Methods and summary data from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018

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METHODS AND SUMMARY DATA FROM THE NORTHUMBERLAND STRAIT MULTI-SPECIES BOTTOM TRAWL SURVEY, 1999 TO 2018

by

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In 1999, Fisheries and Oceans Canada initiated a bottom trawl survey in Northumberland Strait in the southern Gulf of St. Lawrence. The primary survey objective was to collect data to assess the status of the southern Gulf of St. Lawrence lobster stock. Conducted annually from 1999 to 2018, the survey objectives, the sampling methods, the survey vessel and the study area changed over the years. Beginning in 2005, data were systematically collected for lobster, crab and fish. The survey vessel also served as a platform from which to collect oceanographic data [e.g. Conductivity, Temperature and Depth (CTD) and water samples]. The relative densities and length frequencies of the most commonly captured crustacean and fish species (or species groups) are presented. Future work includes quantifying the swept area of the sampling sets to allow for more robust analyses of temporal changes in abundance and distribution.

RÉSUMÉ

Asselin, N.C., Hanson, J.M., Ricard, D. and Rondeau, A. 2021. Methods and summary data from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. Can. Tech. Rep. Fish. Aquat. Sci. 3432: v + 118 p.

En 1999, Pêches et Océans Canada a initié un relevé au chalut de fond dans le détroit de Northumberland, dans le sud du golfe du Saint-Laurent. L'objectif primaire de ce relevé était de recueillir des données afin d'évaluer l'état du stock de homard du sud du golfe du Saint-Laurent. Réalisé annuellement de 1999 à 2018, les objectifs du relevé, les méthodes d'échantillonnage, le navire utilisé et la zone d'étude ont changé au fil des ans. À partir de 2005, des données ont été systématiquement recueillies pour le homard, les crabes et les poissons. Le relevé a également permit la collecte des données océanographiques [p.ex. Conductivité, Température et Profondeur (CTP) et échantillons d'eau]. Les densités relatives et les fréquences de longueur des espèces (ou groupes d'espèces) de crustacés et de poissons les plus couramment capturées sont présentées. Les travaux futurs comprennent la quantification de la zone balayée des traits d'échantillonnage pour permettre une analyse plus robuste des changements temporels d'abondance et de distribution.

1 Introduction

Fisheries and Oceans Canada (DFO) initiated a bottom trawl survey in Northumberland Strait in 1999 to collect fishery-independent data to use in the assessment of the status of the southern Gulf of St. Lawrence lobster (*Homarus americanus*) stock (Hanson 2001). The survey was completed annually from 1999 to 2018 with the sampling methods and study area changing over the years. A multi-species sampling plan, targeting lobster, crabs and fish, has been used since 2005. Portions of the dataset have been used in three lobster stock assessments (Comeau et al. 2004, 2008; Rondeau et al. 2014a), two updates to the stock status indicators of the lobster stock (DFO 2016, 2019), one southern Gulf of St. Lawrence Atlantic rock crab (*Cancer irroratus*) stock assessment (Rondeau et al. 2014b) and three NAFO Division 4T winter flounder (*Pseudopleuronectes americanus*) assessments (Morin et al. 2002, 2012; Surette and Rolland 2019). Data from the Northumberland Strait multi-species bottom-trawl survey have also been used in numerous publications on a wide-range of benthic and pelagic species and on oceanographic conditions in the region (Appendix A).

2 Methods

2.1 Study area

The Northumberland Strait is in the southern Gulf of St. Lawrence, between Prince Edward Island and the mainland (Figure 1). Water depths generally do not exceed 30 m and maximum bottom water temperatures, on average, are higher than in the remainder of the southern Gulf of St. Lawrence, reaching above 23°C in September (Chassé et al. 2014). The general circulation is from west to east with strong tidal mixing (Koutitonsky 1991). The overall flow is weaker than in other areas of the southern Gulf of St. Lawrence (e.g. the north coast of Prince Edward Island) (Chassé and Miller 2010). The survey area changed throughout the study period and included portions or all of Lobster Fishing Areas (LFAs) 25, 26A and 26B.

2.2 Survey design

The survey design has been previously described in Hanson (2001) and Comeau et al. (2008). To accommodate the draft of the research vessel in use in 1999 (i.e. the CCGS Opilio), the study area was restricted to waters exceeding 4 m in depth at Lowest Normal Tide. As a first step, all of the possible sample stations were identified based on a 2 NM X 2 NM (3.7 km X 3.7 km) grid, with a reference coordinate of 46° 30.000' North and 64° 00.000' West (Figure 2). From 1999 to 2011, variations in lobster catches across the study area warranted the use of a random-block design, similar to a stratified sampling plan, to minimize the variance of density estimates and facilitate kriging. Approximately equal-sized strata (i.e. blocks) were established, based on bathymetry and sediment type. Initially, five strata (numbered 1 to 5) were used in 1999 and 2000 when the survey area was restricted to LFA 25. In 2001, stratum 4 was split between strata 3 and 5 and all data from 1999 and 2000 were re-assigned to their new respective stratum. Over the years, five additional strata (numbered 6 to 10) were added as the study area expanded

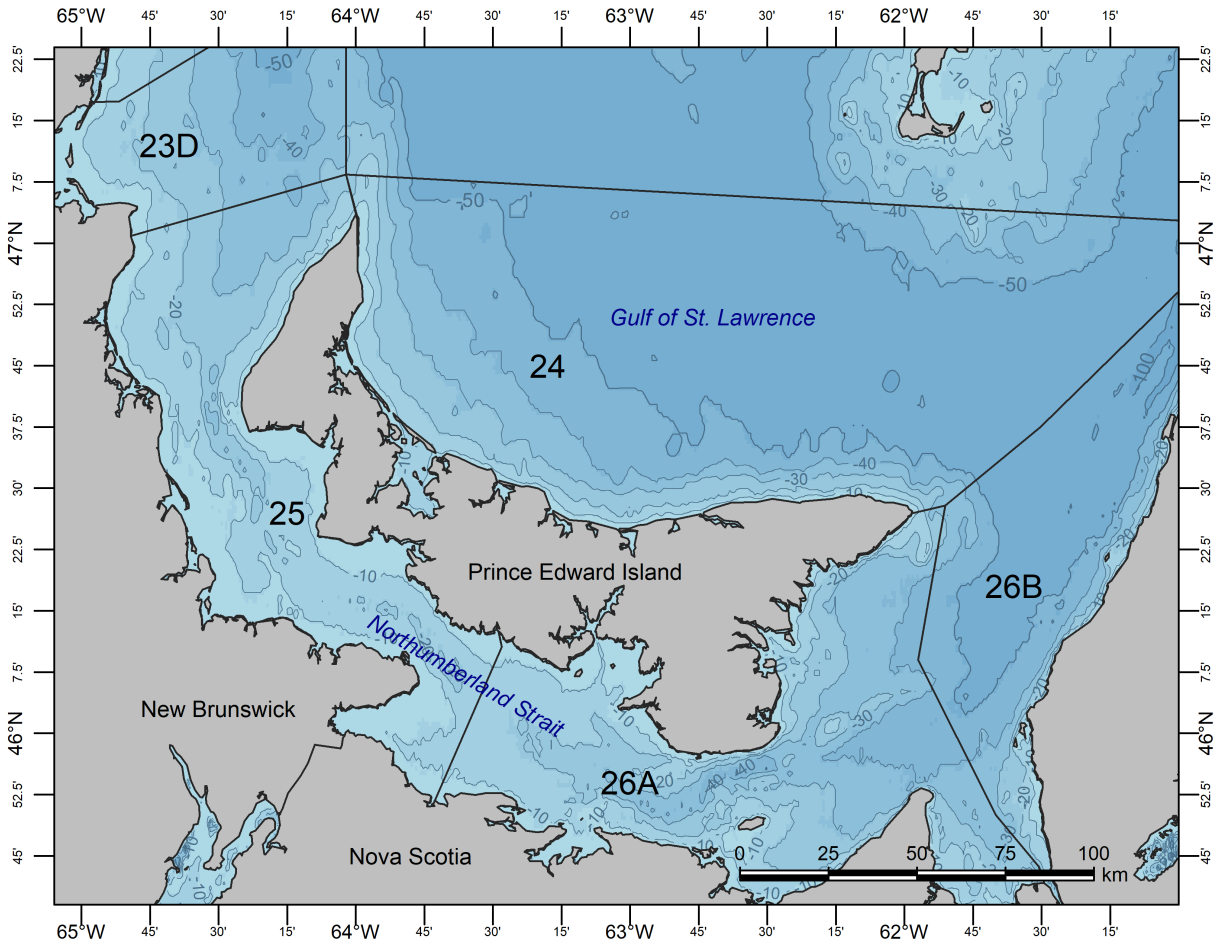

Figure 1. Northumberland Strait in the southern Gulf of St. Lawrence and locations of Lobster Fishing Areas [23 (sub-area D), 24, 25, 26A and 26B] in the southern Gulf of St. Lawrence.

eastward into LFA 26A and, in 2005 only, a portion of LFA 26B (Figures 2 and 3). Stratum 8 was never sampled, partly to avoid impacts on a spawning aggregation of white hake (*Urophycis tenuis*) (Swain et al. 2016), and partly due to vessel logistical constraints. From 2010 to 2018, a consistent study area was used which included all of LFA 25 and most of LFA 26A.

The approach to station selection changed over the course of the survey. From 1999 to 2009, to ensure even sampling, 30 to 40 stations were randomly selected from each stratum (Hanson 2001; Comeau et al. 2008). Prior to the 2010 survey, analyses were completed to determine if the number of stations could be reduced, thus reducing the costs of the survey, while maintaining the accuracy and precision of the survey results (DFO, unpublished data). Consequently, in 2010 and 2011, while strata were also used in station selection, the sampling intensity was reduced to a total of 110 stations across the study area. By 2012, as lobster catches had increased throughout the study area, and the research objectives had expanded to a multi-species survey, strata were no longer used in stations selection. Instead, from 2012 to 2018, a random sample was used whereas the stations to sample were randomly selected from all possible stations. From 2010 to 2017, the sampling plan targeted 110 stations annually. In 2018, the survey plan

was reduced to 100 stations in expectation that a portion of the survey time would be dedicated to testing a new trawl (the new trawl was not used until 2019).

