wiedmer	Unconfirmed Atlantic Walrus haul-outs	2011
AtlanticWalrus_Haulouts_Abandoned	Point	-	Kasser & Wiedmer	Abandoned Atlantic Walrus haul-outs	2011
AtlanticWalrus_Migration	Polyline	-	Kasser & Wiedmer	Approximate migration movements	2011
MAMMARINE	Polygon	1:1.000.000	IUCN	Distribution maps of the IUCN Red List of Threatened Species	2009
IUCN_AtlanticWalrus_Select	Polygon	-	IUCN	Sub-species range selected from MAMMARINE	2009
AtlanticWalrus_Islands_Clip	Polygon	-	Kasser & Wiedmer	Islands within sub-species summer and winter range	2011
Pacific Walrus Distribution					
JPG - Pacific Walrus Distribution and Haul-outs		-	Smith 2010	Map of sub-species summer and winter distribution, breeding areas and terrestrial haul-out sites	
PacificWalrus_Winter	Polygon	-	Kasser & Wiedmer	Pacific Walrus winter distribution	2011
PacificWalrus_Summer	Polygon	-	Kasser & Wiedmer	Pacific Walrus summer distribution	2011
PacificWalrus_Haulout_Male	Point	-	Kasser & Wiedmer	Haul-outs populated by Pacific Walrus Males during summer	2011
PacificWalrus_Haulout_Mix	Point	-	Kasser & Wiedmer	Haul-outs mainly populated by Pacific Walrus females and calves during summer and fall	2011
PacificWalrus_Migration	Polyline	-	Kasser & Wiedmer	Approximate migration movements September/December	2011
PacificWalrus_MigrationII	Polyline	-	Kasser & Wiedmer	Approximate migration movements May/June	2011
PacificWalrus_Breeding	Polygon	-	Kasser & Wiedmer	Approximate Pacific Walrus breeding areas	2011
MAMMARINE	Polygon	1:1.000.000	IUCN	Distribution maps of the IUCN Red List of Threatened Species	2009
IUCN_PacificWalrus_Select	Polygon	-	IUCN	Sub-species range selected from MAMMARINE	2009
PacificWalrus_Islands_Clip	Polygon	-	Kasser & Wiedmer	Islands within sub-species summer and winter range	2011
Laptev Walrus Distribution					
JPG - Laptev Walrus - Haul-outs		-	Gavrilo, 2011	Map of sub-species terrestrial haul-out sites	

LaptevWalrus_Haulouts	Point	-	Kasser & Wiedmer	Laptev Walrus haul-outs	2011
MAMMARINE	Polygon	1:1.000.000	IUCN	Distribution maps of the IUCN Red List of Threatened Species	2009
IUCN_LaptevWalrus_Select	Polygon	-	IUCN	Sub-species range selected from MAMMARINE	2009
Rivers	Polyline	1:15.000.000	ESRI Data & Maps	Major rivers including names	2010
Atlantic Walrus Distribution, Oil & Gas and Shipping (Based on Atlantic Walrus distribution)					
Export2_Oil_50100_AW_Select	Polygon	-	Kasser & Wiedmer	Prospective oil and gas areas overlapping Atlantic Walrus range	2012
ProspectiveOilGasII_New_AW	Polygon	-	Kasser & Wiedmer	Prospective oil and gas areas overlapping Atlantic Walrus range	2011
Arctic_Shipping_NWP*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northwest passage shipping route	2011
Arctic_Shipping_NEP*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northeast passage shipping route	2011
Arctic_Shipping_NSR*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northern sea route	2011
Pacific Walrus Distribution, Oil & Gas and Shipping (Based on Pacific Walrus distribution)					
Export2_Oil_50100_PW	Polygon	-	Kasser & Wiedmer	Prospective oil and gas areas overlapping Pacific Walrus range	2012
ProspectiveOilGasII_New_PW	Polygon	-	Kasser & Wiedmer	Prospective oil and gas areas overlapping Pacific Walrus range	2011
Arctic_Shipping_NWP*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northwest passage shipping route	2011
Arctic_Shipping_NSR*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northern sea route	2011
Laptev Walrus Distribution, Oil & Gas and Shipping (Based on Laptev Walrus distribution)					
Export2_Oil_50100_LW	Polygon	-	Kasser & Wiedmer	Prospective oil and gas areas overlapping Laptev Walrus range	2012
Arctic_Shipping_NSR*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northern sea route	2011
Atlantic Walrus Critical Areas (Based on Atlantic Walrus Distribution, Oil & Gas and Shipping)					
Export2_Oil_50100_AW	Polygon	-	Kasser & Wiedmer	Indicates prospective oil and gas areas in Atlantic Walrus range	2011
IUCN_AtlanticWalrus_InterII	Polygon	-	Kasser & Wiedmer	Indicates prospective oil and gas areas in Atlantic Walrus range	2011
Export2_Oil_50100_AW_Winter	Polygon	-	Kasser & Wiedmer	Indicates prospective oil and gas areas in Atlantic Walrus range	2011
AtlanticWalrus_Haulouts_B	Polygon	-	Kasser & Wiedmer	Indicates Walrus sensitivity when hauled-out	2011
AtlanticWalrus_Haulouts_HisB	Polygon	-	Kasser & Wiedmer	Indicates Walrus sensitivity when hauled-out	2011
Pacific Walrus Critical Areas (Based on Pacific Walrus Distribution, Oil & Gas and Shipping)					
IUCN_PacificWalrus_Intersect	Polygon	-	Kasser & Wiedmer	Indicates Prospective oil and gas areas in Pacific Walrus range	2011
IUCN_PacificWalrus_InterII	Polygon	-	Kasser & Wiedmer	Indicates Prospective oil and gas areas in Pacific Walrus range	2011
PacificWalrus_Haulout_Male_B3	Polygon	-	Kasser & Wiedmer	Indicates Walrus sensitivity when hauled-out	2011
PacificWalrus_Haulout_Mix_B1	Polygon	-	Kasser & Wiedmer	Indicates Walrus sensitivity when hauled-out	2011

Laptev Walrus Critical Areas					
(Based on Laptev Walrus Distribution, Oil & Gas and Shipping)					
IUCN_LaptevWalrus_Intersect	Polygon	-	Kasser & Wiedmer	Indicates Prospective oil and gas areas in Pacific Walrus range	2011
LaptevWalrus_Haulouts_B	Polygon	-	Kasser & Wiedmer	Indicates Walrus sensitivity when hauled-out	2011
Sub-species** maximum foraging depth and haul-outs					
World_Continents	Polygon	-	ESRI Data & Maps	World Country Boundaries	2005
Bathy_oc_ext	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Exportation of bottom relief layer in Pacific Walrus habitat	2011
Bathy_oc_2	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Exportation of bottom relief layer in Atlantic Walrus habitat	2011
Bathy_oc_3	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Exportation of bottom relief layer in Laptev Walrus habitat	2011
contour_bathy_o4	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Contour line indicating the maximum foraging depth for Pacific Walrus	2011
contour_bathy_o2	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Contour line indicating the maximum foraging depth for Atlantic Walrus	2011
contour_bathy_o3	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Contour line indicating the maximum foraging depth for Laptev Walrus	2011
Arctic shipping & Walrus distribution					
(Distribution as shown on sub-species** distribution maps)					
Arctic_Shipping_NWP*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northwest passage shipping route	2011
Arctic_Shipping_NEP*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northeast passage shipping route	2011
Arctic_Shipping_NSR*	Polyline	-	Kasser & Wiedmer	Approximate course of the Northern sea route	2011
Arctic_Shipping_High*	Polygon	-	Kasser & Wiedmer	Areas with a high shipping density in Walrus habitat	2011
Prospective Arctic oil and gas areas & Walrus distribution					
(Distribution as shown on sub-species** distribution maps)					
Cara_au	Polygon	-	USGS	The Circum-Arctic geologic provinces as defined by the U.S. Geological survey	2008
Export2_Oil_50100	Polygon	-	Kasser&Wiedmer	50-100% change of large oil deposits, selected from Cara_au, based on .jpg image OilPotential.	2012
Prospectivebesidesin	Polygon	-	Blijleven & van Dijk	Potential prospective oil and gas areas in the Arctic	2010
OilProduction	Point	-	Blijleven & van Dijk	Operating oil platforms	2010
GasProduction	Point	-	Blijleven & van Dijk	Operating Gas platforms	2010
OilPotential	.jpg	-	Bird et al.	Derived from Bird et al., 2008	2008

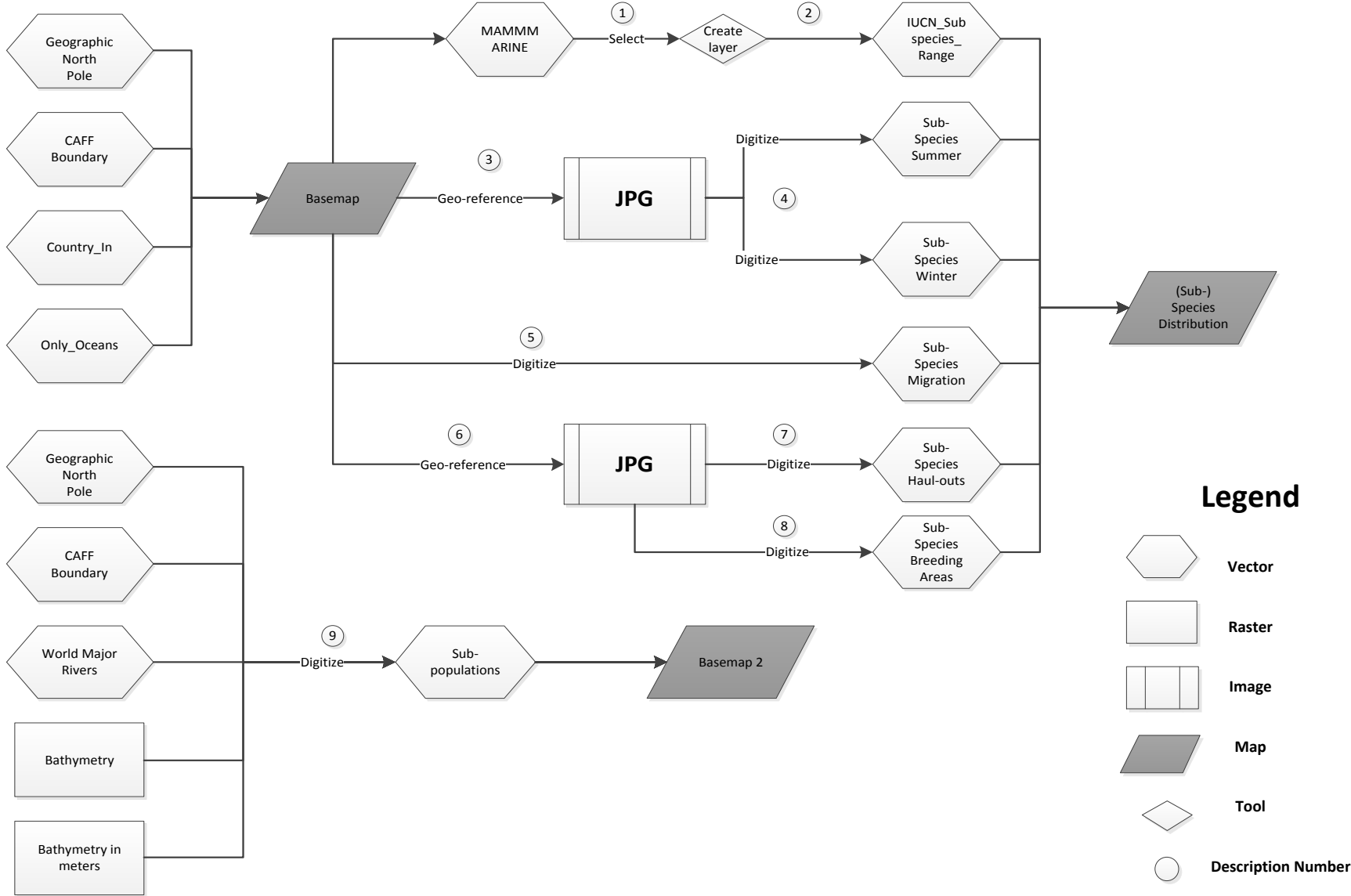
Ice extent difference 1979-2007 & Walrus distribution (Distribution as shown on sub-species** distribution maps)					
Ice_Extent_1979_03_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover March 1979	2009
Ice_Extent_2007_09_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover September 2007	2009
Ice_Extent_Islands_Clip	Polygon	-	Kasser & Wiedmer	Islands within Arctic ice cover	2011
Pacific Walrus distribution and sea-ice cover 1979 (Haul-outs as shown on Pacific Walrus distribution map)					
World_Continents	Polygon	-	ESRI Data & Maps	World Country Boundaries	2005
Extent_N_197909_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover September 1979	2009
Extent_N_197907_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover July 1979	2009
Extent_N_197905_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover May 1979	2009
Extent_N_197903_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover March 1979	2009
contour_bathy_o4	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Contour line indicating the maximum foraging depth for Pacific Walrus	2011
Bathy_ocean2	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Bathymetry of Arctic waters in Pacific Walrus range	2011
Pacific Walrus distribution and sea-ice cover 2007 (Haul-outs as shown on Pacific Walrus distribution map)					
World_Continents	Polygon	-	ESRI Data & Maps	World Country Boundaries	2005
Extent_N_200709_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover September 2007	2009
Extent_N_200707_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover July 2007	2009
Extent_N_200705_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover May 2007	2009
Extent_N_200703_Polygon	Polygon	-	Fetterer <i>et al.</i> ,	Arctic ice cover March 2007	2009
contour_bathy_o4	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Contour line indicating the maximum foraging depth for Pacific Walrus	2011
Bathy_ocean2	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Bathymetry of Arctic waters in Pacific Walrus range	2011
Benthic Biomass in Pacific Walrus habitat (Haul-outs as shown on Pacific Walrus distribution map)					
World_Continents	Polygon	-	ESRI Data & Maps	World Country Boundaries	2005
contour_bathy_o4	Raster	Cell size, 1 arc-minute	Kasser & Wiedmer	Contour line indicating the maximum foraging depth for Pacific Walrus	2011
Idw_bbm5	Raster	Cell size 1 arc-minute	Kasser & Wiedmer	An Invested Distance Weight (IDW) interpolation was made based on a benthic database provided by Audubon Alaska	2011
Arctic protected areas as defined by CAFF & Walrus distribution (Distribution as shown on sub-species** distribution maps)					
CAFF_Arctic_Protected_Areas	Polygon	-	USFWS	Protected areas in the Arctic as recognized by CAFF	

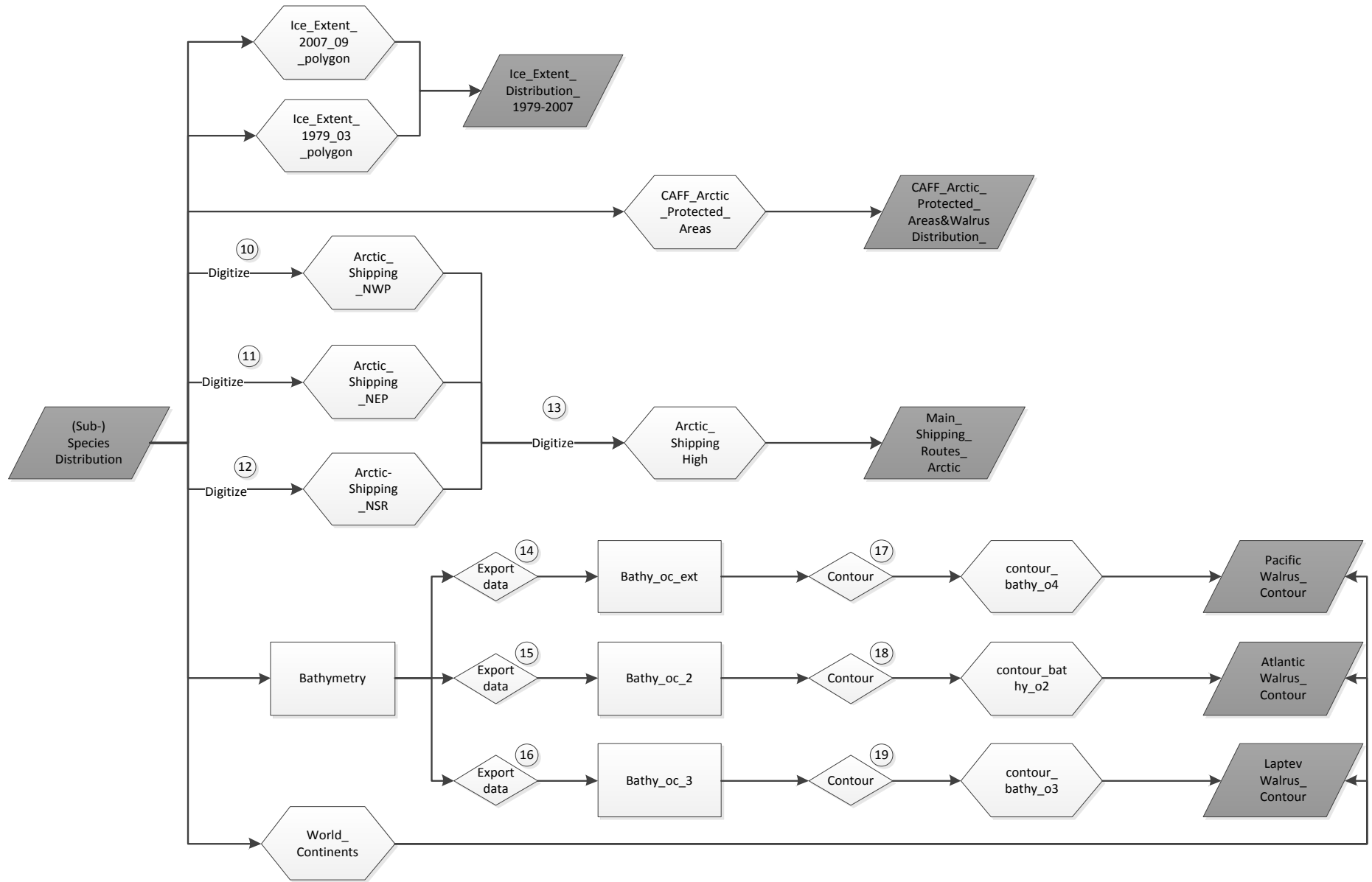
- **AMSA** (2009) Arctic Marine Shipping Assessment
- **Bird, K.J., Charpentier, R.R., Gautier, D.L., Houseknecht, D.W., Klett, T.R., Pitman, J.K., Moore, T.E., Schenk, C.J., Tennyson, M.E., Wandrey, C.J.** (2008) *Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle* U.S. Geological Survey, Central Energy Resources Team, Denver Colorado.
- **Blijleven en van Dijk** (2011) Bathymetry of Arctic waters, personal data exchange
- **Blijleven en van Dijk** (2011) Bathymetry of Arctic Land, personal data exchange
- **Blijleven en van Dijk** (2011) Potential prospective oil and gas areas in the Arctic, personal data exchange
- **Blijleven en van Dijk** (2011) Operating oil platforms, personal data exchange
- **Blijleven en van Dijk** (2011) Operating Gas platforms, personal data exchange
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- **CAFF** (2009) CAFF Boundary, Conservation of Arctic Flora & Fauna, Arctic Council Working Group, October 2009.
- **ESRI** (2008), *Country Boundaries (generalized)* ESRI Data & Maps 9.3.
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- **Fetterer, F., Knowles, K., Meier, W., and Savoie, M.** (2002 updated 2010) Sea Ice Index, Boulder, Colorado USA: National Snow and Ice Data Center, Digital Media.
- **Gavrilo M.V.** (2011), Russia: Arctic & Antarctic Research Institute, St. Petersburg.
- **IUCN** (2009) Digital Distribution Maps of The IUCN Red List of Threatened Species, IUCN Red List of Threatened Species. Version 2009.1
- **Norwegian polar Institute** (1995). Available on:
[http://zope.data.npolar.no/svalbard/metaSearch/select_index_html7_script?metadata_id=543 /](http://zope.data.npolar.no/svalbard/metaSearch/select_index_html7_script?metadata_id=543/)
http://eivind.npolar.no/Geocortex/Essentials/Web/viewer.aspx?Site=svbk_v01_no. Accessed on 18 November 2011
- **Olson, D. M. and E. Dinerstein.** The Global 200: Priority ecoregions for global conservation. (PDF file) *Annals of the Missouri Botanical Garden* 89:125-126 USGS (2008) Maps showing geology, oil and gas fields, and geologic provinces of the Arctic, U.S. Geological Survey, Central Energy Resources Team.
- **Smith** (2010) Audubon Alaska, <http://ak.audubon.org/special-reports-and-publications>, accessed on 20th October 2011
- **USWFS** (undated) Protected areas in the Arctic as recognized by CAFF

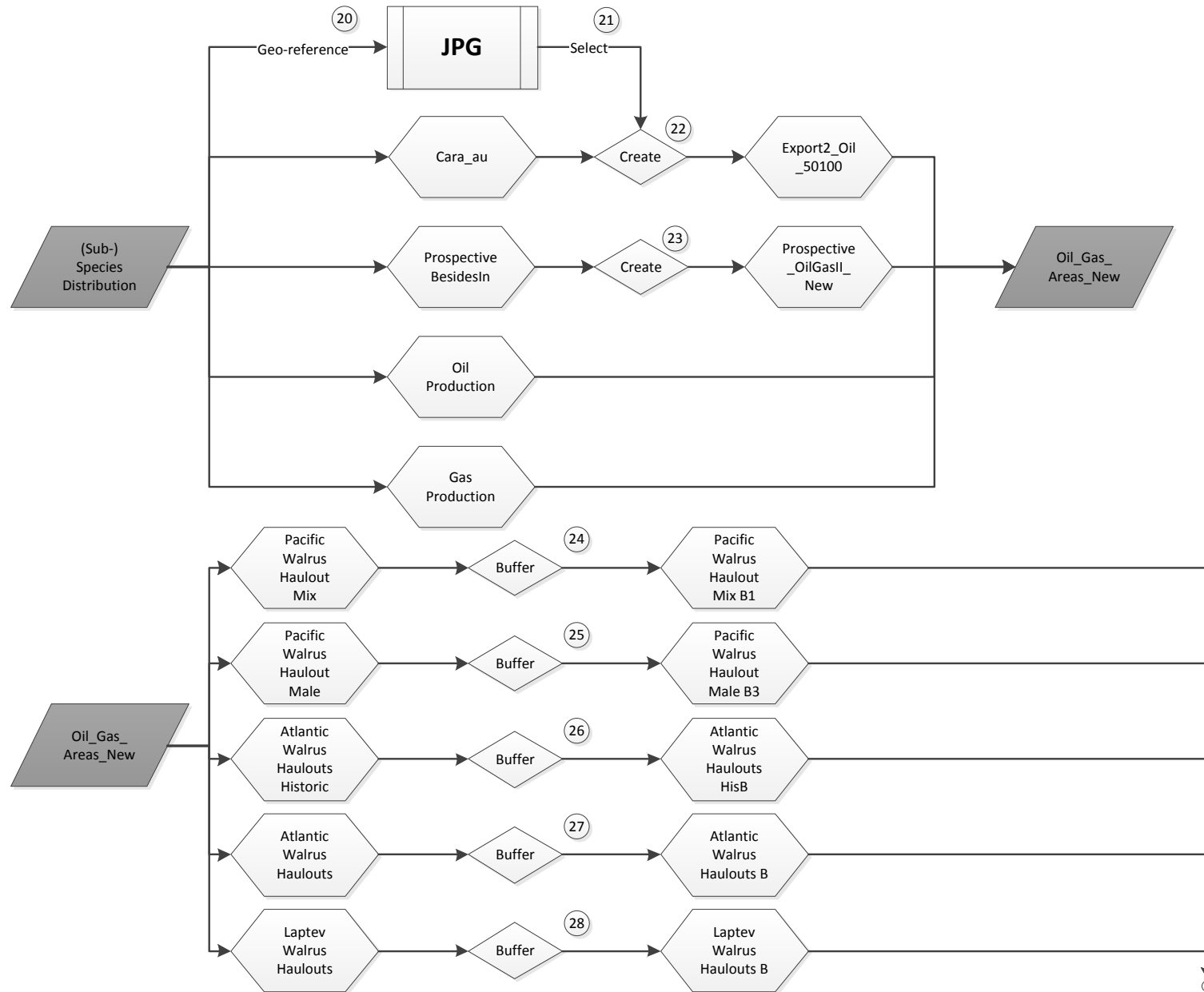
* Based on maps displayed in the AMSA (check) and considered variable depending on sea-ice extent

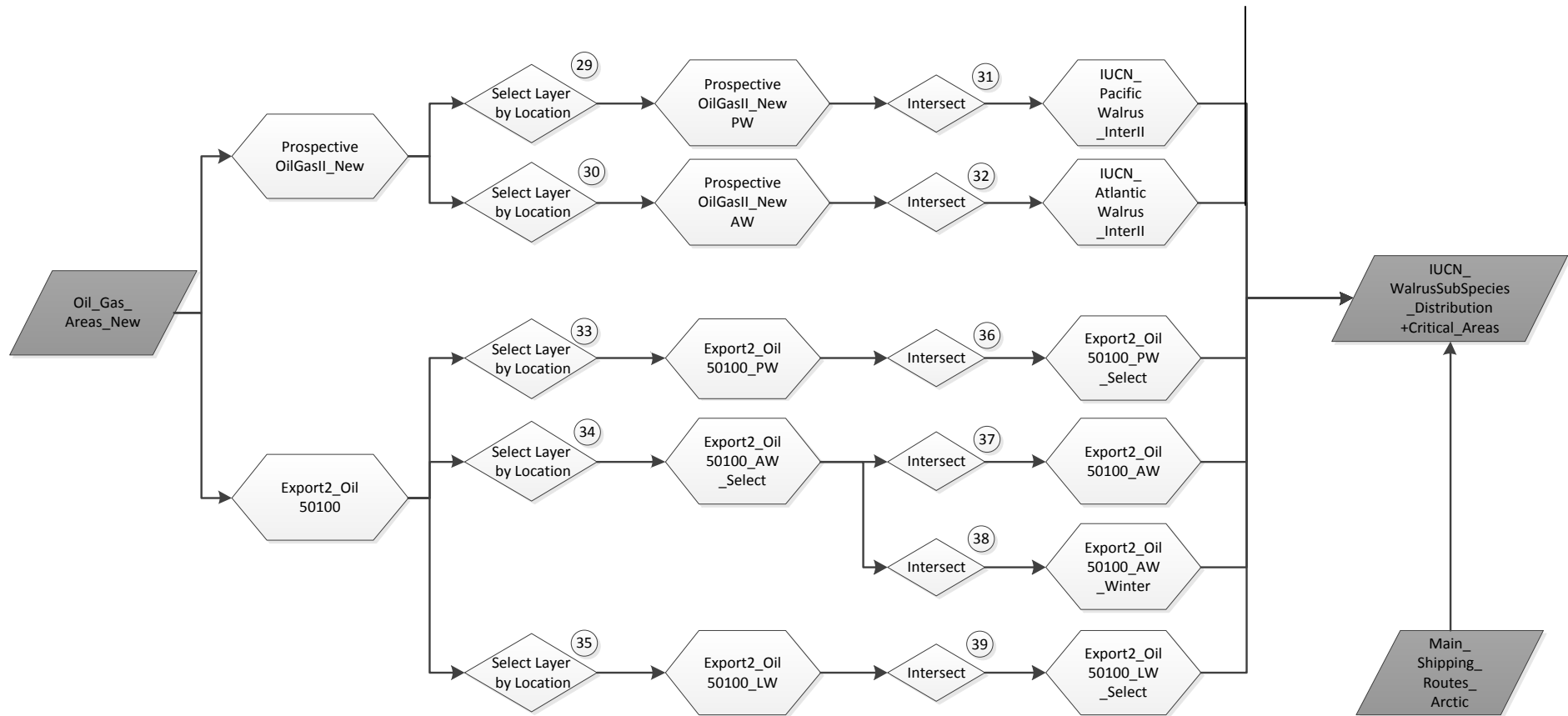
** Sub-species can be replaced with Atlantic Walrus, Pacific Walrus and Laptev Walrus