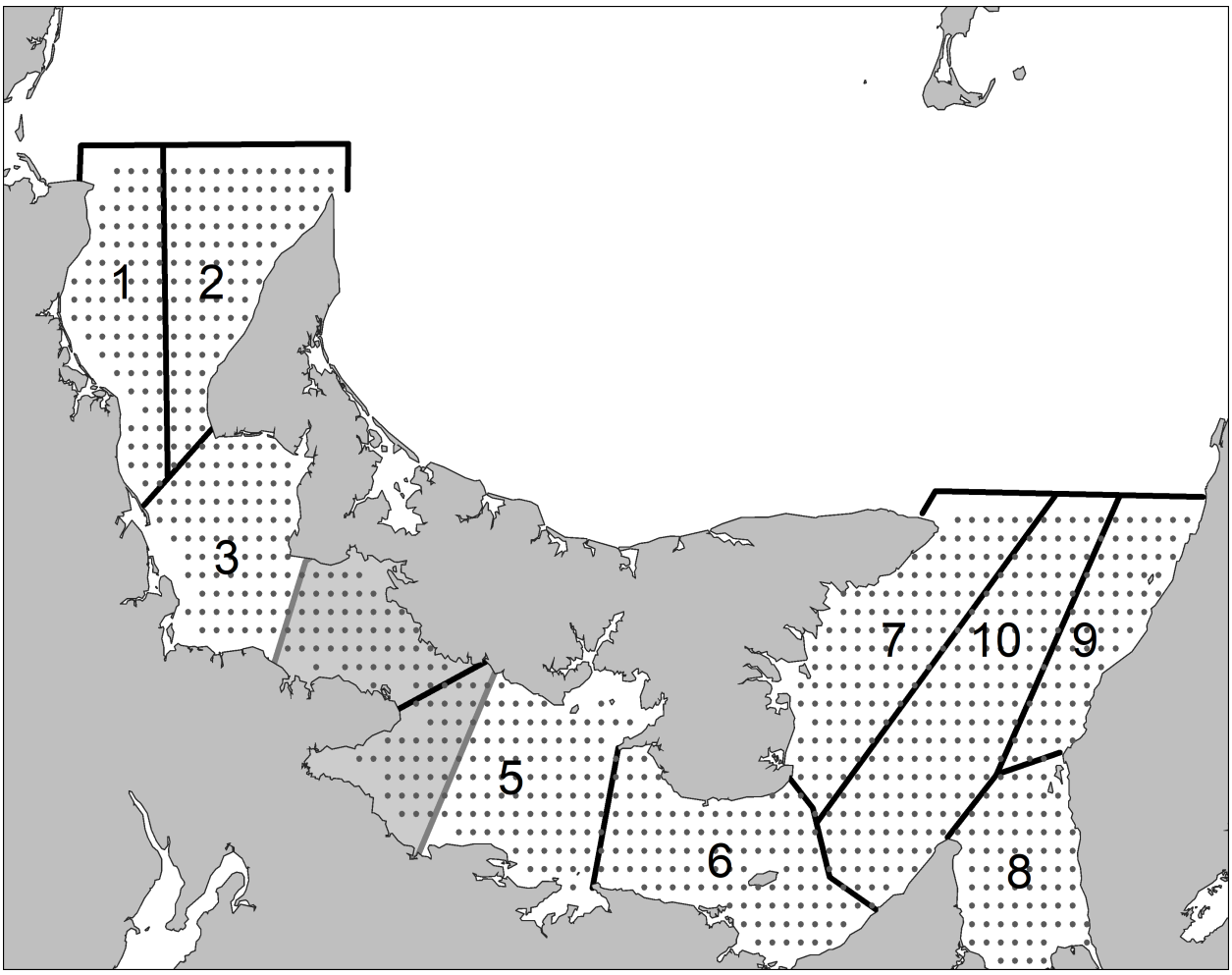

Figure 2. Northumberland Strait multi-species bottom trawl survey strata (bold black lines) and stations (grey points). These strata were used for station selection from 2001 to 2011. Stratum 4, used in 1999 and 2000 only, is shown in light grey.

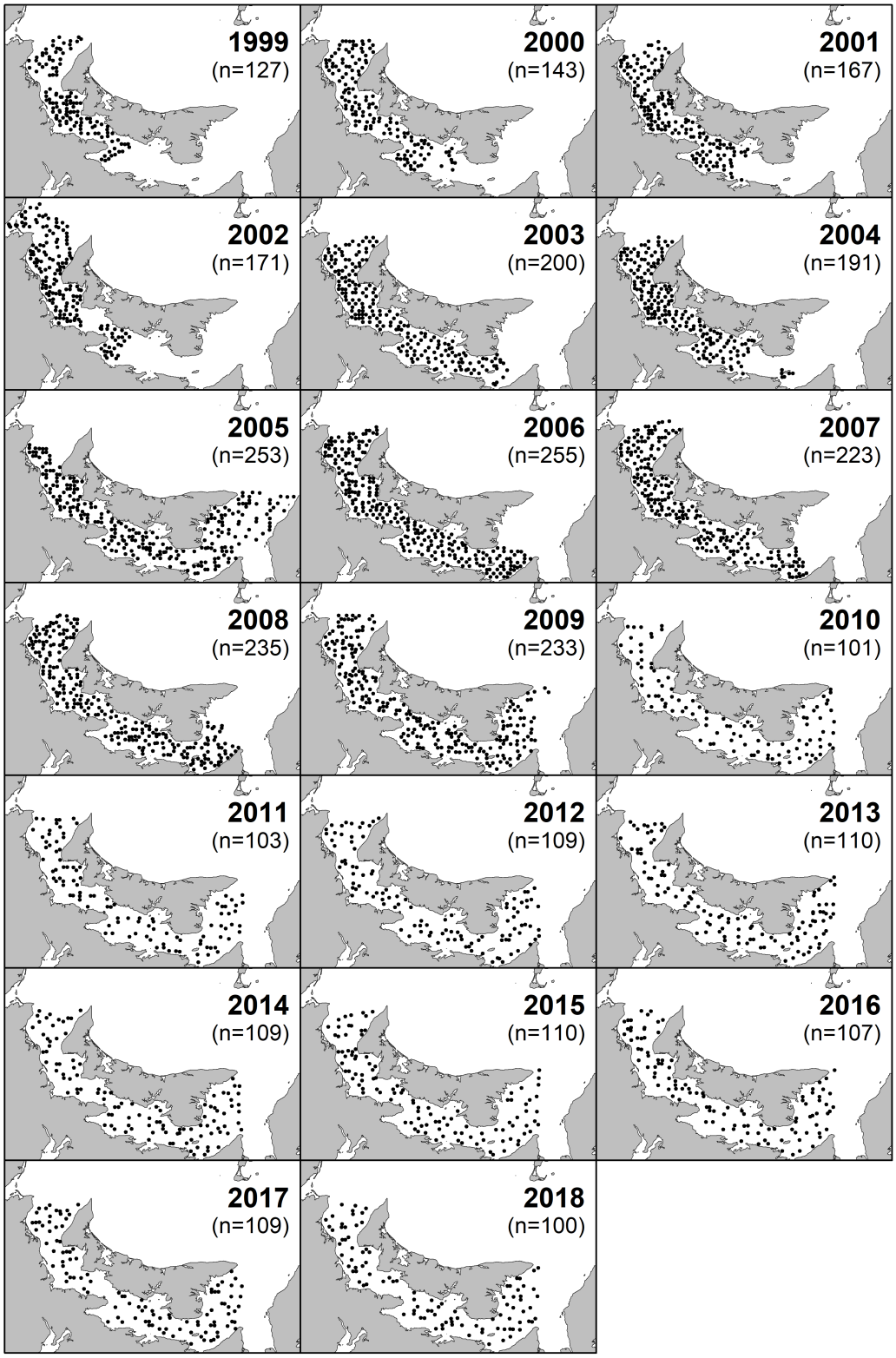

Figure 3. Stations sampled from 1999 to 2018 for the Northumberland Strait multi-species bottom trawl survey.

2.3 Field methods

Field methods varied throughout the years due to logistical limitations (e.g. weather and changes to Canadian Coast Guard vessels) and changes to survey objectives (e.g. from a focus on lobster to a multi-species survey). These include changes to the survey trawl, survey effort (i.e. number of sets and set duration), vessel and vessel speed (Table 1). In all years, sampling was completed annually over two to five weeks in July and August, between 6:00 and 18:00 daily local time (i.e. ADT). The survey was initially completed as 'pilot' surveys in 1999 and 2000 (Hanson 2001). In 1999, as a 1975 survey had successfully used a beam trawl to sample shellfish in Northumberland Strait (Caddy et al. 1977), a 4.2 m beam trawl was used (Hanson 2001). At each station, the net was towed for 10 minutes at a speed of 3 kts (5.6 km/hr). In 2000, a number 286 otter trawl equipped with "rockhopper" footgear was used (Hanson 2001). Otter trawl doors were not available at the time and Bigounden Nephrops doors were used . At each station, the net was towed for 15 minutes (brake lock to brake release) at 2.5 kts (4.6 km/hr). From 2001 to 2009 and from 2012 to 2018, the survey consistently used a number 286 otter trawl equipped with rubber "rock-hopper" footgear and otter trawl doors (Comeau et al. 2008; Rondeau et al. 2014a). At each station, the trawl was towed for 15 minutes (brake lock to brake release) at a speed of about 2.5 kts (4.6 km/hr). In 2010 and 2011, in an attempt to increase the capture of Atlantic rock crab, a Bigouden Nephrops trawl was used (Rondeau et al. 2014a). At each station, the trawl was towed for 5 minutes (brake lock to brake release) at a speed of about 1.5 kts (2.8 km/hr) and 2.0 kts (3.7 km/hr) in 2010 and 2011, respectively.

When possible, the trawl was equipped with sensors (e.g. Marport, SCANMAR) to provide measurements of wing spread or door spread. For example, for 2002 and part of 2003, wing width was recorded at 5, 10 and 15 minutes into each tow based on measurements from SCANMAR sensors (Comeau et al. 2008). When available, the measurements were recorded manually by a technician from a digital display aboard the research vessel.

Generally, a set was considered valid if the trawl was towed for the full set duration and the trawl was not torn or obstructed. At times, lobster or rock crab traps entered the net, but if these did not rip the trawl, block the trawl, result in the doors closing or the vessel slowing, the set was valid. If the trawl ripped, got hung up or the set was cut short, the set was declared "Null". If a set was declared "Null", generally, another attempt was made to trawl the station, unless the crew determined the ground was un-suitable for trawling. In these cases, a nearby alternative station was selected and trawled. At the end of each set, the net was checked for rips, the cod-end was opened and the catch was emptied into plastic bins. Any lobsters, crabs or fish caught in the net were removed manually and added to the catch.

For most sets in the dataset, the full catch was sorted to species, or lowest taxonomic group possible, and weighed. From 1999 to 2013, certain sets were sub-sampled prior to sorting, or partially sorted and then sub-sampled. In cases of sub-sampling prior to sorting, the full catch was first weighed and the sub-sample was taken and sorted. The catch weights for the individual species were adjusted after the fact based on the ratios of the weights of the species in the sub-sample. In 2010 and 2011, when a Bigouden Nephrops trawl was used, the catch from certain sets contained large amounts of substrate (e.g. mud) and small biological material (e.g. shells), which precluded a complete sort of the catch. In these cases, the full catch was sub-sampled visually by an estimated volume (e.g. one quarter or half of the catch). The sub-sample was then rinsed as needed and sorted to species. The weights of the sorted sub-samples were then used

to estimate the total catch weights.

From 2005 to 2018, random sub-sampling (e.g. 'Dutch shuffle') of fish was used at times when more than approximately 200 individuals of one species were caught in a set. Beginning in 2017, sub-sampling was used at times for large lobster catches, above approximately 50 kg in a set.

After the catch was sorted and weighed, detailed sampling was completed for species of interest. As lobster and crab were the main targets of the survey, consistent detailed sampling was completed throughout the survey period (1999-2018). For lobster, carapace length (to the mm) and sex were recorded. For female lobster, the presence or absence of eggs was noted and, starting in 2010, the stage of development of the eggs (i.e. new or old) when present was also recorded. Carapace condition (i.e. stage of moult) was recorded starting in 2010. Similarly, for crabs, the carapace width and sex were recorded as was the presence or absence of eggs (for females). Starting in 2010, the stage of development of the eggs (i.e. new or old) when present and the carapace condition (i.e. stage of moult) were also recorded.

Fish sampling was inconsistent until 2005. From 2005 to 2018, with the exception of Atlantic herring (*Clupea harengus*) fish length was measured on a 0.5 cm offset board to the nearest larger centimeter. Fork length or total length was measured, dependent on tail shape [e.g. fork length for cod species, total length for winter flounder (*Pseudopleuronectes americanus*)]. From 2005 to 2009, Atlantic herring were measured in this same manner, also on a 0.5 cm offset board. From 2010 to 2018 sampling of Atlantic herring was modified to the approach used on other surveys, and they were measured on a herring board with a pinched tail, to the lower 0.5 cm. In 2017 and 2018, in addition to length, the disk width of winter skate (*Leucoraja ocellata*) was also measured. In all years, alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) were not seperated. They were recorded together and are reported here under the common name 'gaspereau'.

Beginning in 2010, the presence of other species in the tow was also recorded (e.g. jellyfish, shrimp, seaweed, molluscs) but weights do not necessarily represent the total catch as certain invertebrates were not fully removed from the net between tows (e.g. jellyfish were left in the net if they did not fall out). Similarly, the weight measurements of very small individuals (e.g. small shrimp) may also be negatively biased as these were not necessarily fully sorted and weighed. In 2010 and 2011 only, the objective was to complete an ecosystem survey, including the sorting and weighing of all of invertebrates in the catch consistently.

From 2001 to 2018 bottom temperature data were collected during sets through the use of a temperature logger (e.g. a HOBO minilogger or a Vemco minilog) on the cod end or temperature sensors on the Marport door sensors.

Additional biological samples were collected for specific projects as requested by DFO researchers (e.g. Bernier et al. 2009; Voutier and Hanson 2008; Hanson et al. 2014). Conductivity, Temperature and Depth (CTD) casts were completed at each station from 2005 to 2018. In 2017 and 2018, water samples were collected for Total Inorganic Carbon at approximately 40 stations annually.

2.4 Data management

Catch and set data are stored in a DFO network database (i.e. Oracle) and can be accessed by Gulf Region DFO employees. CTD data are stored by the oceanography group at the DFO Maurice Lamontagne Institute, Mont-Joli, Québec. Catch data from 2000 to 2018 are available to the public through the Government of Canada Open Government initiative.

2.5 Data processing

Data manipulation and graphing were completed in R (R Core Team 2019). Data were checked for errors (e.g. male lobsters with eggs, unrealistic size measurements). Catches of non-marine life (i.e. rock, mud, wood, garbage) were removed from further analysis. Two duplicated invertebrate species or species groups in the database were combined: “sea squirts” and “adult ascidians”; “large polychaete” and “bristle worms”. Catches identified as Atlantic cod (*Gadus morhua*), Greenland cod (*Gadus ogac*) and the more general cod (unspecified) (unspecified *Gadidae* sp., used for cod specimens <15 cm fork length) were combined due to the small size of *Gadus* species cod captured during the survey and the difficulties in differentiating between small (i.e. <20 cm fork length) Atlantic cod and Greenland cod (Methven and McGowan 1998). These are reported together as cod (unspecified). Catches of Atlantic tomcod (*Microgadus tomcod*) and the solo specimen identified as an Arctic cod (*Boreogadus saida*) were not combined with these but small individuals of these species (i.e. <15 cm fork length) may also have been recorded under cod (unspecified) during surveys. Catches of northern sand lance (*Ammodytes dubius*) were combined with those of the more general sand lance (*Ammodytes* sp.) due to difficulties in differentiating between Northern sand lance and American sand lance (*Ammodytes americanus*) and the overlap in the ranges of the two closely related species (Staudinger et al. 2020).

For all species recorded from 1999 to 2018, the number of years with records and the total catch weight (kg) were calculated. For species where individuals were counted consistently, the number of years when more than 10 individuals were recorded and the total number of individuals recorded (1999-2018) were calculated.

Catch data (weights and numbers of individuals) were standardized to the target set distance of 0.5 NM (0.926 km) in 1999; 0.625 NM (1.158 km) for 2000 to 2009 and 2012 to 2018; 0.12 NM (0.222 km) in 2010 and 0.18 NM (0.333 km) in 2011. The standardized catch data were used to graph the relative densities of the most common species or species groups, by weight. The annual probability of occurrence of a species (i.e. the number of sets with records divided by the total number of sets) was calculated. When the catch was sub-sampled, frequency data were further adjusted to represent the full catch by multiplying by the quotient of the weight caught divided by the weight sampled. The standardized and adjusted data were used to graph the length frequencies of species with captures of a minimum of 10 individuals in a minimum of 18 years of survey.

Table 1. Northumberland Strait Multi-Species bottom trawl survey methods, 1999 to 2018.

Year	Start date	End date	Days fishing	Vessel	Trawl	Valid sets	Null sets[a]	Target set duration (min)	Target speed (kts)	Average distance (SD) (naut. miles)	Average catch (SD) (kg)
1999	1999-07-06	1999-07-28	15	CCGS Opilio	4.2 m beam	127	8	10	3.0	0.48 (0.05)	6 (4)
2000	2000-07-25	2000-08-07	14	CCGS Opilio	No. 286 otter[b]	143	3	15	2.5	0.64 (0.08)	11 (20)
2001	2001-07-19	2001-08-10	17	CCGS Opilio	No. 286 otter	167	NA	15	2.5	0.65 (0.06)	20 (36)
2002	2002-07-18	2002-08-10	18	CCGS Opilio	No. 286 otter	171	NA	15	2.5	0.63 (0.07)	15 (16)
2003	2003-07-15	2003-08-15	25	CCGS Opilio	No. 286 otter	200	2	15	2.5	0.64 (0.07)	15 (16)
2004	2004-07-26	2004-08-18	21	CCGS Opilio	No. 286 otter	191	NA	15	2.5	0.64 (0.06)	19 (96)
2005	2005-07-26	2005-08-29	30	CCGS Opilio	No. 286 otter	253	2	15	2.5	0.60 (0.08)	15 (34)
2006	2006-07-19	2006-08-23	33	CCGS Opilio	No. 286 otter	255	1	15	2.5	0.60 (0.07)	27 (27)
2007	2007-07-19	2007-08-25	30	CCGS Opilio	No. 286 otter	223	NA	15	2.5	0.60 (0.06)	20 (18)
2008	2008-07-17	2008-08-24	30	CCGS Opilio	No. 286 otter	235	2	15	2.5	0.63 (0.15)	29 (79)
2009	2009-07-08	2009-08-19	36	CCGS Opilio	No. 286 otter	233	1	15	2.5	0.63 (0.07)	23 (63)
2010	2010-07-14	2010-08-08	22	CCGS Opilio	Bigouden Nephrops	101	1	5	1.5	0.12 (0.01)	17 (21)
2011	2011-07-21	2011-08-26	22	CCGS Opilio	Bigouden Nephrops	103	4	5	2.0	0.18 (0.03)	23 (20)
2012	2012-07-17	2012-08-11	20	CCGS M. Perley	No. 286 otter	109	1	15	2.5	0.62 (0.03)	22 (62)
2013	2013-07-17	2013-08-13	19	CCGS M. Perley	No. 286 otter	110	1	15	2.5	0.61 (0.05)	24 (33)
2014	2014-07-16	2014-08-09	19	CCGS M. Perley	No. 286 otter	109	NA	15	2.5	0.60 (0.03)	22 (31)
2015	2015-07-15	2015-08-08	20	CCGS M. Perley	No. 286 otter	110	NA	15	2.5	0.63 (0.03)	23 (29)
2016	2016-07-12	2016-08-06	20	CCGS M. Perley	No. 286 otter	107	NA	15	2.5	0.63 (0.02)	34 (55)
2017	2017-07-12	2017-08-02	19	CCGS M. Perley	No. 286 otter	109	4	15	2.5	0.63 (0.02)	35 (41)
2018	2018-07-10	2018-07-30	20	CCGS M. Perley	No. 286 otter	100	2	15	2.5	0.63 (0.02)	31 (36)

[a] NA values indicate that null sets were not recorded.

[b] Bigouden Nephrops doors were used with the No. 286 otter trawl in 2000.

3 Results

The Northumberland Strait multi-species bottom trawl survey dataset contains records of 60 fish species or species groups and 156 invertebrates or invertebrate species groups. American lobster is the most captured species, accounting for nearly 40% of the overall catch by weight.

For all species recorded (1999 to 2018), the number of years with records and the total catch weight (kg) are presented in Table 2. For species where individuals were counted consistently, the number of years when more than 10 individuals were recorded and the total number of individuals recorded (1999-2018) are also presented.

Species' relative densities (kg/tow) were plotted by year for the three most captured crustacean species [in alphabetical order by common name: American lobster (*Homarus americanus*), Figures 4 to 7; Atlantic rock crab (*Cancer irroratus*), Figures 8 to 11; lady crab (*Ovalipes ocellatus*), Figures 12 to 15] and the 16 most captured species (or species groups) of fish [in alphabetical order by common name: American plaice (*Hippoglossoides platessoides*), Figures 16 to 19; Atlantic herring (*Clupea harengus*), Figures 20 to 23; Atlantic mackerel (*Scomber scombrus*), Figures 24 to 27; Atlantic tomcod (*Microgadus tomcod*), Figures 28 to 31; cod (Gadidae), Figures 32 to 35; cunner (*Tautogolabrus adspersus*), Figures 36 to 39; gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*), Figures 40 to 43; longhorn sculpin (*Myoxocephalus octodecemspinosus*), Figures 44 to 47; rainbow smelt (*Osmerus mordax*), Figures 48 to 51; sand lance (*Ammodytes* sp.), Figures 52 to 55; shorthorn sculpin (*Myoxocephalus scorpius*), Figures 56 to 59; white hake (*Urophycis tenuis*), Figures 60 to 63; windowpane flounder (*Scophthalmus aquosus*), Figures 64 to 67; winter flounder (*Pseudopleuronectes americanus*), Figures 68 to 71; winter skate (*Leucoraja ocellata*), Figures 72 to 75; yellowtail flounder (*Limanda ferruginea*), Figures 76 to 79.