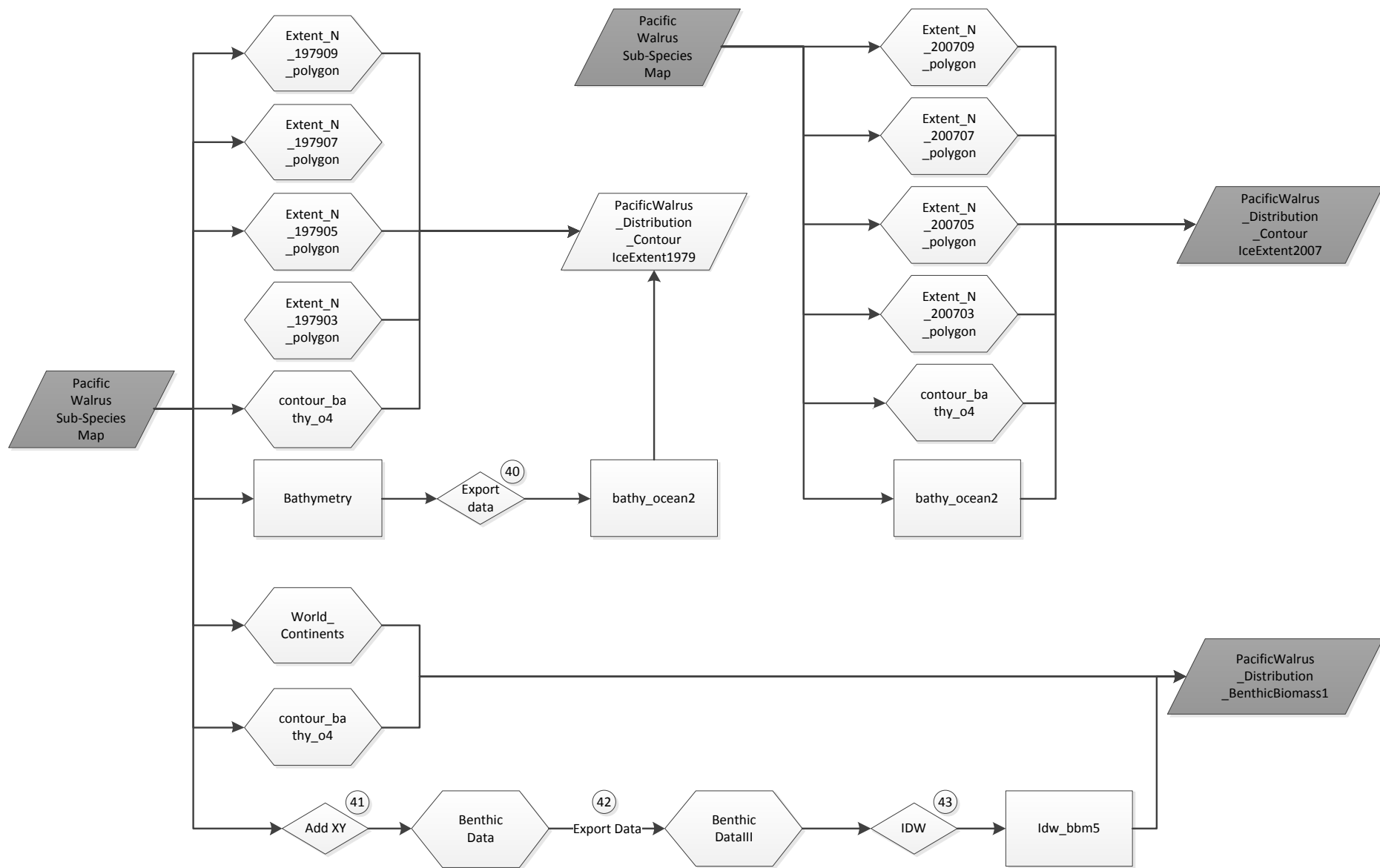
Appendix II Flowchart ArcGIS











Appendix III Flowchart table ArcGIS

1	<p>Select by attributes</p> <ul style="list-style-type: none"> - Input: MAMMMARINE - Action: Select (sub-) species
2	<p>Create new layer</p> <ul style="list-style-type: none"> - Input: MAMMMARINE - Command: Create layer from selected features - Output: IUCN_sub-species*_Select
3	<p>Geo-reference tool</p> <ul style="list-style-type: none"> - Input: Summer distribution Canada - West Greenland Born 1995.jpg, Summer distribution East Greenland Born 1995.jpg, Summer distribution North Water stock Born 1995.jpg, Summer distribution Norway Russia Born 1995.jpg, Winter Distribution Atlantic Walrus Canada - West Greenland Born 1995.jpg, Winter distribution East Greenland Born 1995.jpg, Winter distribution North Water Stock Born 1995.jpg, Winter distribution Norway Russia Born 1995.jpg, Pacific Walrus haulouts Smith.jpg, Laptev Walrus - Russian Article Gert.jpg
4	<p>Editor toolbar</p> <ul style="list-style-type: none"> - Insert: New polygon created in ArcCatalog (Sub-species**_Summer & Sub-species**_Winter) - Action: Digitize species summer & winter distribution - Task: Create new feature - Output: Sub-species**_Summer.shp & Sub-species**_Winter.shp
5	<p>Editor toolbar</p> <ul style="list-style-type: none"> - Insert: New polyline created in ArcCatalog (Sub-species**_Migration & PacificWalrus_MigrationII) - Action: Digitize sub-species migration routes - Task: Create new feature - Output: Sub-species**_Migration.shp & PacificWalrus_migrationII.shp
6	<p>Geo-reference tool</p> <ul style="list-style-type: none"> - Haul-outs - Baffin Island.jpg, Haul-outs - Devon Island.jpg, Haul-outs - East Greenland.jpg, Haul-outs - Fox Basin.jpg, Haul-outs - Franz Joseph Land.jpg, Haul-outs - Hudson Bay.jpg, Haul-outs - Newfoundland.jpg, Haul-outs - Newfoundland.jpg, Haul-outs - SpitsbergenII.jpg, Haul-outs - West Greenland.jpg, Haul-outs - West GreenlandII.jpg, Pacific Walrus haul-outs Smith.jpg, Laptev Walrus - Russian Article Gert.jpg
7	<p>Editor toolbar</p> <ul style="list-style-type: none"> - Insert: New polygon created in ArcCatalog (Sub-species**_Haul-outs) - Action: Digitize species haul-out sites - Task: Create new feature - Output: AtlanticWalrus_Haulouts.shp, AtlanticWalrus_Haulouts_Historic.shp, AtlanticWalrus_Haulouts_Abandoned.shp, LaptevWalrus_Haulouts.shp, PacificWalrus_Haulout_Male.shp, PacificWalrus_Haulout_Mix.shp
8	<p>Editor toolbar</p> <ul style="list-style-type: none"> - Insert: New polygon created in ArcCatalog (PacificWalrus_Breeding) - Action: Digitize Pacific Walrus approximate breeding areas - Task: Create new feature - Output: PacificWalrus_Breeding.shp
9	<p>Editor toolbar</p> <ul style="list-style-type: none"> - Insert: New polygon created in ArcCatalog (Sub-populations) - Action: Digitize sub-species range

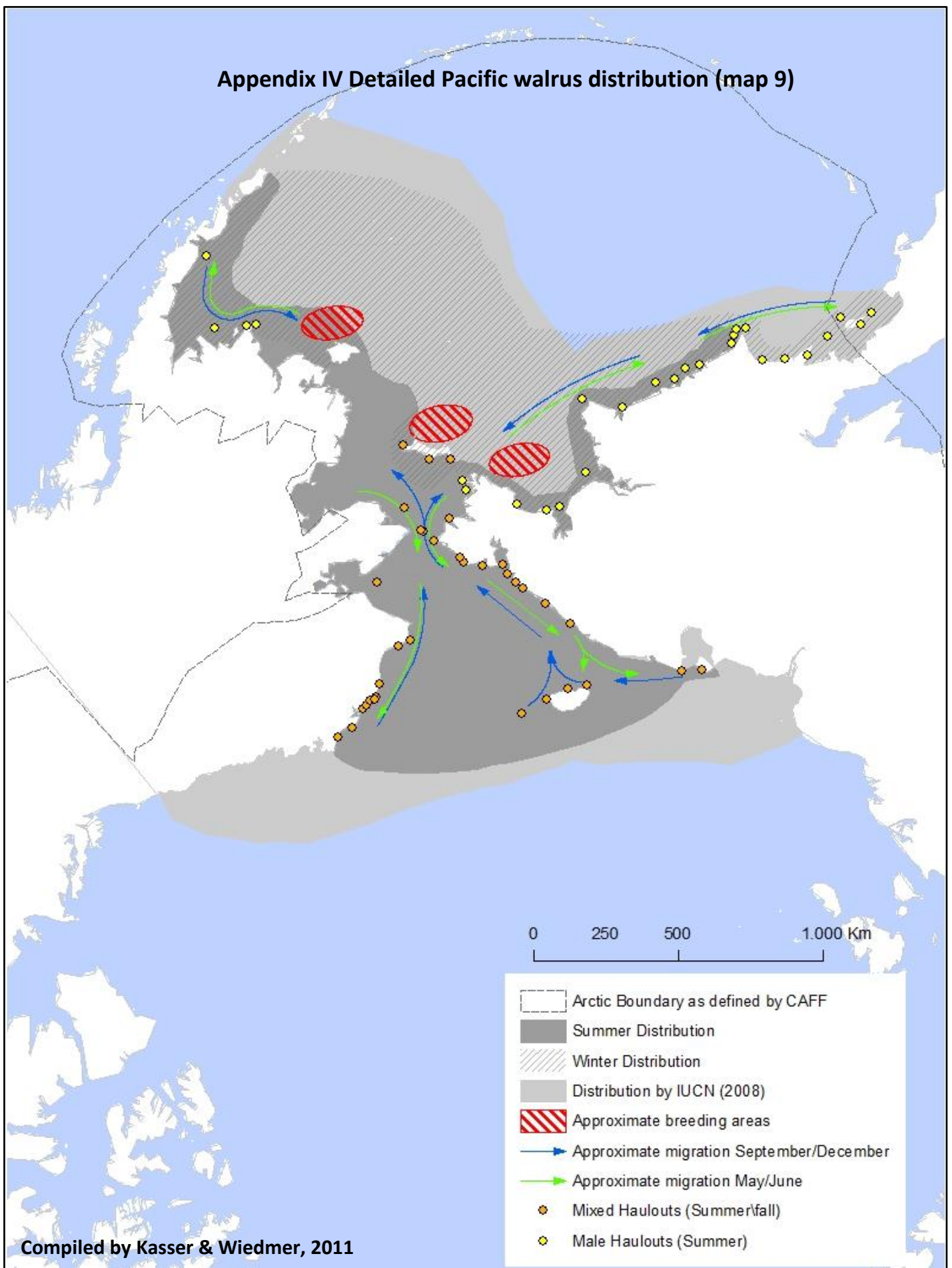
	<ul style="list-style-type: none"> - Task: Create new feature - Output: Sub-populations.shp
10	Editor toolbar <ul style="list-style-type: none"> - Insert: New polyline created in ArcCatalog (Arctic_Shipping) - Action: Digitize shipping route - Task: Create new feature - Output: Arctic_Shipping_NWP.shp
11	Editor toolbar <ul style="list-style-type: none"> - Insert: New polyline created in ArcCatalog (Arctic_Shipping) - Action: Digitize shipping route - Task: Create new feature - Output: Arctic_Shipping_NEP.shp
12	Editor toolbar <ul style="list-style-type: none"> - Insert: New polyline created in ArcCatalog (Arctic_Shipping) - Action: Digitize shipping route - Task: Create new feature - Output: Arctic_Shipping_NSR.shp
13	Editor toolbar <ul style="list-style-type: none"> - Insert: New polygon created in ArcCatalog (Arctic_Shipping_High) - Action: Digitize approximate high shipping areas - Task: Create new feature - Output: Arctic_Shipping_High.shp
14	Export data <ul style="list-style-type: none"> - Input: Bathymetry - Extent: Data Frame (Current) - Spatial Reference (Current) - Format: Grid - Output: Bathy_oc_ext
15	Export data <ul style="list-style-type: none"> - Input: Bathymetry - Extent: Data Frame (Current) - Spatial Reference (Current) - Format: Grid - Output: Bathy_oc_2
16	Export data <ul style="list-style-type: none"> - Input: Bathymetry - Extent: Data Frame (Current) - Spatial Reference (Current) - Format: Grid - Output: Bathy_oc_3
17	Contour tool <ul style="list-style-type: none"> - Input: Bathy_oc_ext - Output: Contour_bathy_o4 - Interval: 50
18	Contour tool <ul style="list-style-type: none"> - Input: Bathy_oc_2 - Output: Contour_bathy_o2 - Interval: 50
19	Contour tool <ul style="list-style-type: none"> - Input: Bathy_oc_3 - Output: Contour_bathy_o3

	<ul style="list-style-type: none"> - Interval: 50
20	Geo-reference tool <ul style="list-style-type: none"> - Input: OilPotential.jpg
21	Select <ul style="list-style-type: none"> - Input: Cara_au - Select: features with 50 - 100% oil potential
22	Create new layer <ul style="list-style-type: none"> - Input: Selected features with 50 - 100% oil potential - Command: Create layer from selected features - Output: Export2_Oil_50100.shp
23	Create new layer <ul style="list-style-type: none"> - Input: ProspectiveBesidesIn - Action: Select prospective oil and gas areas overlapping with Walrus distribution - Command: Create layer from selected features - Output: Prospective_OilGasII_New
24	Buffer tool <ul style="list-style-type: none"> - Input: PacificWalrus_Haulout_Mix - Output: PacificWalrus_Haulout_Mix_B1 - Linear unit: 75 Kilometres
25	Buffer tool <ul style="list-style-type: none"> - Input: PacificWalrus_Haulout_Male - Output: PacificWalrus_Haulout_Male_B3 - Linear unit: 75 Kilometres
26	Buffer tool <ul style="list-style-type: none"> - Input: AtlanticWalrus_Haulouts_Historic - Output: AtlanticWalrus_Haulouts_HisB - Linear unit: 75 Kilometres
27	Buffer tool <ul style="list-style-type: none"> - Input: AtlanticWalrus_Haulouts - Output: AtlanticWalrus_Haulouts_B - Linear unit: 75 Kilometres
28	Buffer tool <ul style="list-style-type: none"> - Input: LaptevWalrus_Haulouts - Output: LaptevWalrus_Haulouts_B - Linear unit: 75 Kilometres
29	Select layer by location <ul style="list-style-type: none"> - Input: Prospective_OilGasII_New - Relationship: Intersect - Selecting features: IUCN_PacificWalrus_Select - Selection type: New Selecton - Output: Prospective_OilGasII_New_PW
30	Select layer by location <ul style="list-style-type: none"> - Input: Prospective_OilGasII_New - Relationship: Intersect - Selecting features: IUCN_AtlanticWalrus_Select - Selection type: New Selecton - Output: Prospective_OilGasII_New_AW
31	Intersect tool <ul style="list-style-type: none"> - Input: Prospective_OilGasII_New_PW - Intersect with: IUCN_PacificWalrus_Select - Output: IUCN_PacificWalrus_Select_InterII

32	Intersect tool <ul style="list-style-type: none"> - Input: Prospective_OilGasII_New_AW - Intersect with: IUCN_AtlanticWalrus_Select - Output: IUCN_AtlanticWalrus_Select_InterII
33	Select layer by location <ul style="list-style-type: none"> - Input: Export2_Oil_50100 - Relationship: Intersect - Selecting features: IUCN_PacificWalrus_Select - Selection type: New Selecton - Output: Export2_Oil_50100_PW
34	Select layer by location <ul style="list-style-type: none"> - Input: Export2_Oil_50100 - Relationship: Intersect - Selecting features: IUCN_AtlanticWalrus_Select - Selection type: New Selecton - Output: Export2_Oil_50100_AW_Select
35	Select layer by location <ul style="list-style-type: none"> - Input: Export2_Oil_50100 - Relationship: Intersect - Selecting features: IUCN_LaptevWalrus_Select - Selection type: New Selecton - Output: Export2_Oil_50100_LW
36	Intersect tool <ul style="list-style-type: none"> - Input: Export2_Oil_50100_PW - Intersect with: IUCN_PacificWalrus_Select - Output: Export2_Oil_50100_PW_Select
37	Intersect tool <ul style="list-style-type: none"> - Input: Export2_Oil_50100_AW_Select - Intersect with: IUCN_AtlanticWalrus_Select - Output: Export2_Oil_50100_AW
38	Intersect tool <ul style="list-style-type: none"> - Input: Export2_Oil_50100_AW_Select - Intersect with: AtlanticWalrus_Winter - Output: Export2_Oil_50100_AW_Winter
39	Intersect tool <ul style="list-style-type: none"> - Input: Export2_Oil_50100_LW - Intersect with: IUCN_LaptevWalrus_Select - Output: Export2_Oil_50100_LW_Select
40	Export data <ul style="list-style-type: none"> - Input: Bathymetry - Extent: Data Frame (Current) - Spatial Reference (Current) - Format: Grid - Output: Bathy_ocean2
41	Add XY data tool <ul style="list-style-type: none"> - Input: Arctic_biomass.mdb (sheet: BENTHOS) - Output: BENTHOS Events
42	Export data <ul style="list-style-type: none"> - Export BENTHOS Events as shape file - Output: BenthicDataIII
43	IDW interpolation tool