Length frequencies were plotted by year for crustacean and fish species with 10 or more individuals captured in 18 or more years of the survey. These include three crustacean species [in alphabetical order by common name: American lobster (*Homarus americanus*), Figure 80; Atlantic rock crab (*Cancer irroratus*), Figure 81; lady crab (*Ovalipes ocellatus*), Figure 82] and 13 fish species or species groups (e.g. cod) [in alphabetical order by common name: American plaice (*Hippoglossoides platessoides*), Figure 83; ; Atlantic herring (*Clupea harengus*), Figure 84; Atlantic mackerel (*Scomber scombrus*), Figure 85; cod (*Gadidae*), Figure 86; cunner (*Tautogolabrus adspersus*), Figure 87; gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*), Figure 88; longhorn sculpin (*Myoxocephalus octodecemspinosus*), Figure 89; rainbow smelt (*Osmerus mordax*), Figure 90; white hake (*Urophycis tenuis*), Figure 91); windowpane flounder (*Scophthalmus aquosus*), Figure 92; winter flounder (*Pseudopleuronectes americanus*), Figure 93; winter skate (*Leucoraja ocellata*), Figure 94; yellowtail flounder (*Limanda ferruginea*), Figure 95.

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018.

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
12	126504	White hake	*Urophycis tenuis*	20	18	1,114	232
14	158962	Silver hake	*Merluccius bilinearis*	2	0	2	1
16	126441	Pollock	*Pollachius virens*	2	0	2	2
17	158928	Atlantic tomcod	*Microgadus tomcod*	18	16	969	87
23	126175	Redfish (unspecified)	*Sebastes sp.*	1	0	1	<0.5
30	127138	Atlantic halibut	*Hippoglossus hippoglossus*	13	0	36	68
31	127144	Greenland halibut	*Reinhardtius hippoglossoides*	5	0	7	1
40	127137	American plaice	*Hippoglossoides platessoides*	20	19	6,090	580
41	127136	Witch flounder	*Glyptocephalus cynoglossus*	1	0	3	2
42	158879	Yellowtail flounder	*Limanda ferruginea*	20	19	10,474	660
43	158885	Winter flounder	*Pseudopleuronectes americanus*	20	20	127,484	7,967
60	126417	Atlantic herring	*Clupea harengus*	19	19	393,646	12,779
61	158670	American shad	*Alosa sapidissima*	11	2	204	72
62	158669	Gaspereau	*Alosa pseudoharengus, Alosa aestivalis*	18	18	19,830	1,873
63	126737	Rainbow smelt	*Osmerus mordax*	20	20	345,589	6,286
64	126735	Capelin	*Mallotus villosus*	6	1	112	1
65	127186	Atlantic salmon	*Salmo salar*	3	1	72	14
70	127023	Atlantic mackerel	*Scomber scombrus*	18	18	7,157	1,077
110	126433	Arctic cod	*Boreogadus saida*	1	0	1	<0.5
114	126450	Fourbeard rockling	*Enchelyopus cimbrius*	6	0	13	<0.5
122	159785	Cunner	*Tautogolabrus adspersus*	20	20	21,349	1,116
143	158907	Windowpane flounder	*Scophthalmus aquosus*	20	20	2,960	239
201	105865	Thorny skate	*Amblyraja radiata*	1	0	4	6
204	158553	Winter skate	*Leucoraja ocellata*	20	20	2,052	1,054
220	105923	Spiny dogfish	*Squalus acanthias*	3	0	3	12
240	101174	Sea lamprey	*Petromyzon marinus*	1	0	1	<0.5
251	125469	Cod (unspecified)	*Gadidae (f.)*	20	19	24,313	647
300	159520	Longhorn sculpin	*Myoxocephalus octodecemspinosus*	20	20	5,285	645
301	127203	Shorthorn sculpin	*Myoxocephalus scorpius*	18	7	183	85
302	127198	Arctic staghorn sculpin	*Gymnocanthus tricuspis*	5	0	17	2
303	159519	Grubby	*Myoxocephalus aenaeus*	9	3	261	4
304	127205	Moustache sculpin	*Triglops murrayi*	7	5	192	2
306	127195	Arctic hookear sculpin	*Artediellus uncinatus*	1	0	3	<0.5

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. *(continued)*

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
309	126154	Sculpin (unspecified)	*Triglops sp.*	2	0	9	<0.5
311	125589	Sculpin (unspecified)	*Cottidae (f.)*	1	1	41	<0.5
314	127200	Spatulate sculpin	*Icelus spatula*	1	0	1	<0.5
318	126150	Sculpin (unspecified)	*Icelus sp.*	1	0	1	<0.5
320	159518	Sea raven	*Hemitripterus americanus*	20	17	459	149
340	159459	Alligatorfish	*Aspidophoroides monopterygius*	16	12	487	2
346	10331	Flatfish (unspecified)	*Pleuronectiformes (o.)*	1	0	9	<0.5
361	126505	Three-spined stickleback	*Gasterosteus aculeatus*	11	6	702	3
363	159436	Fourspine stickleback	*Apeltes quadracus*	1	0	1	<0.5
500	234519	Snailfish (unspecified)	*Liparidae sp.*	1	0	2	<0.5
501	127214	Lumpfish	*Cyclopterus lumpus*	10	1	37	7
502	127217	Atlantic spiny lumpsucker	*Eumicrotremus spinosus*	1	0	1	<0.5
512	159526	Dusky snailfish	*Liparis gibbus*	5	0	8	1
611	125909	Sand lance (unspecified)	*Ammodytes sp.*	18	17	45,756	474
616	127096	Fish doctor	*Gymnelus viridis*	1	0	1	<0.5
620	127107	Laval's eelpout	*Lycodes lavalaei*	1	0	3	1
621	126996	Rock gunnel	*Pholis gunnellus*	9	0	19	<0.5
622	154675	Snakeblenny	*Lumpenus lampretaeformis*	16	9	479	10
623	127072	Daubed shanny	*Leptoclinus maculatus*	14	1	101	<0.5
625	159821	Radiated shanny	*Ulvaria subbifurcata*	2	0	5	<0.5
626	159817	Fourline snakeblenny	*Eumesogrammus praecisus*	4	0	5	<0.5
630	159675	Wrymouth	*Cryptacanthodes maculatus*	10	3	56	5
631	127073	Slender eelblenny	*Lumpenus fabricii*	3	1	30	<0.5
632	127070	Stout eelblenny	*Anisarchus medius*	2	0	2	<0.5
640	159267	Ocean pout	*Zoarces americanus*	18	6	184	44
642	126104	Eelpout (unspecified)	*Lycodes sp.*	1	0	2	1
701	159828	Atlantic butterfish	*Peprilus triacanthus*	2	0	4	<0.5
1810	146420		*Tunicata (s.p.)*	3	NA	NA	<0.5
1815	103448		*Molgulidae (f.)*	1	NA	NA	<0.5
1821	103483	Sea squirt (unspecified)	*Ascidia sp.*	4	NA	NA	<0.5
1827	103828	Sea peach	*Halocynthia pyriformis*	1	NA	NA	<0.5

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. *(continued)*

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
1930	1803	Lampshell (unspecified)	*Brachiopoda (p.)*	1	NA	NA	<0.5
2100	1130		*Decapoda (o.)*	6	NA	NA	40
2200	106789		*Pandalidae (f.)*	4	NA	NA	27
2210	107044		*Pandalus sp.*	1	NA	NA	2
2211	107649		*Pandalus borealis*	3	NA	NA	<0.5
2212	107651		*Pandalus montagui*	11	NA	NA	49
2213	158351		*Atlantopandalus propinqvus*	1	NA	NA	<0.5
2220	107678		*Pasiphaea tarda*	1	NA	NA	<0.5
2312	107521		*Lebbeus polaris*	3	NA	NA	<0.5
2319	107520		*Lebbeus groenlandicus*	2	NA	NA	<0.5
2331	158359		*Eualus macilentus*	2	NA	NA	<0.5
2400	106782		*Crangonidae (f.)*	1	NA	NA	<0.5
2411	107550		*Argis dentata*	10	NA	NA	18
2414	107568		*Sclerocrangon boreas*	6	NA	NA	2
2416	107007		*Crangon sp.*	3	NA	NA	<0.5
2417	158355		*Crangon septemspinosa*	9	NA	NA	11
2421	107567		*Sabinea septemcarinata*	1	NA	NA	<0.5
2513	158057	Atlantic rock crab	*Cancer irroratus*	20	20	6,170	691
2515	106763		*Portunidae (f.)*	1	NA	NA	<0.5
2518	158436	Black fingered mud crab	*Panopeus herbstii*	6	5	82	<0.5
2520	106903	Toad crab (unspecified)	*Hyas sp.*	4	1	17	2
2521	107323		*Hyas coarctatus*	15	3	95	5
2522	106898	Spider, queen or snow crab	*Chionoecetes sp.*	1	0	3	<0.5
2526	107315	Snow crab	*Chionoecetes opilio*	12	8	297	97
2527	107322	Toad crab	*Hyas araneus*	11	3	137	16
2531	107381	Green crab	*Carcinus maenas*	1	1	15	<0.5
2535	129642		*Spirorbis sp.*	1	NA	NA	<0.5
2539	158434	Lady crab	*Ovalipes ocellatus*	20	20	3,332	453
2541	158379		*Axius serratus*	3	NA	NA	<0.5
2550	156134	American lobster	*Homarus americanus*	20	20	92,370	26,464
2561	106854		*Pagurus sp.*	4	NA	NA	3
2562	158400		*Pagurus acadianus*	3	NA	NA	1
2564	107240		*Pagurus pubescens*	1	NA	NA	7
2568	158402		*Pagurus arcuatus*	1	NA	NA	5
2600	1128	Krill	*Euphausiacea (o.)*	1	NA	NA	<0.5
2700	149668		*Mysida (o.)*	1	NA	NA	<0.5
2710	119886		*Mysis sp.*	1	NA	NA	<0.5
2711	226994		*Mysis stenolepis*	1	NA	NA	<0.5
2715	119822		*Mysidae (f.)*	1	NA	NA	<0.5