	<ul style="list-style-type: none"> - Input point features: BenthicDataIII - Z value field: Biomass_g_ - Output raster: Idw_bbm5 - Output cell size: Bathy_oc_ext
<p>Note:</p> <p>* Sub-species can be replaced by Atlantic Walrus, Pacific Walrus or Laptev Walrus.</p> <p>** Sub-species can be replaced by Atlantic Walrus or Pacific Walrus.</p>	

Appendix IV Detailed Pacific walrus distribution (map 9)

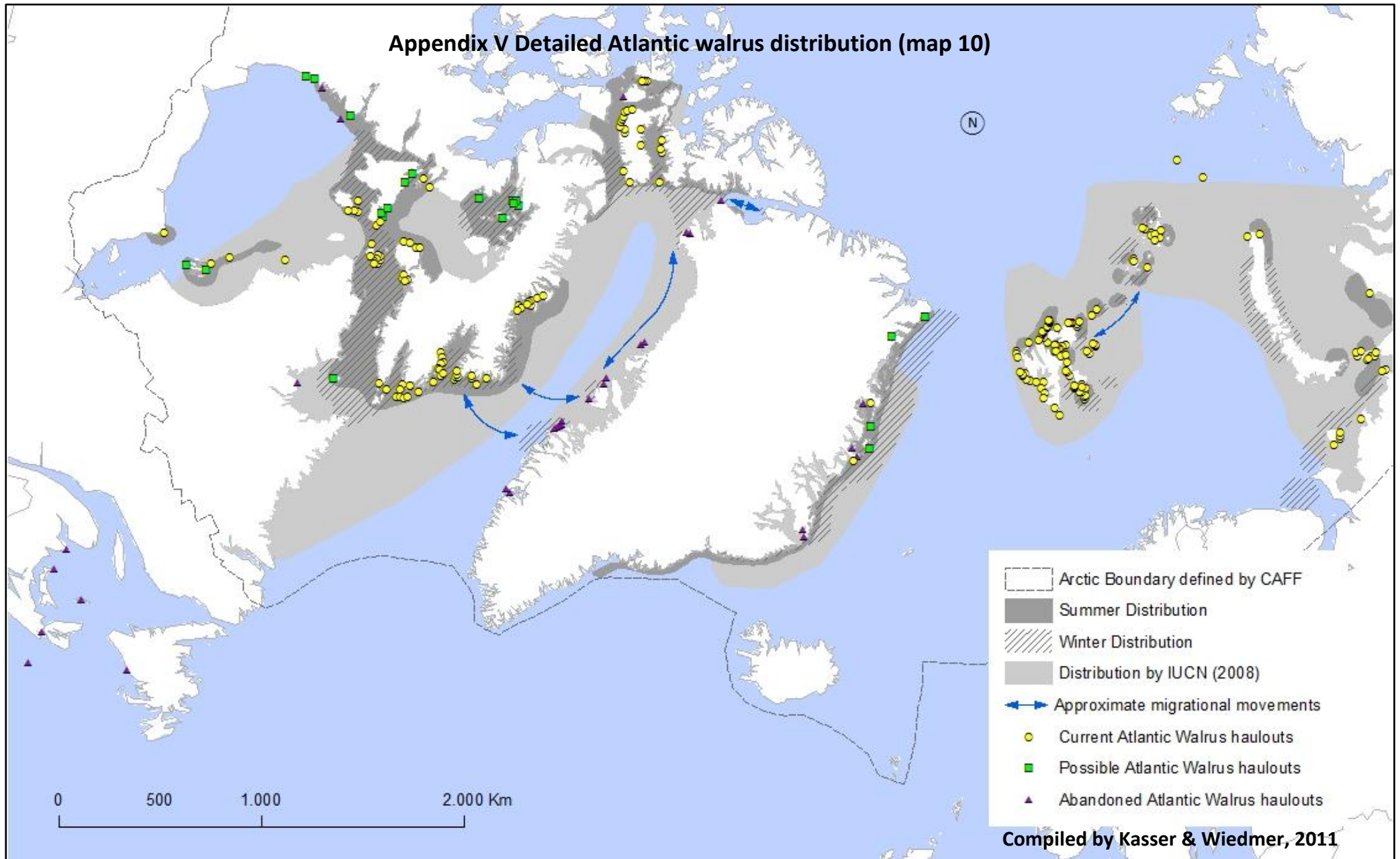


Compiled by Kasser & Wiedmer, 2011

This map represents the summer and winter distribution of the Pacific walrus, known haul-out sites, approximate migration patterns and approximate breeding grounds.

References used to compile this map: CAFF, 2009; ESRI, 2008; IUCN, 2009; Olson & Dinerstein, 2010; Smith, 2010

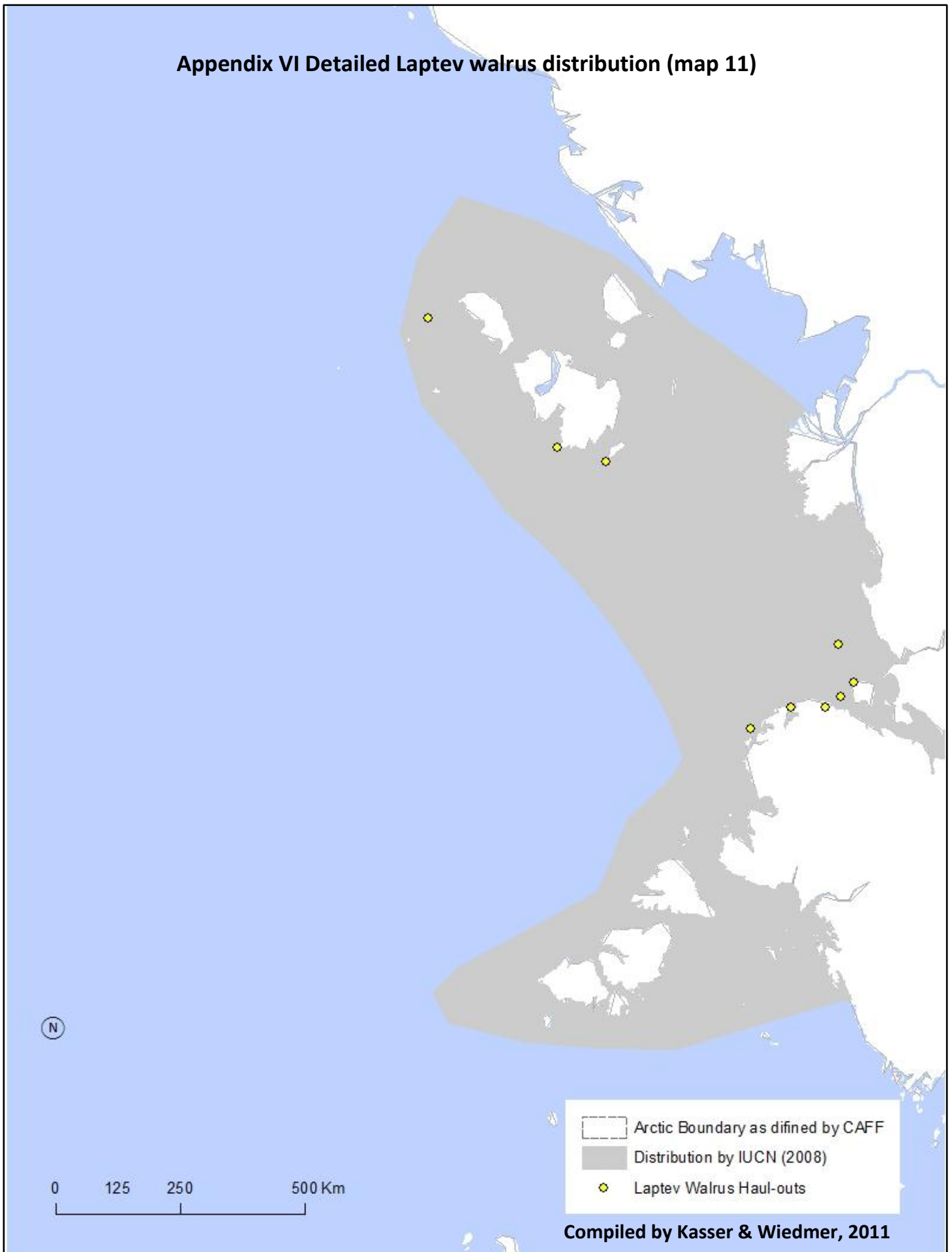
Appendix V Detailed Atlantic walrus distribution (map 10)



This map represents the summer and winter distribution of the Atlantic walrus, known haul-out sites and approximate migration patterns.

References used to compile this map: Born *et al.*, 1995; CAFF, 2009; ESRI, 2008; Gavrilov, 2011; IUCN, 2009; Norwegian Polar Institute, 1995; Olson & Dinerstein, 2010

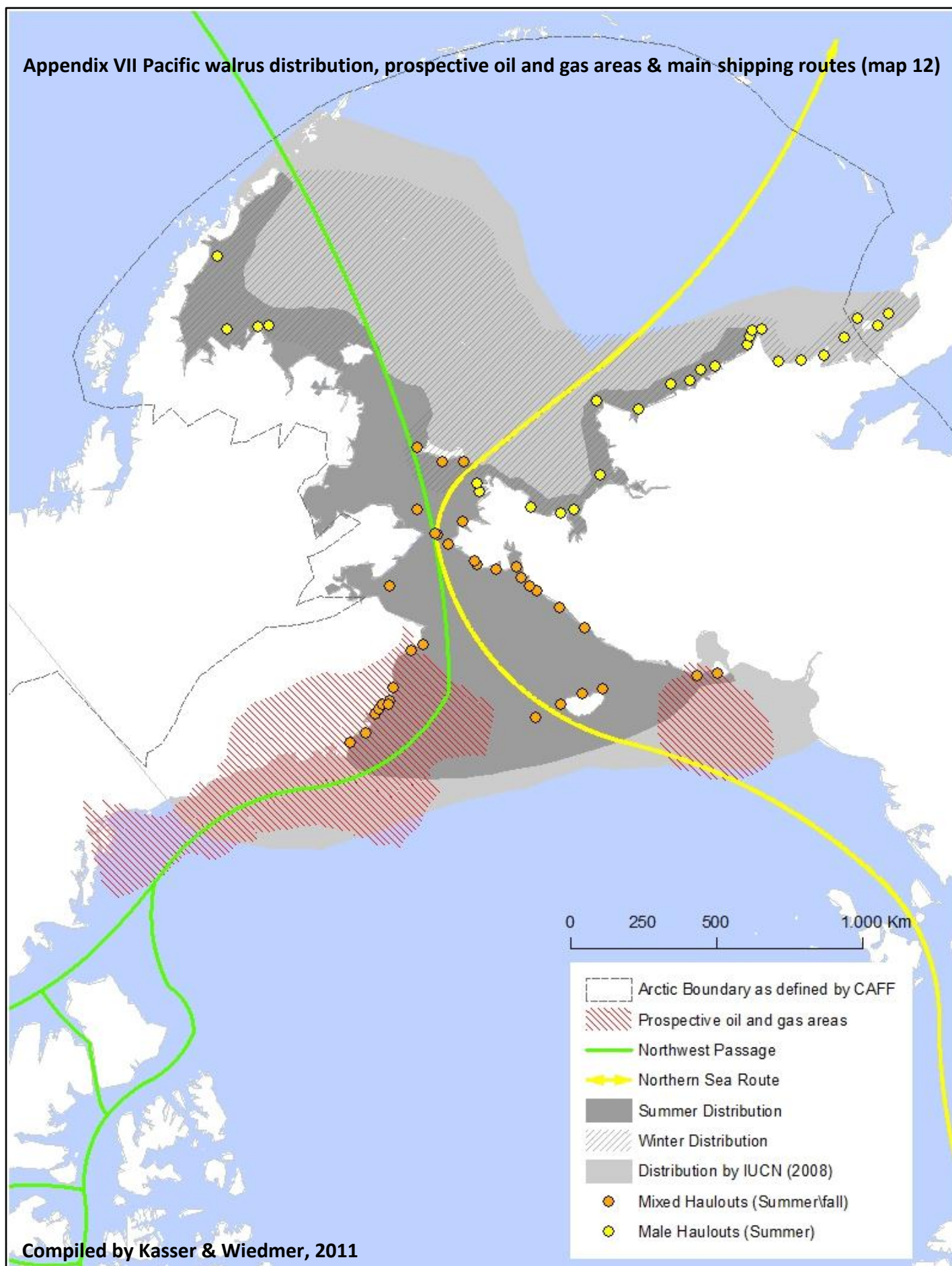
Appendix VI Detailed Laptev walrus distribution (map 11)



This map represents the estimated distribution of the Laptev walrus and historic haul-out sites.

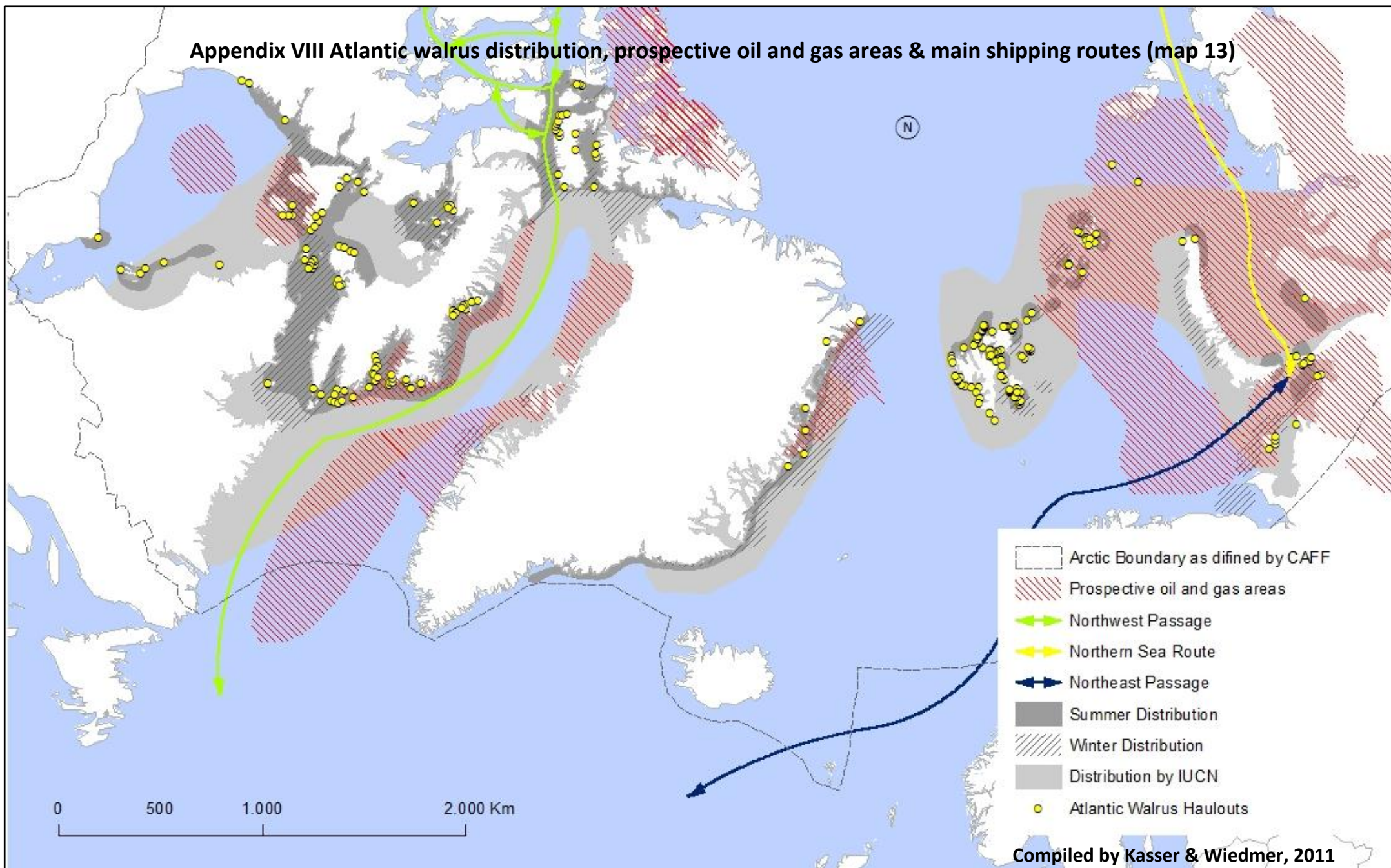
References used to compile this map: CAFF, 2009; ESRI, 2008; Gavrilov, 2011; IUCN, 2009; Olson & Dinerstein, 2010

Appendix VII Pacific walrus distribution, prospective oil and gas areas & main shipping routes (map 12)



This map represents prospective oil and gas areas and main arctic shipping routes overlaid with Pacific walrus distribution. References used to compile this map: Bird *et al.*, 2008; Blijleven & van Dijk, 2010; Born *et al.*, 1995; CAFF, 2009; ESRI, 2008; Olson & Dinerstein, 2010; Smith, 2010; USGS, 2008

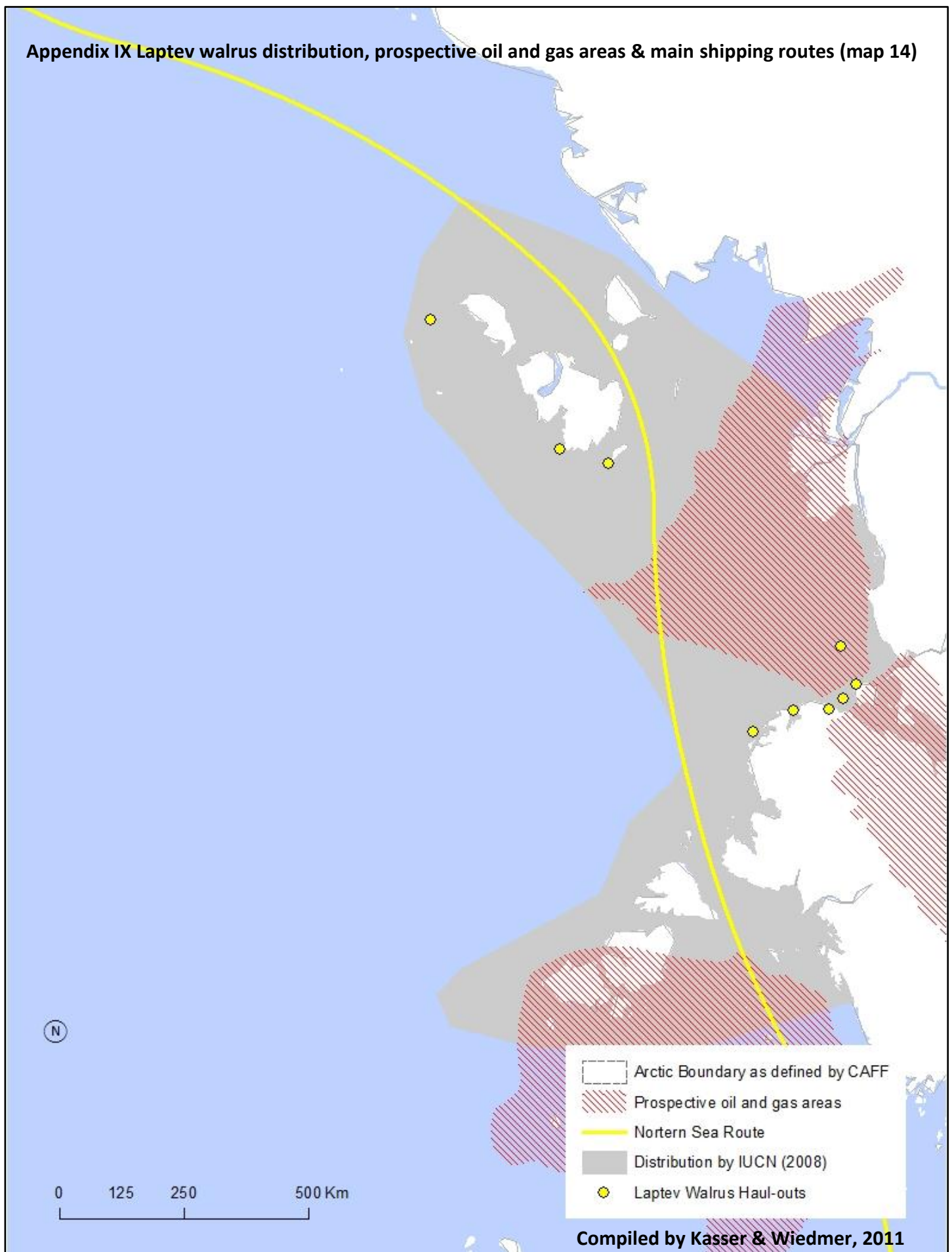
Appendix VIII Atlantic walrus distribution, prospective oil and gas areas & main shipping routes (map 13)



This map represents prospective oil and gas areas and main arctic shipping routes overlaid with Atlantic walrus distribution.

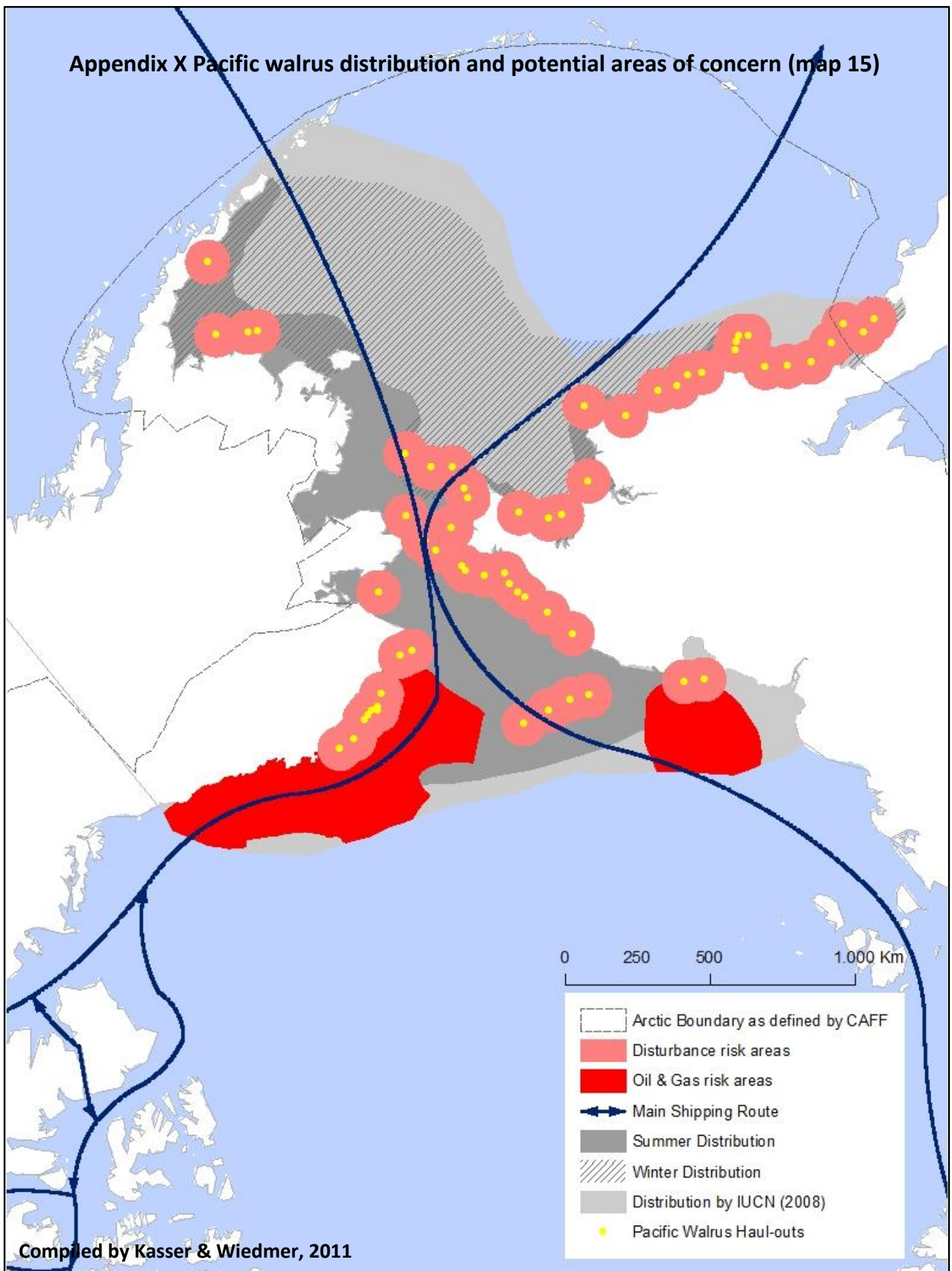
References used to compile this map: Bird *et al.*, 2008; Blijleven & van Dijk, 2010; Born *et al.*, 1995; CAFF, 2009; ESRI, 2008; Gavrilov, 2011; IUCN, 2009; Norwegian Polar Institute, 1995; Olson & Dinerstein, 2010; USGS, 2008

Appendix IX Laptev walrus distribution, prospective oil and gas areas & main shipping routes (map 14)



This map represents prospective oil and gas areas and main arctic shipping routes overlaid with Laptev walrus distribution. References used to compile this map: Bird *et al.*, 2008; Blijleven & van Dijk, 2010; CAFF, 2009; ESRI, 2008; Gavrilov, 2011; IUCN, 2009; Olson & Dinerstein, 2010; USGS, 2008

Appendix X Pacific walrus distribution and potential areas of concern (map 15)

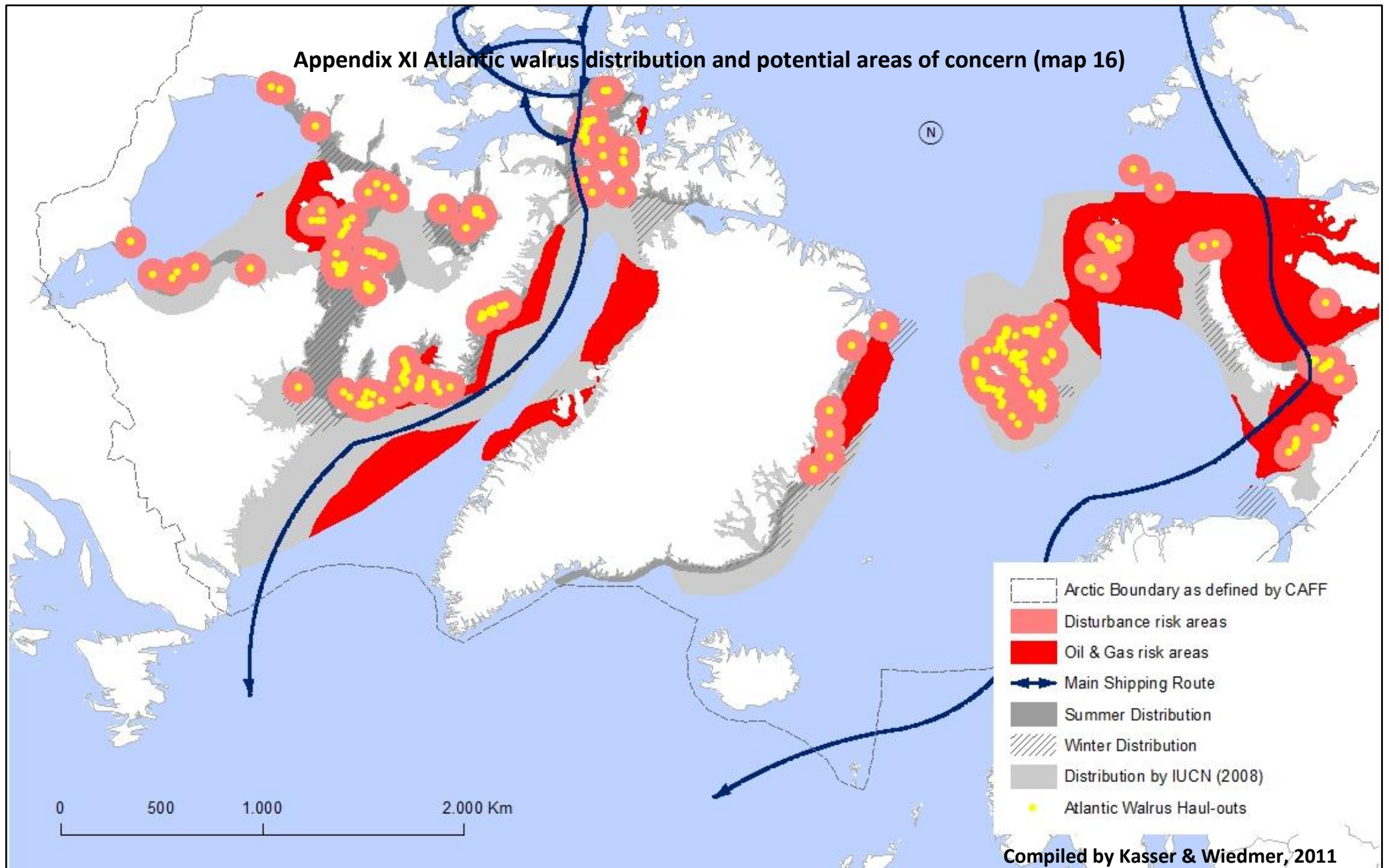


Compiled by Kasser & Wiedmer, 2011

This map represents the risk areas that are present in Pacific walrus habitat when economic activities increase in the area (disturbance perimeters are not to scale).