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. *(continued)*

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
2800	1135		*Amphipoda (o.)*	1	NA	NA	<0.5
2804	102108		*Neohela monstrosa*	1	NA	NA	<0.5
2811	101383		*Gammaridae (f.)*	1	NA	NA	<0.5
2819	1207		*Gammaridea (s.o.)*	2	NA	NA	<0.5
2833	101592		*Anonyx sp.*	1	NA	NA	<0.5
2839	158155		*Unciola inermis*	1	NA	NA	<0.5
2906	101417		*Hyperiidae (f.)*	1	NA	NA	<0.5
2990	1082	Barnacle (unspecified)	*Cirripedia (s.o.)*	5	NA	NA	2
2995	106057		*Balanidae (f.)*	2	NA	NA	<0.5
3100	883	Bristle worm (unspecified)	*Polychaeta (c.)*	10	NA	NA	20
3115	956		*Nephtyidae (f.)*	3	NA	NA	1
3117	967		*Lumbrineridae (f.)*	2	NA	NA	<0.5
3139	980		*Pectinariidae (f.)*	2	NA	NA	<0.5
3143	923	Bamboo worm (unspecified)	*Maldanidae (f.)*	2	NA	NA	2
3144	129437		*Pectinaria sp.*	1	NA	NA	3
3146	981		*Ampharetidae (f.)*	1	NA	NA	<0.5
3150	22496		*Nereididae (f.)*	1	NA	NA	<0.5
3170	976		*Flabelligeridae (f.)*	1	NA	NA	<0.5
3194	975		*Oweniidae (f.)*	1	NA	NA	6
3196	130544		*Owenia fusiformis*	1	NA	NA	<0.5
3200	157181		*Aphrodita hastata*	3	NA	NA	21
3300	1268		*Sipuncula (p.)*	1	NA	NA	<0.5
3314	410749		*Phascolion (Phascolion) strombus strombus*	1	NA	NA	<0.5
3451	101160		*Priapulus caudatus*	1	NA	NA	<0.5
3500	939		*Polynoidae (f.)*	7	NA	NA	<0.5
3501	130801		*Lepidonotus squamatus*	1	NA	NA	<0.5
4000	51		*Mollusca (p.)*	5	NA	NA	230
4200	101	Snails and slugs (unspecified)	*Gastropoda (o.)*	1	NA	NA	<0.5
4211	138878	Waved whelk	*Buccinum undatum*	4	2	300	12
4221	160315	Northern moonsnail	*Euspira heros*	4	0	1	2
4227	491164	New England Neptune	*Neptunea decemcostata*	4	NA	NA	6
4228	137704		*Colus sp.*	2	NA	NA	<0.5
4230	137656	Pelican's foot snail	*Aporrhais sp.*	4	NA	NA	11
4300	105		*Bivalvia (c.)*	1	NA	NA	<0.5
4304	138802	Ocean quahog	*Arctica islandica*	4	0	4	7
4307	156747		*Astarte undata*	1	NA	NA	<0.5
4313	138531		*Macoma sp.*	1	NA	NA	<0.5
4316	137683		*Astarte sp.*	2	NA	NA	<0.5
4317	156996	Atlantic surf clam	*Spisula solidissima*	2	NA	NA	<0.5
4318	140430	Softshell clam	*Mya arenaria*	3	NA	NA	<0.5
4319	140103	Arctic hiatella	*Hiatella arctica*	2	NA	NA	<0.5

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. *(continued)*

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
4320	213	Scallop (unspecified)	*Pectinidae (f.)*	5	0	8	1
4321	156972	Sea scallop	*Placopecten magellanicus*	7	3	141	30
4322	140692	Iceland scallop	*Chlamys islandica*	1	0	2	<0.5
4326	140657	American cupped oyster	*Crassostrea virginica*	1	NA	NA	<0.5
4328	214		*Anomiidae (f.)*	1	NA	NA	<0.5
4329	243		*Veneridae (f.)*	1	NA	NA	<0.5
4330	211	Mussels (unspecified)	*Mytilidae (f.)*	1	NA	NA	<0.5
4331	140480	Blue mussel	*Mytilus edulis*	6	NA	NA	4
4332	140467	Northern horsemussel	*Modiolus modiolus*	8	NA	NA	29
4334	140474		*Musculus niger*	1	NA	NA	<0.5
4340	229	Cockle (unspecified)	*Cardiidae (f.)*	1	NA	NA	<0.5
4342	139000	Iceland cockle	*Ciliatocardium ciliatum*	2	NA	NA	1
4343	582749	Greenland cockle	*Serripes groenlandicus*	2	NA	NA	3
4349	NA	Scallop, empty (unspecified)	*Pectinidae sp. empty*	1	NA	NA	<0.5
4350	204	Nut clam (unspecified)	*Nuculidae (f.)*	1	NA	NA	<0.5
4351	138259		*Nuculana sp.*	3	NA	NA	<0.5
4352	156923	Thin nut clam	*Nuculana tenuisulcata*	1	NA	NA	<0.5
4354	138672		*Yoldia sp.*	5	NA	NA	5
4355	156863	Arctic surfclam	*Mactromeris polynyma*	1	NA	NA	1
4357	141983	Broad yoldia	*Megayoldia thraciaeformis*	2	NA	NA	13
4359	156859	Ribbed mussel	*Geukensia demissa*	1	NA	NA	<0.5
4380	156737		*Anomia simplex*	2	NA	NA	<0.5
4381	137650		*Anomia sp.*	1	NA	NA	<0.5
4400	1762	Sea slug (unspecified)	*Nudibranchia (o.)*	4	NA	NA	<0.5
4511	153087	Northern shortfin squid	*Illex illecebrosus*	12	9	512	51
4515	138278		*Illex sp.*	1	NA	NA	<0.5
4700	55	Chitons (unspecified)	*Polyplacophora (c.)*	1	NA	NA	<0.5
5100	1302	Sea spider (unspecified)	*Pycnogonida sp.*	2	NA	NA	<0.5
5201	160233	Striate cup-and-saucer	*Crucibulum striatum*	2	NA	NA	<0.5
5202	138963	Common Atlantic slipper shell	*Crepidula fornicata*	1	NA	NA	<0.5

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. *(continued)*

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
5500	152391		*Nemertea (p.)*	2	NA	NA	<0.5
6100	123080		*Asteroidea (s.o.)*	3	NA	NA	7
6110	123219		*Asterias sp.*	13	NA	NA	60
6113	125154		*Leptasterias (Hexasterias) polaris*	5	NA	NA	2
6115	123915	Mud star	*Ctenodiscus crispatus*	9	NA	NA	179
6118	123276	Blood star (unspecified)	*Henricia sp.*	8	NA	NA	2
6119	123974	Fat blood star	*Henricia sanguinolenta*	8	NA	NA	5
6121	124160	Purple sunstar	*Solaster endeca*	10	NA	NA	96
6123	124154	Red spiny sunstar	*Crossaster papposus*	9	NA	NA	31
6200	123084	Brittle star (unspecified)	*Ophiuroidea (s.o.)*	6	NA	NA	2
6211	125125	Daisy brittle star	*Ophiopholis aculeata*	4	NA	NA	<0.5
6212	123574		*Ophiura sp.*	8	NA	NA	772
6213	124934		*Ophiura sarsii*	2	NA	NA	<0.5
6215	124933		*Ophiura robusta*	4	NA	NA	40
6300	242196	Basket star (unspecified)	*Gorgonocephalidae, asteronychidae f.*	7	NA	NA	4
6397	123082	Sand dollars and urchins (unspecified)	*Echinoidea (c.)*	1	NA	NA	<0.5
6400	123390	Sea urchin (unspecified)	*Strongylocentrotus sp.*	9	NA	NA	1
6411	124321		*Strongylocentrotus droebachiensis*	6	NA	NA	20
6500	123100	Sand dollar (unspecified)	*Clypeasteroida (o.)*	4	NA	NA	<0.5
6511	158062		*Echinarachnius parma*	9	NA	NA	17
6600	123083	Sea cucumber (unspecified)	*Holothuroidea (c.)*	10	NA	NA	29
6601	124655		*Pentamera calcigera*	1	NA	NA	1
6611	124612	Northern sea cucumber	*Cucumaria frondosa*	3	NA	NA	2
6713	124703	Scarlet psolus	*Psolus fabricii*	1	NA	NA	<0.5
6715	124710		*Psolus phantapus*	1	NA	NA	<0.5
6718	123540		*Molpadia sp.*	3	NA	NA	1
8010	135306	Moon jelly	*Aurelia aurita*	1	NA	NA	28
8208	1360		*Actiniaria (c.)*	2	NA	NA	5
8300	1292		*Anthozoa (c.)*	11	NA	NA	61
8324	156103	Sea strawberry	*Gersemia rubiformis*	8	NA	NA	1
8400	1337		*Hydrozoa (c.)*	3	NA	NA	2
8500	135220	Jellyfish (unspecified)	*Scyphozoa (c.)*	12	NA	NA	400
8511	135301	Lion's mane jellyfish	*Cyanea capillata*	4	NA	NA	35

Table 2. Complete species list and summary information from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. *(continued)*

Species code[a]	Aphia ID	Common name	Scientific name	Number of years recorded (1999-2018)	Number of years with 10 or more individuals recorded (1999-2018)	Total count	Total catch (kg)
8600	558	Sponge (unspecified)	*Porifera*	10	NA	NA	210
8610	132046		*Polymastia sp.*	2	NA	NA	<0.5
8611	134193		*Polymastia bartletti*	3	NA	NA	<0.5
8621	132833	Eyed finger sponge	*Haliclona (Haliclona) oculata*	6	NA	NA	26
8623	165853	Breadcrumb sponge	*Halichondria (Halichondria) panicea*	2	NA	NA	<0.5

[a] Species identification code used in the Oracle database, Fisheries and Oceans Canada, Gulf Region.

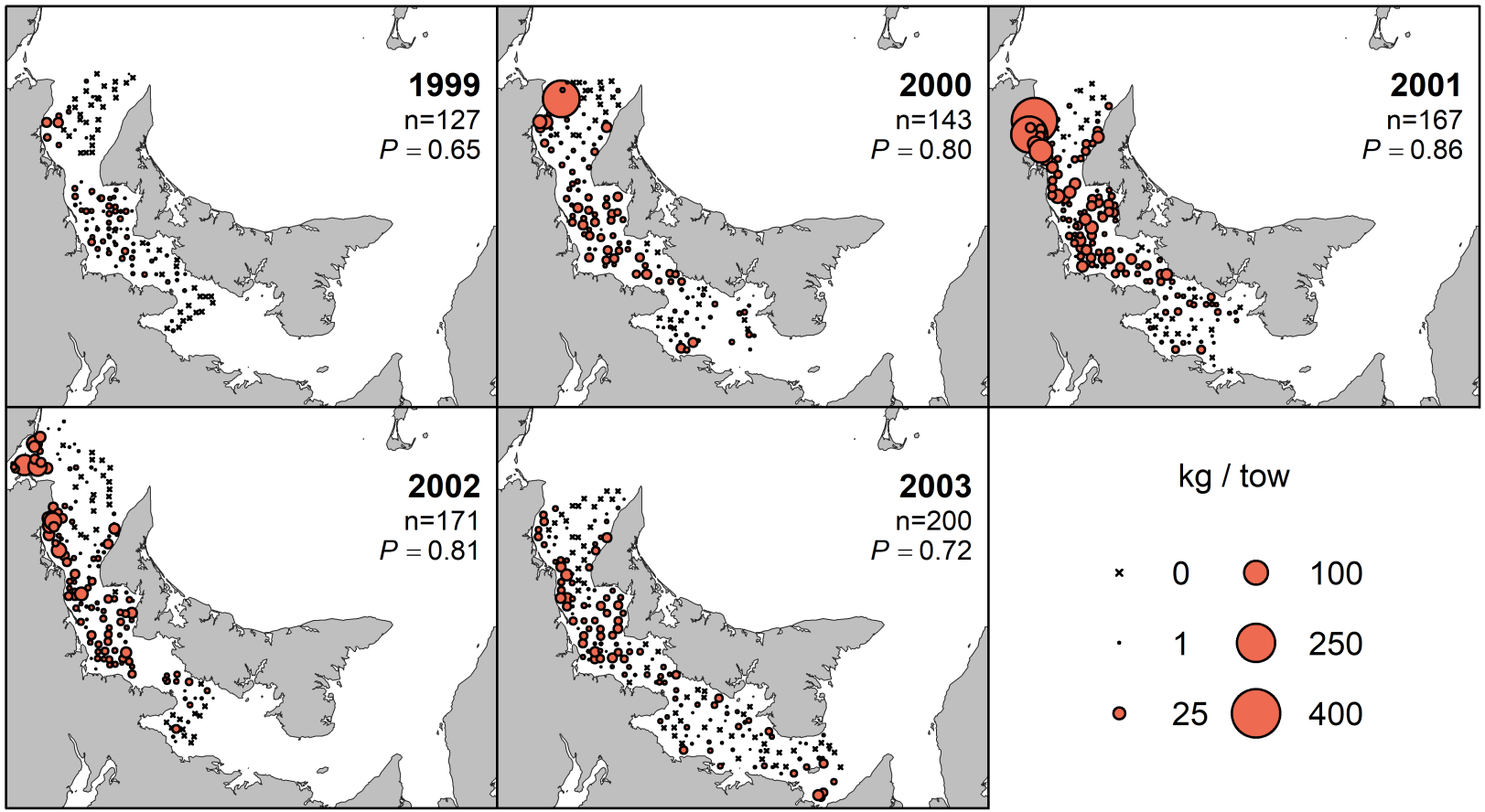

Figure 4. Relative density (kg/tow) of American lobster (*Homarus americanus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

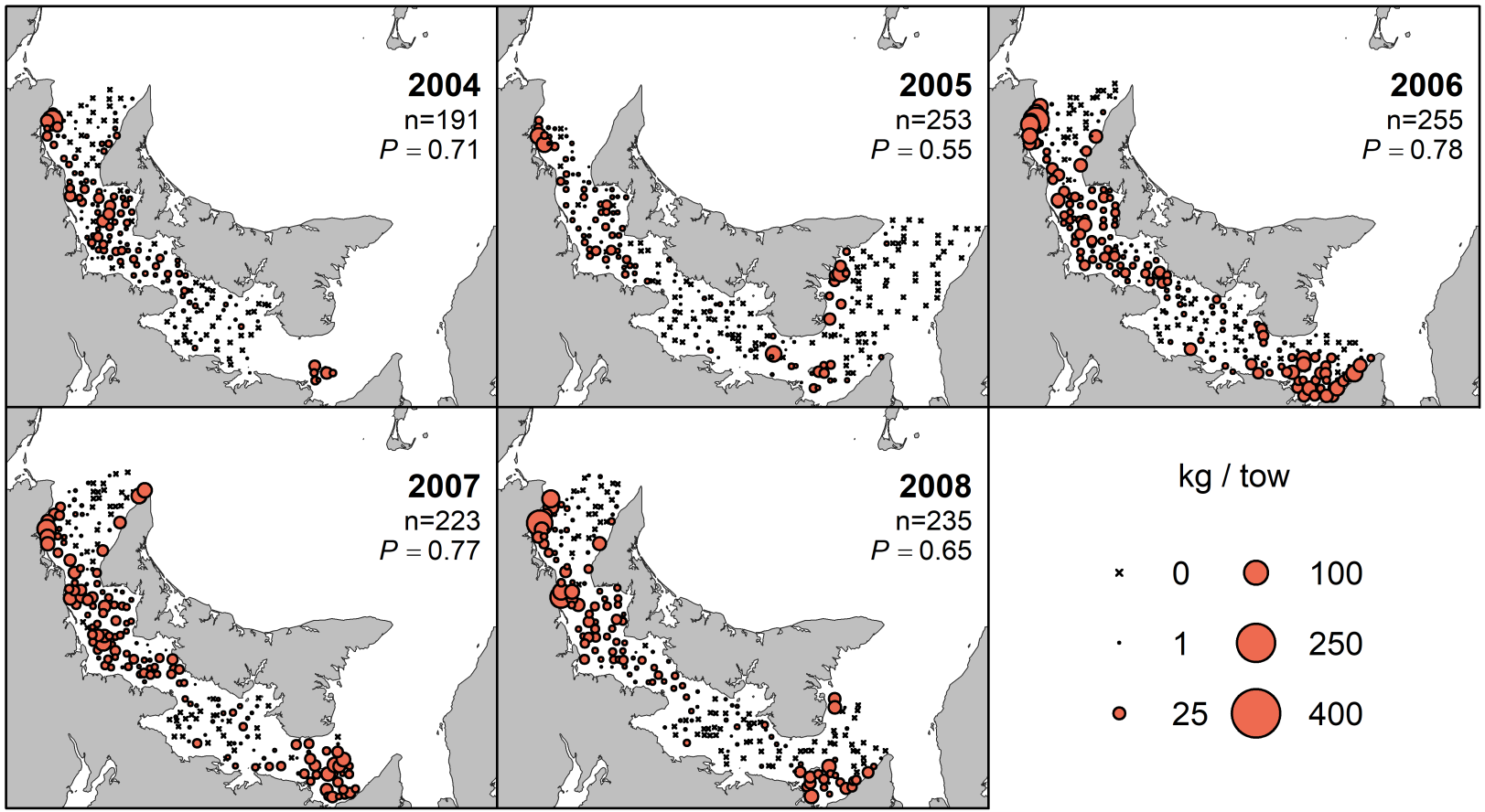

Figure 5. Relative density (kg/tow) of American lobster (*Homarus americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

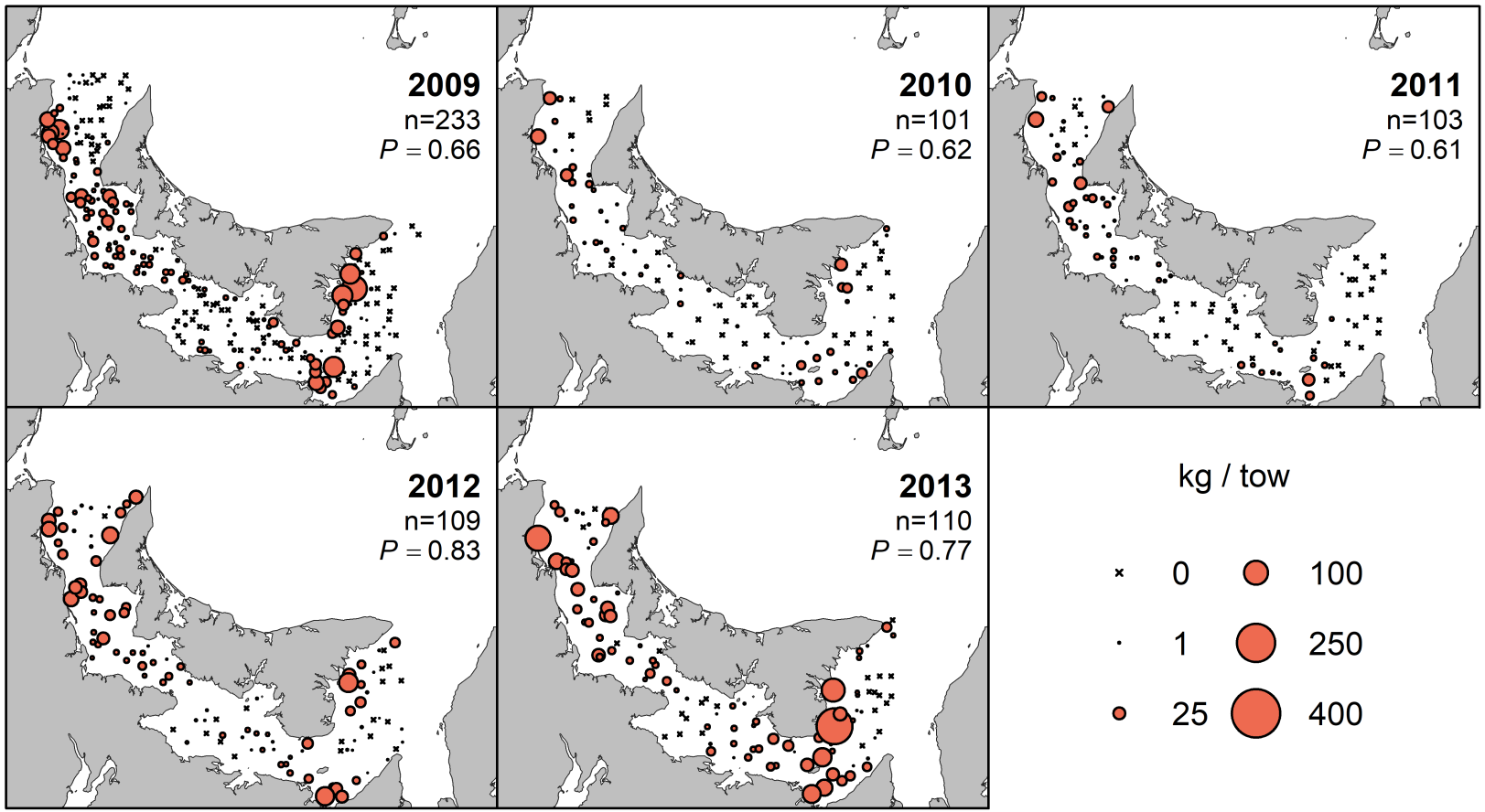

Figure 6. Relative density (kg/tow) of American lobster (*Homarus americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