References used to compile this map: AMSA, 2009; Bird *et al.*, 2008; Blijleven & van Dijk, 2010; CAFF, 2009; ESRI, 2008; IUCN, 2009; Olson & Dinerstein, 2010; Smith, 2010; USGS, 2008

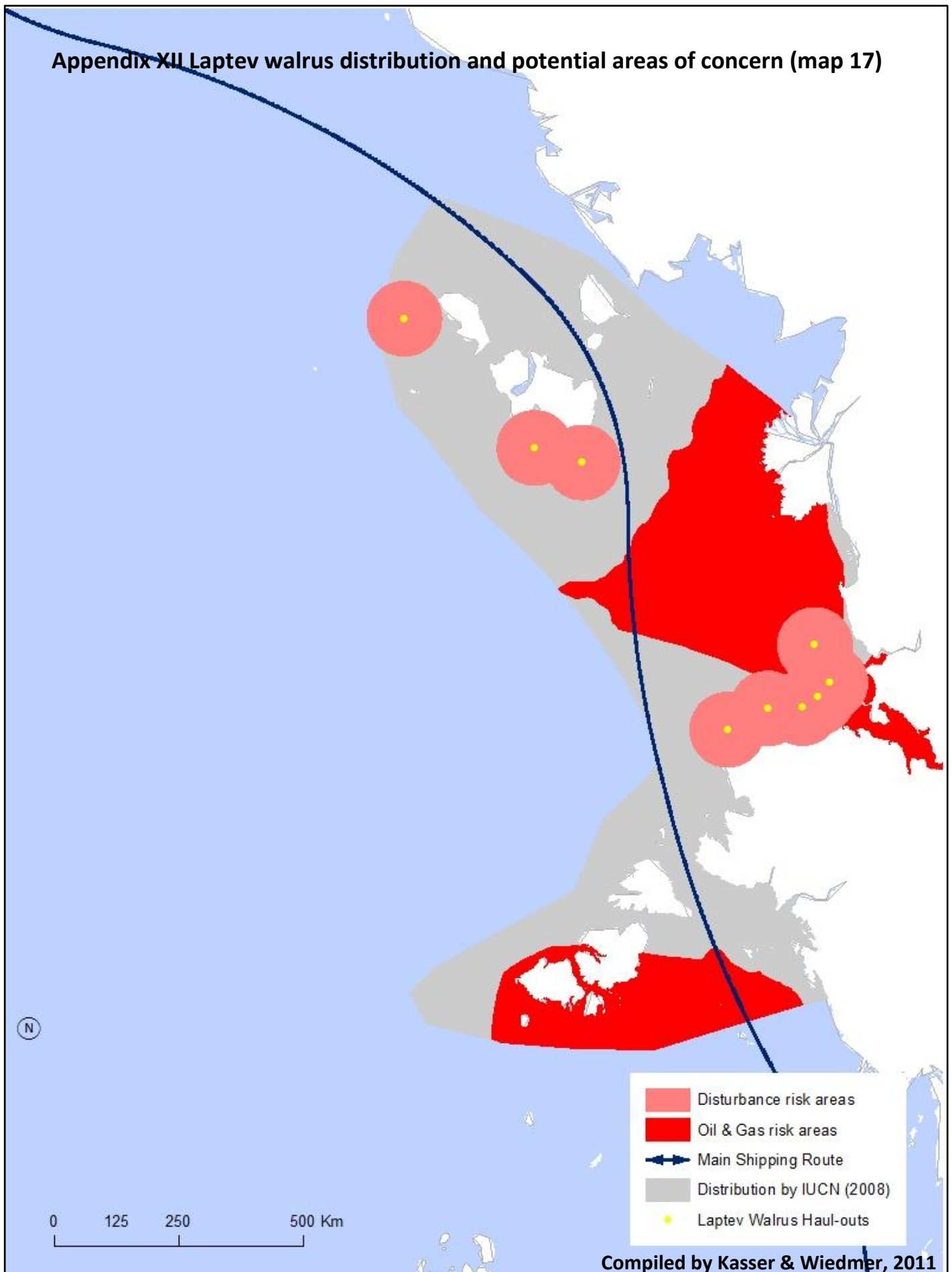
Appendix XI Atlantic walrus distribution and potential areas of concern (map 16)



This map represents the risk areas that are present in Atlantic walrus habitat when economic activities increase in the area (disturbance perimeters are not to scale).

References used to compile this map: AMSA, 2009; Bird *et al.*, 2008; Blijleven & van Dijk, 2010; Born *et al.*, 1995; CAFF, 2009; ESRI, 2008; IUCN, 2009; Norwegian Polar Institute, 1995; Olson & Dinerstein, 2010; USGS, 2008

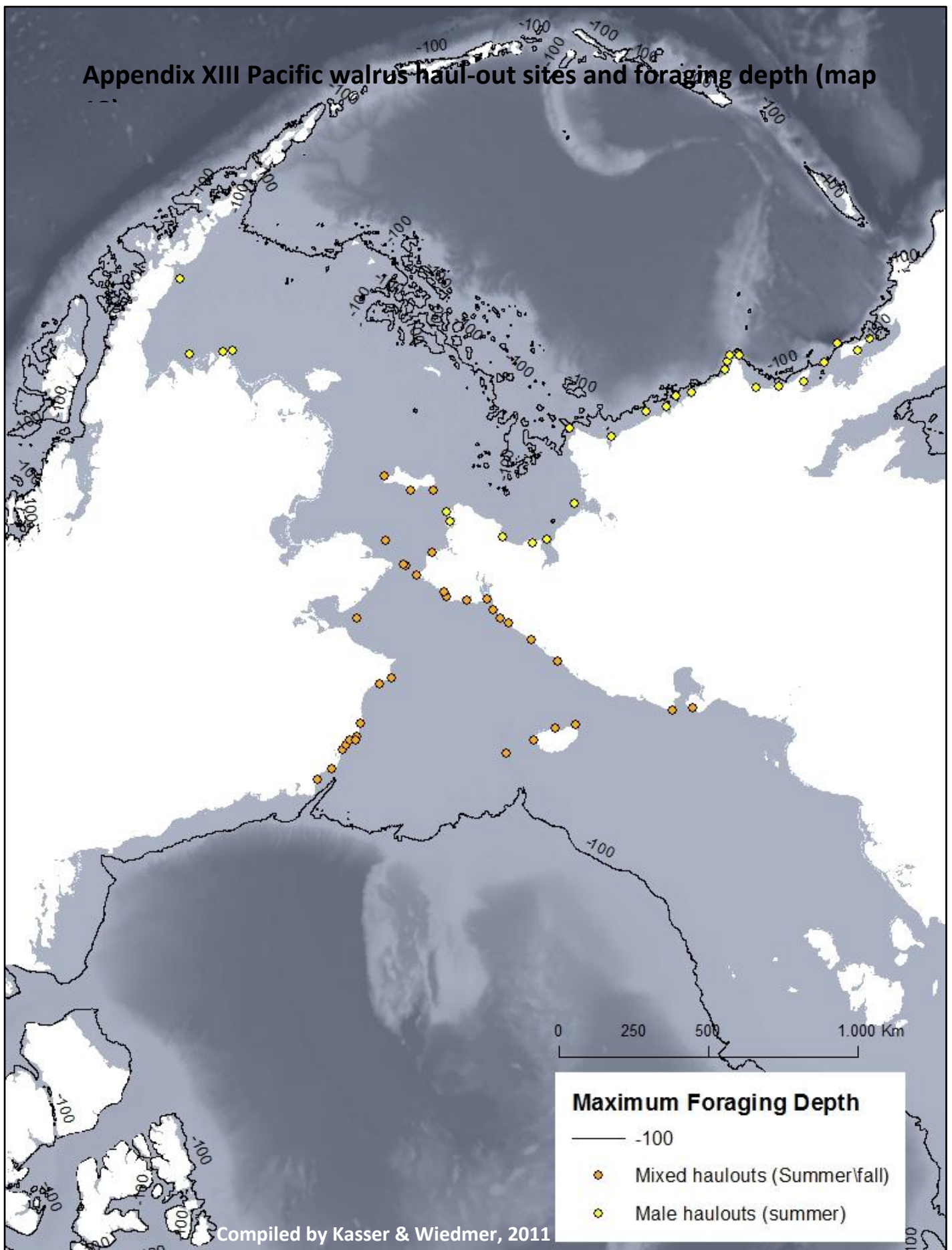
Appendix XII Laptev walrus distribution and potential areas of concern (map 17)



This map represents the risk areas that are present in Laptev walrus habitat when economic activities increase in the area (disturbance perimeters are not to scale).

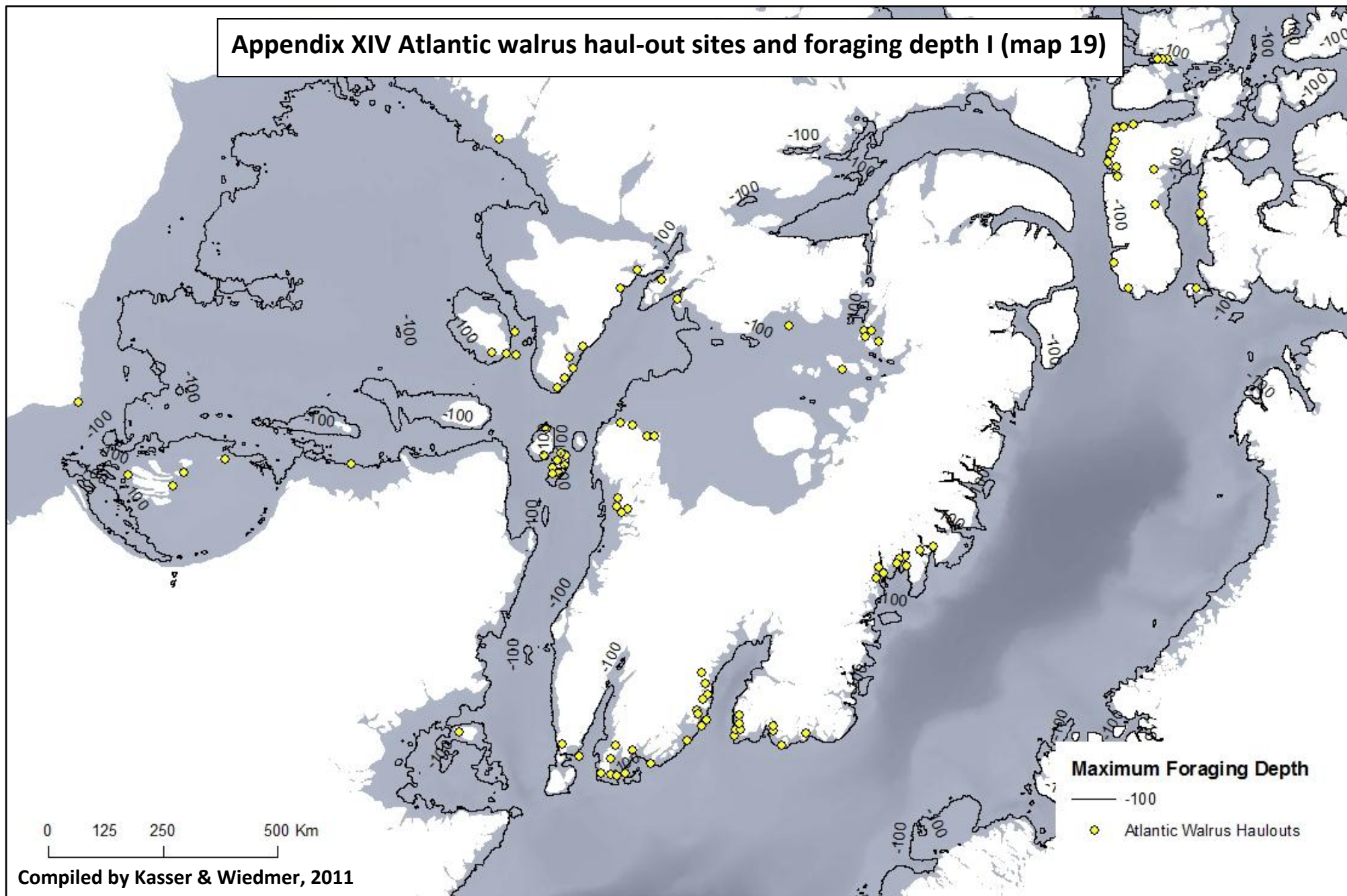
References used to compile this map: AMSA, 2009; Bird *et al.*, 2008; Blijleven & van Dijk, 2010; CAFF, 2009; ESRI, 2008; Gavrilov, 2011; IUCN, 2009; Olson & Dinerstein, 2010; USGS, 2008

Appendix XIII Pacific walrus haul-out sites and foraging depth (map)



This map represents Pacific walrus haul-outs in comparison to their maximum foraging depth of 100 meters.
References used to compile this map: Blijleven & van Dijk, 2010; ESRI, 2008; Olson & Dinerstein, 2010; Smith, 2010

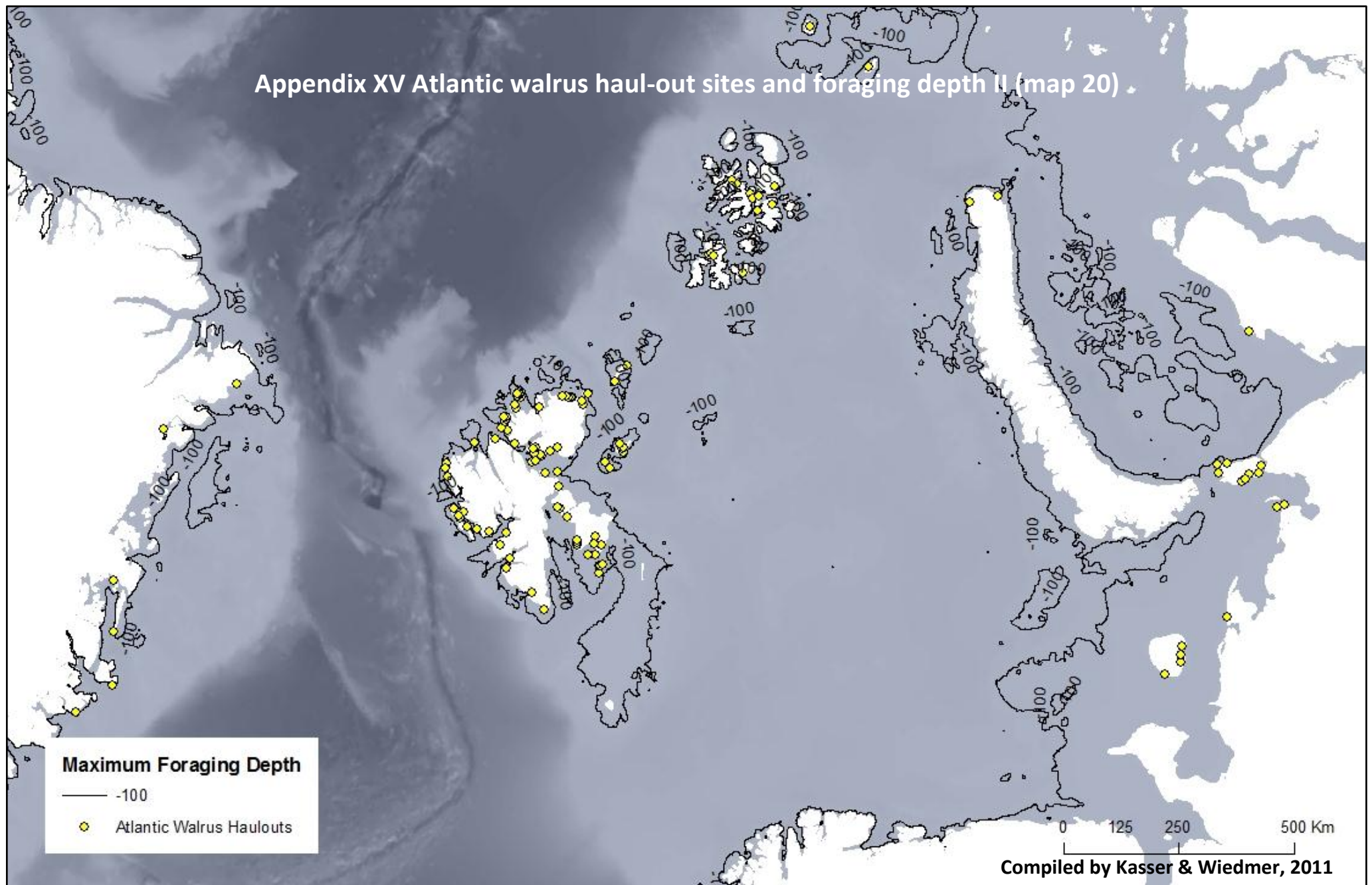
Appendix XIV Atlantic walrus haul-out sites and foraging depth I (map 19)



This map represents Atlantic walrus haul-outs in comparison to their maximum foraging depth of 100 meters.

References used to compile this map: Blijleven & van Dijk, 2010; Born *et al.*, 1995; ESRI, 2008; Gavrilov, 2011; Norwegian Polar Institute, 1995; Olson & Dinerstein, 2010

Appendix XV Atlantic walrus haul-out sites and foraging depth II (map 20)



This map represents Atlantic walrus haul-outs in comparison to their maximum foraging depth of 100 meters.

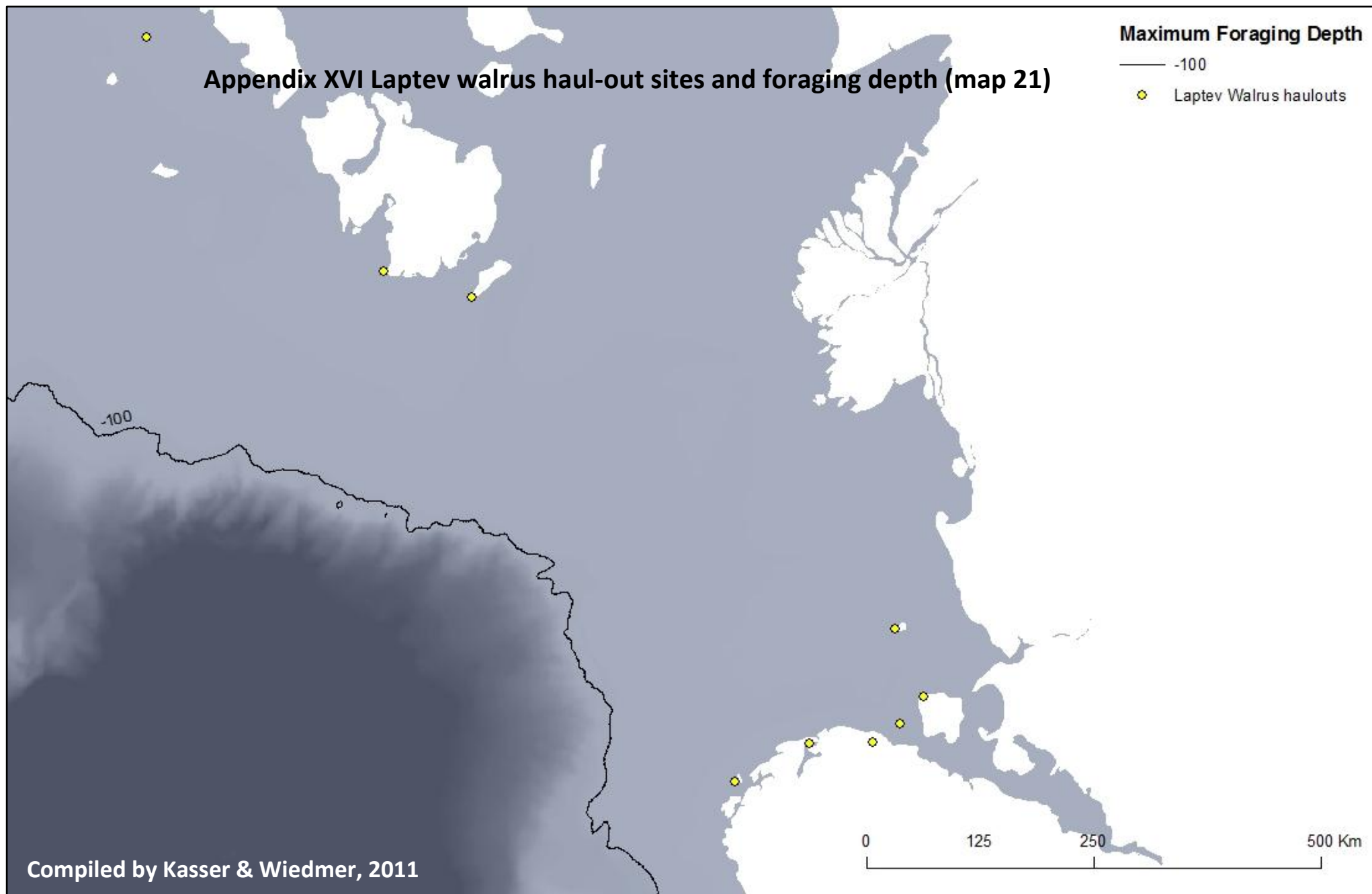
References used to compile this map: Blijleven & van Dijk, 2010; Born *et al.*, 1995; ESRI, 2008; Gavrilov, 2011; Norwegian Polar Institute, 1995; Olson & Dinerstein, 2010

Appendix XVI Laptev walrus haul-out sites and foraging depth (map 21)

Maximum Foraging Depth

— -100

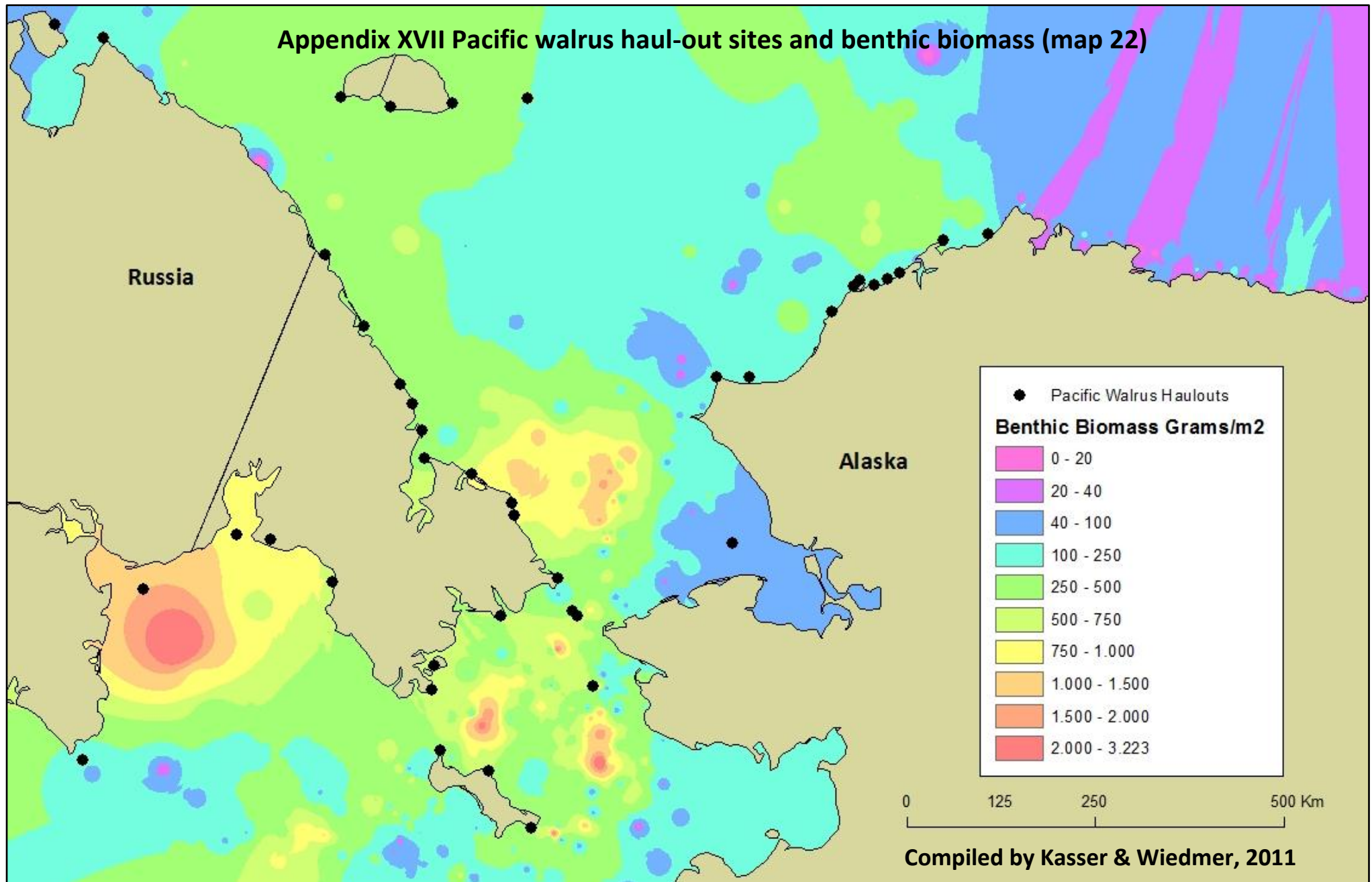
● Laptev Walrus haulouts



Compiled by Kasser & Wiedmer, 2011

This map represents Laptev walrus haul-outs in comparison to their maximum foraging depth of 100 meters.
References used to compile this map: Blijleven & van Dijk, 2010; ESRI, 2008; Gavrilov, 2011; Olson & Dinerstein, 2010

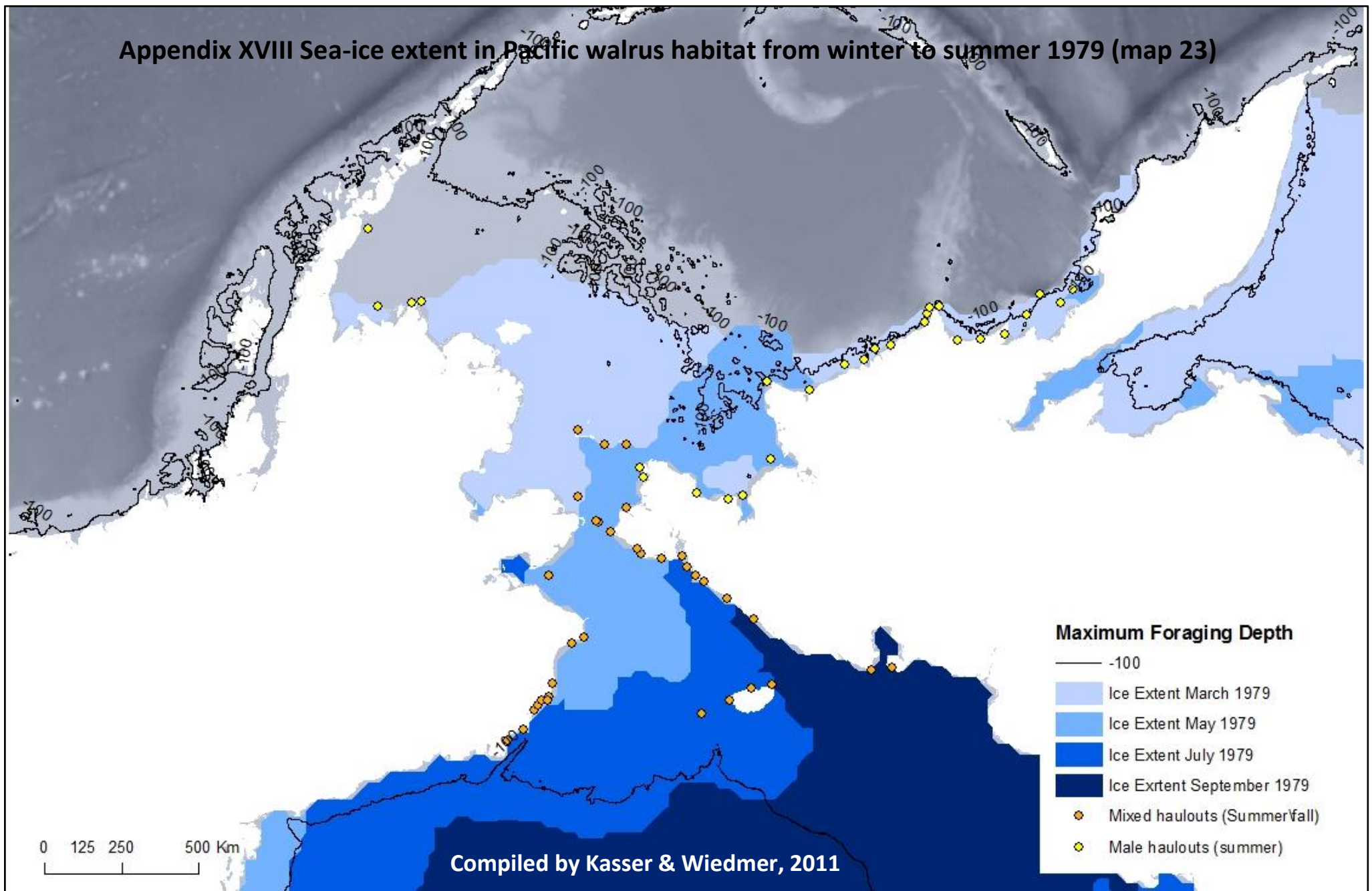
Appendix XVII Pacific walrus haul-out sites and benthic biomass (map 22)



This map represents Pacific walrus haul-outs in comparison with modeled benthic biomass in grams per square meter.