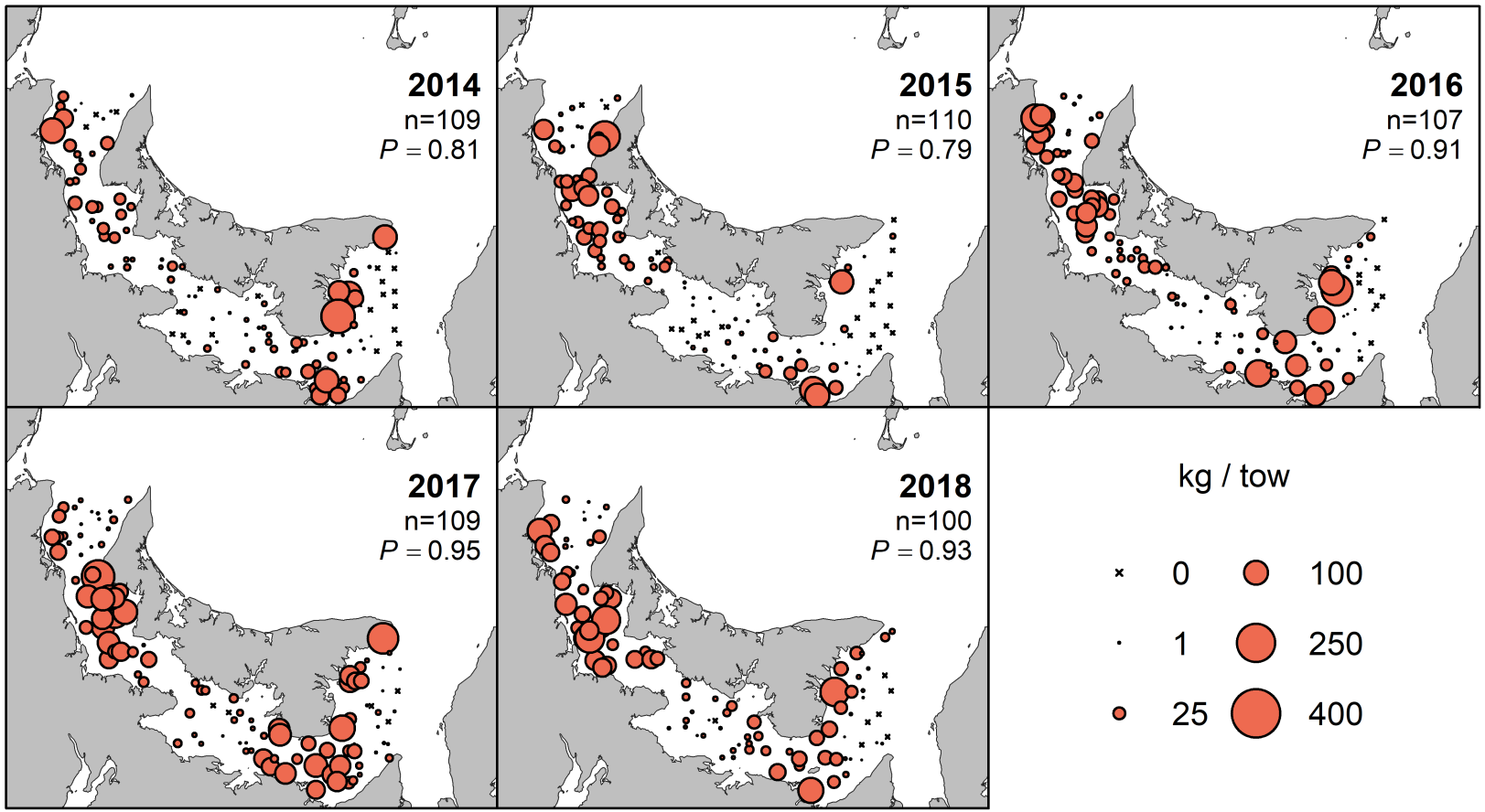

Figure 7. Relative density (kg/tow) of American lobster (*Homarus americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

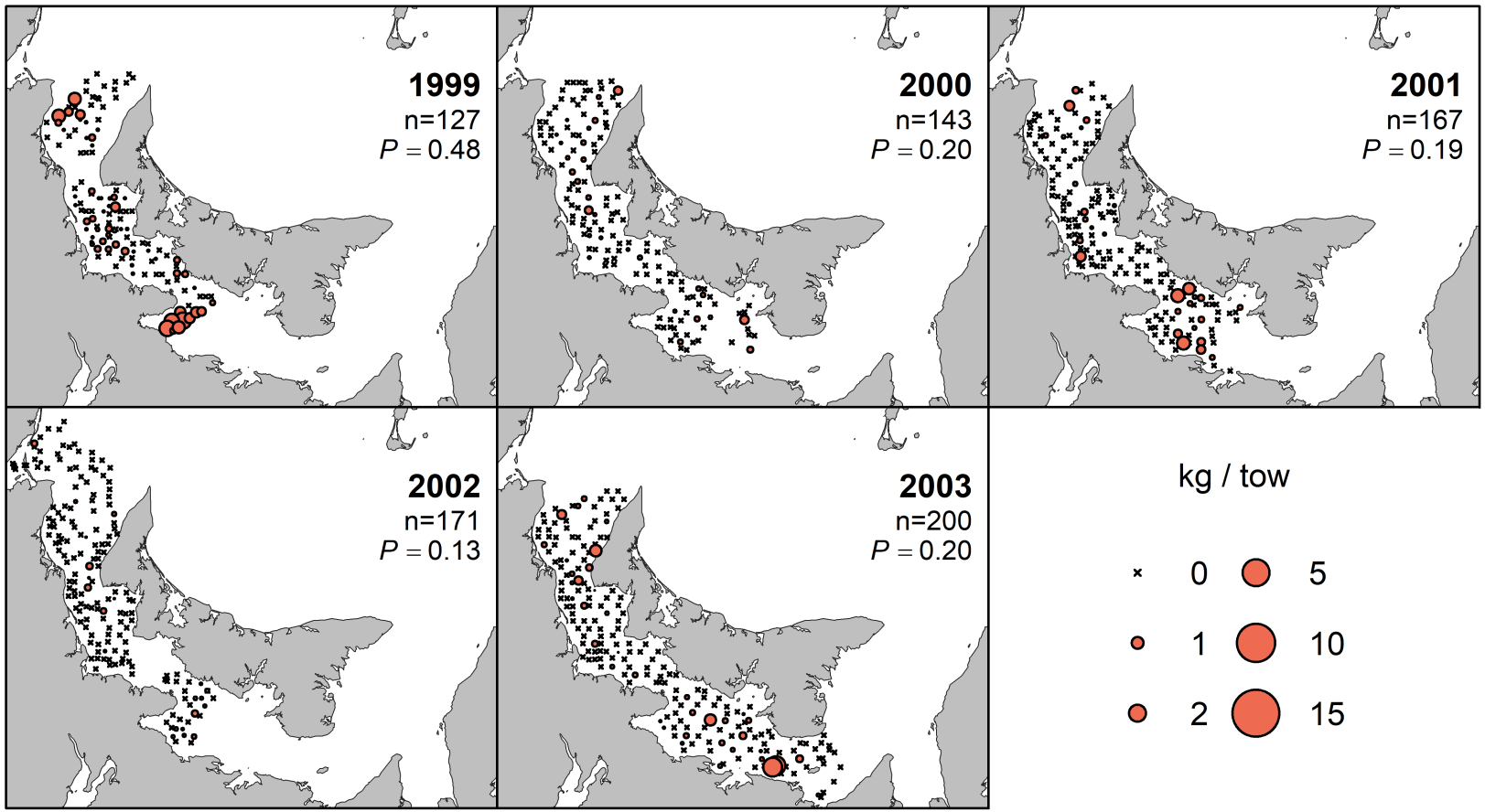

Figure 8. Relative density (kg/tow) of Atlantic rock crab (*Cancer irroratus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

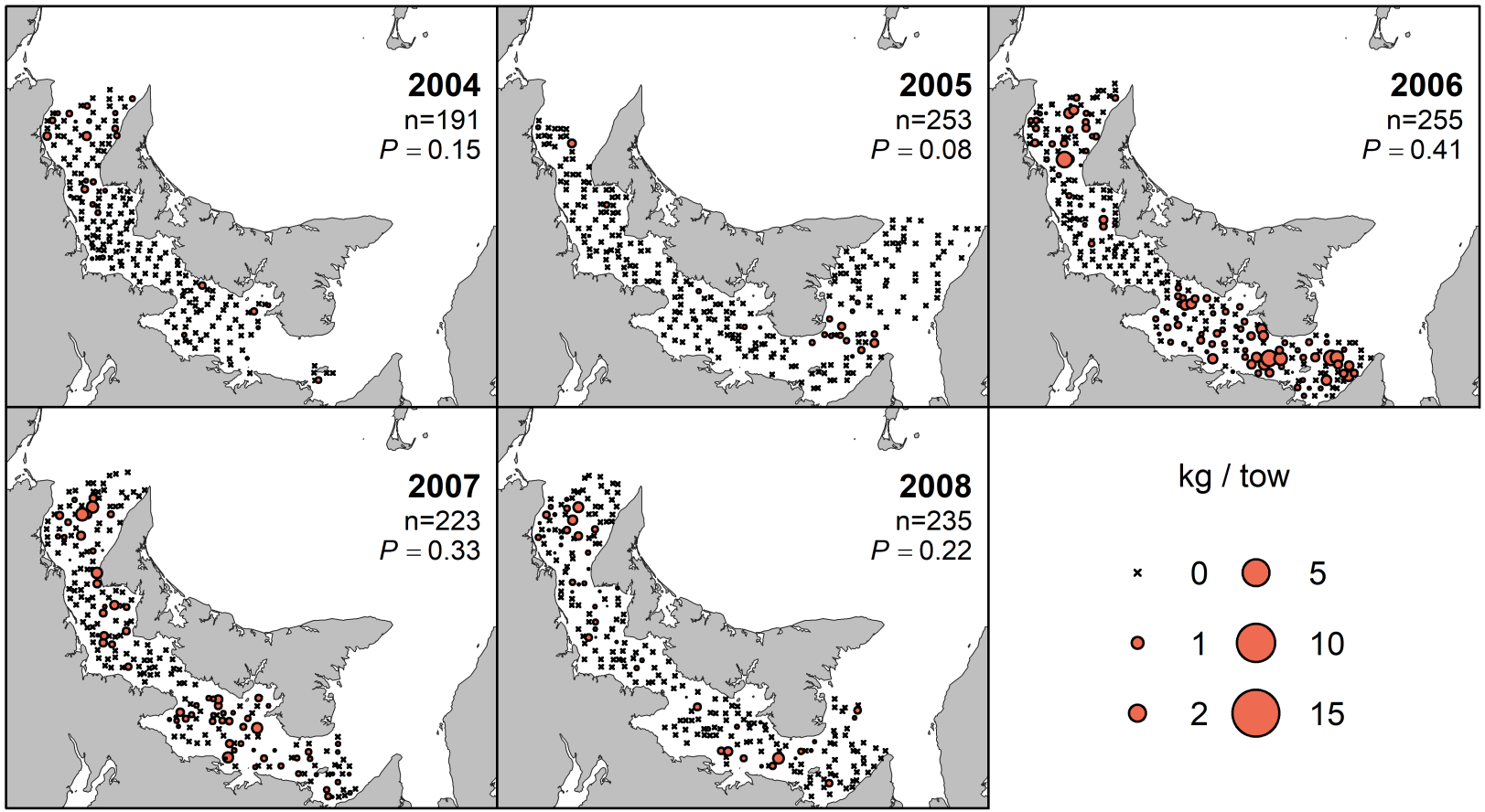

Figure 9. Relative density (kg/tow) of Atlantic rock crab (*Cancer irroratus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