References used to compile this map: Audubon, 2010; ESRI, 2008; Feder, 1979; Feder, 1980; Feder, 1986; Grebmeier, 1988; Grebmeier, 1993; Smith, 2010; Stoker, 1970; Stoker, 1971; Stoker, 1972; Stoker, 1973; Stoker, 1974; Wacasey, 1971; Wacasey, 1973; Wacasey, 1974; Wacasey, 1975

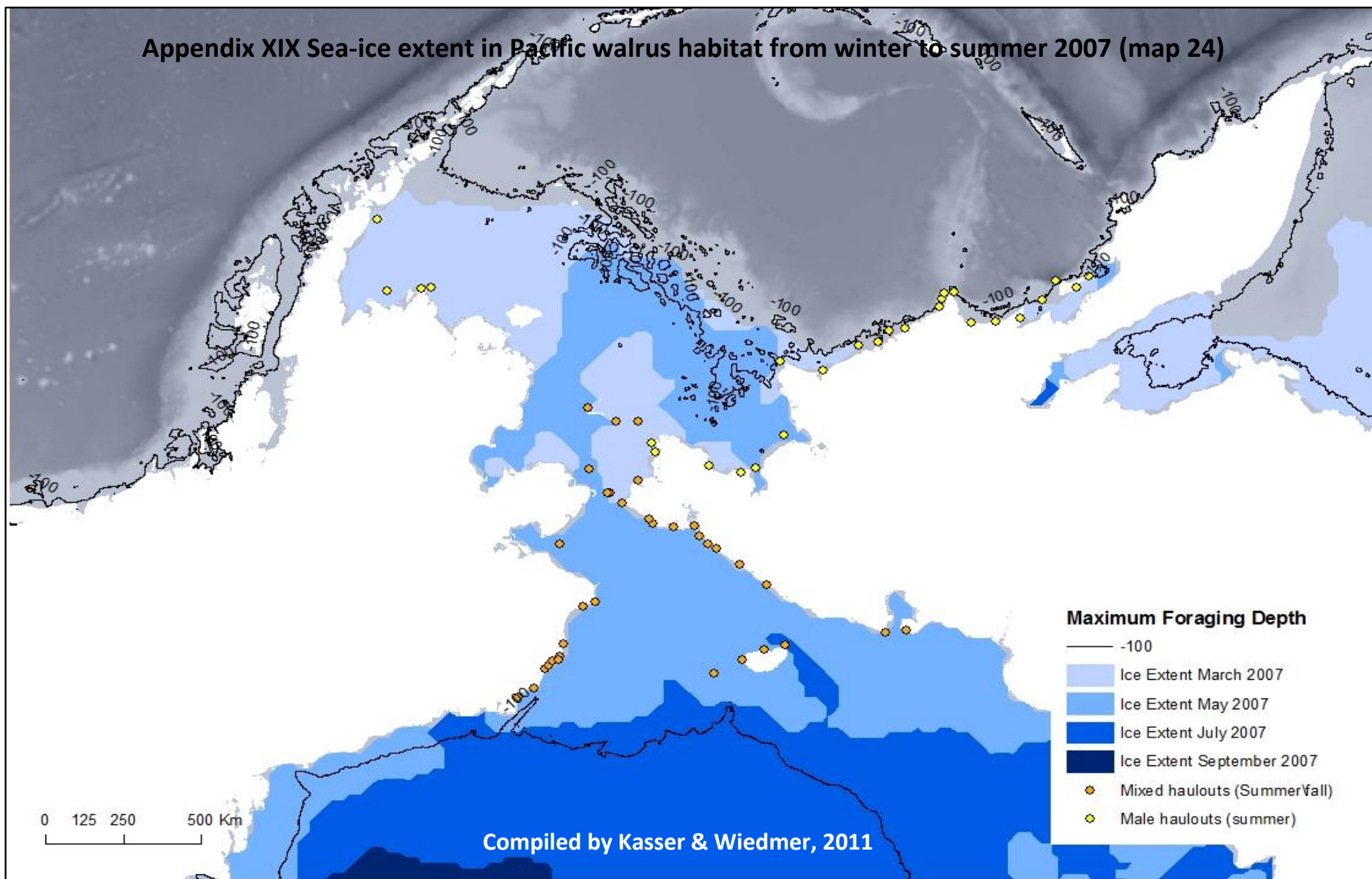
Appendix XVIII Sea-ice extent in Pacific walrus habitat from winter to summer 1979 (map 23)



This map represents sea-ice retreat in Pacific walrus habitat with a two month interval from winter maxima to summer minima in comparison with their Haul-out sites and maximum foraging depth.

References used to compile this map: Blijleven & van Dijk, 2010; ESRI, 2008; Fetterer *et al.*, 2009; Olson & Dinerstein, 2010; Smith, 2010

Appendix XIX Sea-ice extent in Pacific walrus habitat from winter to summer 2007 (map 24)



This map represents sea-ice retreat in Pacific walrus habitat with a two month interval from winter maxima to summer minima in comparison with their Haul-out sites and maximum foraging depth.

References used to compile this map: Blijleven & van Dijk, 2010; ESRI, 2008; Fetterer *et al.*, 2009; Olson & Dinerstein, 2010; Smith, 2010

Appendix XX Instruments and tools in the Arctic regulation *

Instrument or tool	Translation of abbreviation	Function	Scope / parties	Legally binding	Reference
AEPS	Arctic Environmental Protection Strategy	Deals with monitoring, assessment, protection, emergency preparedness/response, and conservation of the Arctic zone.	Arctic states	No	Finland Government, 1991
Arctic Shipping Guidelines	Arctic Shipping Guidelines	IMO Instrument of guidelines for Ships Operating in Arctic Ice-Covered Waters.	Arctic Ice-Covered waters	No	Koivurova and Molenaar, 2009
BWM Convention	International Convention for the Control and Management of Ship's Ballast Water and Sediments	IMO Instrument to prevent the potentially devastating effects of the spread of harmful aquatic organisms carried by ships' ballast water from one region to another.	Entire marine Arctic	Yes	http://www.imo.org
CBD	Convention on Biological Diversity	Establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.	Entire Arctic	Yes	http://www.cbd.int
CITES	Convention on International Trade in Endangered Species of Wild Animals	Aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Entire Arctic	Yes	http://www.cites.org
CMS	Convention on the Conservation of Migratory Species of Wild Animals	Intergovernmental treaty that aims to conserve terrestrial, marine and avian migratory species throughout their range.	Marine Arctic	Yes	Koivurova and Molenaar, 2009
COLREG 72	Convention on the International Regulations for Preventing Collisions at Sea	IMO Instrument that makes traffic separation schemes adopted by IMO mandatory and considerably reduced the number of collisions in many areas.	Entire marine Arctic	Yes	IMO, 2009
EIA	Environmental Impact Assessment	Assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the natural, social and economic aspects.	Entire Arctic	No	Koivurova and Molenaar, 2009
General Provisions on Ships' Routing	General Provisions on Ships' Routing	IMO Instrument to delineate the details of establishing a ships' routing system, including definitions of the types of systems available; the procedures and responsibilities of Member Governments and IMO; the planning of, and methods for, establishing a system; design criteria; use of the system; and representation of systems on charts.	Marine Arctic	No	IMO, 2003
LOS Convention	United Nations Convention on the Law of the Sea	To establish a universally accepted constitution for the oceans that lessens risk of International conflict and enhances stability and peace in the International community.	Entire Arctic	Yes	Koivurova and Molenaar, 2009
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships	IMO Instrument and international treaty regulating disposal of wastes generated by normal operation of vessels.	Entire marine Arctic	Yes	http://www.epa.gov
Offshore Oil and Gas Industry Strategy		Strategy of the OSPAR Commission for the Protection of the Marine Environment of the Northeast Atlantic.	North East Atlantic	Yes	Koivurova and Molenaar, 2009

OPRC 90	International Convention on Oil Pollution Preparedness, Response and Cooperation	IMO Instrument to facilitate international co-operation and mutual assistance in preparing for and responding to a major oil pollution incident and to encourage States to develop and maintain an adequate capability to deal with oil pollution emergencies.	Entire marine Arctic	Yes	http://www5.imo.org
OSPAR Convention	Oslo or Paris Conventions: The Convention for the Protection of the marine Environment of the North-East Atlantic	To prevent and eliminate marine pollution and to achieve sustainable management in the Arctic region.	Arctic waters of the North-East Atlantic / Denmark and Norway	Yes	Koivurova and Molenaar, 2009
Part XI Deep-Sea Mining Agreement	-	Agreement relating to the Implementation of Part XI of the UNCLOS to address certain difficulties with the seabed mining provisions.	Entire marine Arctic	Yes	Koivurova and Molenaar, 2009
SEA	Strategic Impact Assessment	System of incorporating environmental considerations into policies, plans and programmes.	Entire Arctic	No	Koivurova and Molenaar, 2009
PSSA Guidelines	-	IMO Instrument of guidelines for the Identification and Designation of Particularly Sensitive Sea Areas.	Entire marine Arctic	No	Koivurova and Molenaar, 2009
SOLAS 74	International Convention for the Safety of Live at Sea	IMO Instrument to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety.	Entire marine Arctic	Yes	http://www.imo.org
STCW 78	International Convention on Standards of Training, Certification and Watchkeeping for seafarers	IMO Instrument that prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.	Entire marine Arctic	Yes	http://www.imo.org
The Treaty on the Status of Spitsbergen (also often referred as the Svalbard Treaty)	-	Recognizes the full and absolute sovereignty of Norway over the arctic archipelago of Spitsbergen (Svalbard) and is signed by 52 Arctic and non-Arctic countries.	Svalbard, Norway All Arctic states	Yes	Moe and Schei, 2005 Umbreid, 2009
UNCLOS	United Nations Convention on the Law of the Sea	Comprehensive legal regime for the world's oceans and seas, establishing rules governing all uses of the oceans and ocean resources.	Entire Marine area	Yes	Koivurova and Molenaar, 2009
UNEP	United Nations Environment Programme	Provides leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and people to improve their quality of life without compromising that of future generations.	Entire Arctic	No	http://www.unep.org

UNFSA	United Nations Fish Stocks Agreement	Establishes a set of rights and obligations for States to conserve and manage fish stocks, associated and dependent species as well as to protect biodiversity in the marine environment. It sets out mechanisms for international cooperation, and identifies RFMOs as the mechanism through which States can fulfill their obligations to manage and conserve the stocks.	Marine Arctic	Yes	RFMO, 2009
2000 OPRC-HNS Protocol	Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances	IMO Instrument that ensures that ships carrying hazardous and noxious substances are covered by preparedness and response regimes similar to those already in existence for oil incidents.	Entire marine Arctic	Yes	Koivurova and Molenaar, 2009
* Adjusted from the Arctic Cetaceans Hotspots report (Blijleven and Van Dijk 2011)					

Appendix XXI Involved parties in Arctic regulation *

Party	Translation of abbreviation	Function	Scope	Reference
ACAP	Arctic Contaminants Action Program	Arctic Council working group to reduce emissions of pollutants into the environment in order to reduce the identified pollution risks.	Entire Arctic	http://acap.arctic-council.org
AMAP	Arctic Monitoring and Assessment Programme	Arctic Council working group to advice the governments of the Arctic countries on matters relating to threats to the Arctic region from pollution, and associated issues.	Arctic countries within CAFF Boundary	http://www.amap.no
Arctic Council		A high level intergovernmental forum to provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic Indigenous communities and other Arctic inhabitants on common Arctic issues, in particular issues of sustainable development and environmental protection in the Arctic.	Entire Arctic	http://arctic-council.org
CAFF	Conservation of Arctic Flora and Fauna	Arctic Council working group to address the conservation of Arctic biodiversity, and communicate the findings to the governments and residents of the Arctic, helping to promote practices, which ensure sustainability of the Arctic's living resources.	Entire Arctic	http://www.caff.is
CLCS	Commission on the Limits of the Continental Shelf	To facilitate the implementation of the UNCLOS in respect of the establishment of the outer limits of the continental shelf beyond 200 nautical miles (M) from the baselines from which the breadth of the territorial sea is measured.	The continental shelf	http://www.un.org
COFI	FAO Committee on Fisheries	Presently constitutes the only global inter-governmental forum where major international fisheries and aquaculture problems and issues are examined and recommendations addressed to governments, regional fishery bodies, NGOs, fish workers, FAO and international community, periodically on a worldwide basis.	Entire Arctic	http://www.fao.org
EPPR	Emergency, Prevention, Preparedness and Response	Arctic Council working group to deal with the prevention, preparedness and response to environmental emergencies in the Arctic.	Entire Arctic	http://eppr.arctic-council.org
FAO	United Nations Food and Agriculture Organization	To raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy.	Entire Arctic	http://www.fao.org
IACS	International Association of Classification Societies	Makes a unique contribution to maritime safety and regulation through technical support, compliance verification and research and development.	Marine Arctic	http://www.iacs.org.uk
ICES	International Council for the Exploration of the Sea	Coordinates and promotes marine research on oceanography, the marine environment, the marine ecosystem, and on living marine resources in the North Atlantic.	North Atlantic Ocean and adjacent seas	http://www.ices.dk

IMO	International Maritime Organization	United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships.	Marine Arctic	http://www.imo.org
IPCC	Intergovernmental Panel on Climate Change	Leading international body for the assessment of climate change to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.	Arctic countries	http://www.ipcc.ch
ISA	International Seabed Authority	Organization through which States Parties of the Convention on the Law of the Sea shall, in accordance with the regime for the seabed and ocean floor and subsoil thereof in the area beyond the limits of national jurisdiction or the seabed (which lies beyond the limits of the continental shelf) established in Part XI and the Agreement, organize and control activities in the Area, particularly with a view to administering the resources of the Area.	Marine Arctic beyond areas of national jurisdiction	http://www.isa.org.jm
IUCN	International Union for Conservation of Nature	Influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.	Entire Arctic	http://www.iucn.org
MEPC	Marine Environment Protection Committee	A subsidiary body of the Council (the Executive Organ of IMO) that is empowered to consider any matter within the scope of the organization concerned with prevention and control of pollution from ships, in particular with the adoption and amendment of conventions and other regulations and measures to ensure their enforcement.	Marine Arctic / Arctic Countries	http://www.imo.org
NAMMCO	North Atlantic Marine Mammal Commission	International body for cooperation on the conservation, management and study of marine mammals in the North Atlantic.	North Atlantic	http://www.nammco.no
OSPAR Commission	The Convention for the Protection of the marine Environment of the North-East Atlantic	Mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the North-East Atlantic.	North-East Atlantic	http://www.ospar.org
PAME	Protection of the Arctic Marine Environment	Arctic Council working group that has to keep under review the adequacy of global and regional legal, policy and other measures, and where necessary to make recommendations for improvements that would support the Arctic Council's Arctic Marine Strategic Plan (2004).	Marine Arctic	http://www.fakr.noaa.gov
SDWG	Sustainable Development Working Group	Arctic Council Working group to protect and enhance the economies, culture and health of the inhabitants of the Arctic, in an environmentally sustainable manner.	Entire Arctic	http://arctic-council.org
TRAFFIC		Wildlife trade monitoring network, works to ensure that trade in wild plants and animals is not a threat to the conservation of nature.	Entire Arctic	www.traffic.org

UNWG BBNJ	United Nations Working Group Biological diversity Beyond areas of National Jurisdiction	United Nations ad hoc open-ended informal working group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction.	Marine Arctic beyond areas of national jurisdiction	http://www.wwf.se
WMO	World Meteorological Organization	A specialized agency of the United Nations. It is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources.	Arctic Countries	http://www.wwf.se
* Adjusted from the Arctic Cetaceans Hotspots report (Blijleven and Van Dijk 2011)				