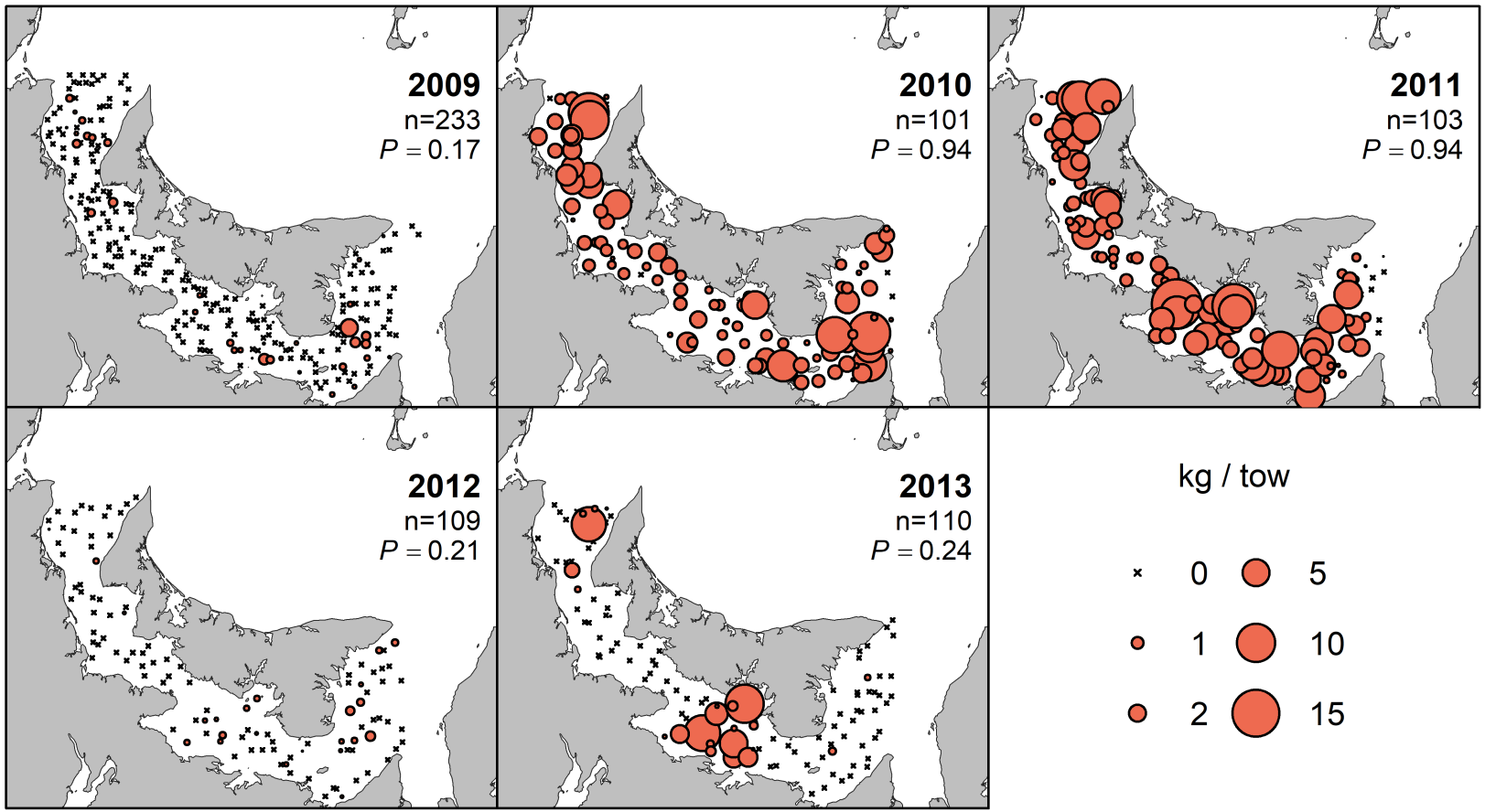

Figure 10. Relative density (kg/tow) of Atlantic rock crab (*Cancer irroratus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

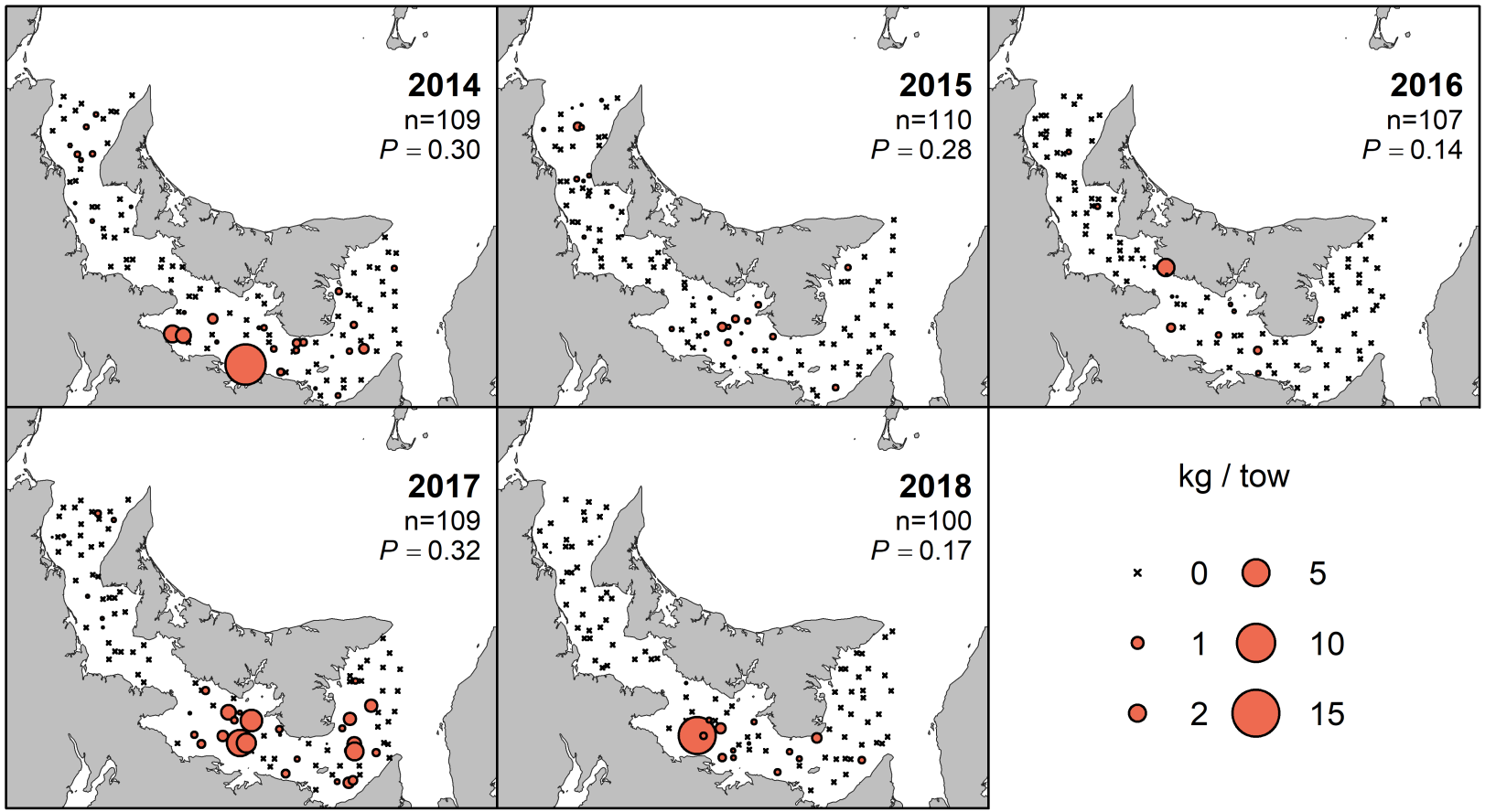

Figure 11. Relative density (kg/tow) of Atlantic rock crab (*Cancer irroratus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

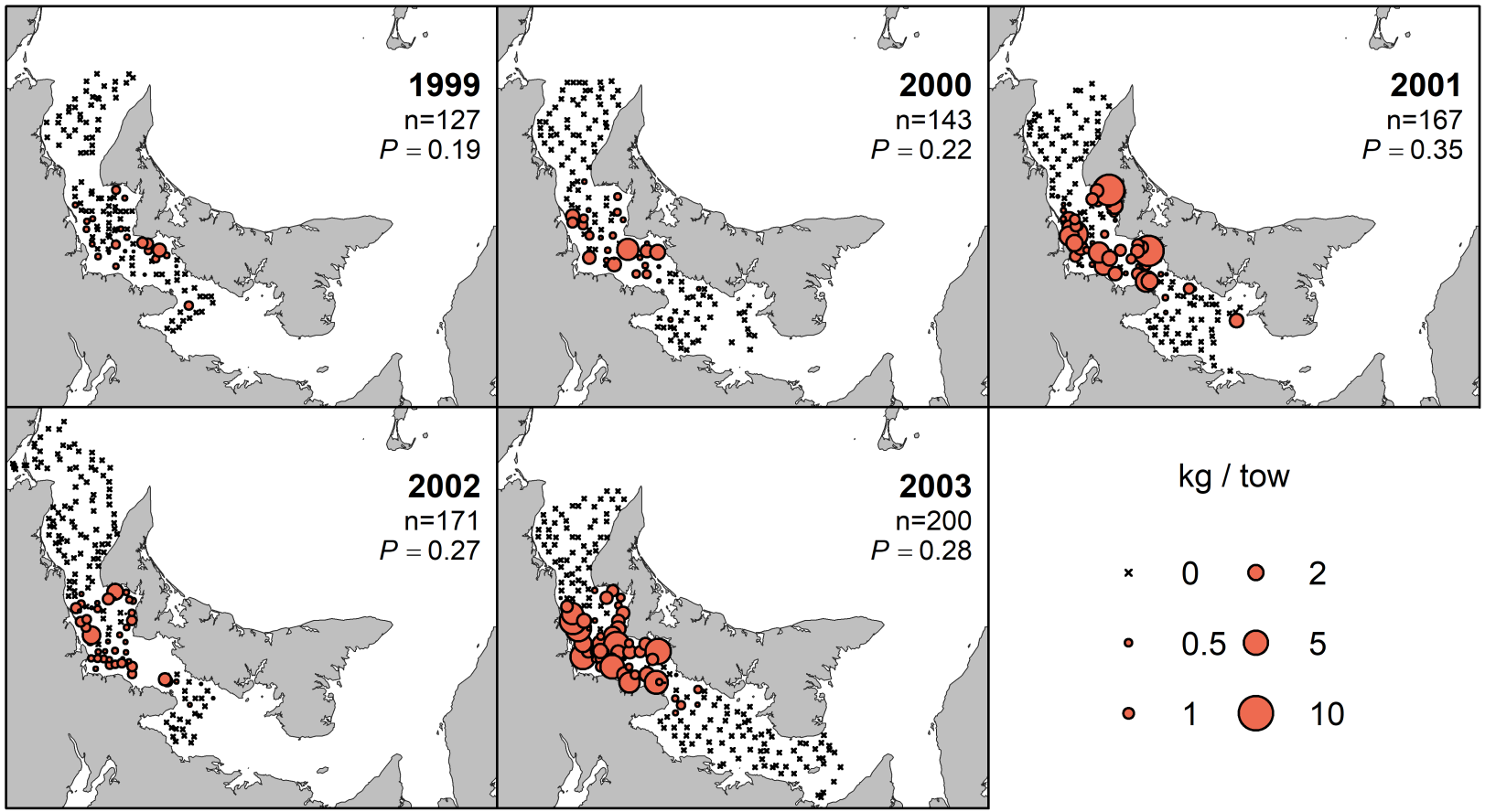

Figure 12. Relative density (kg/tow) of lady crab (*Ovalipes ocellatus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

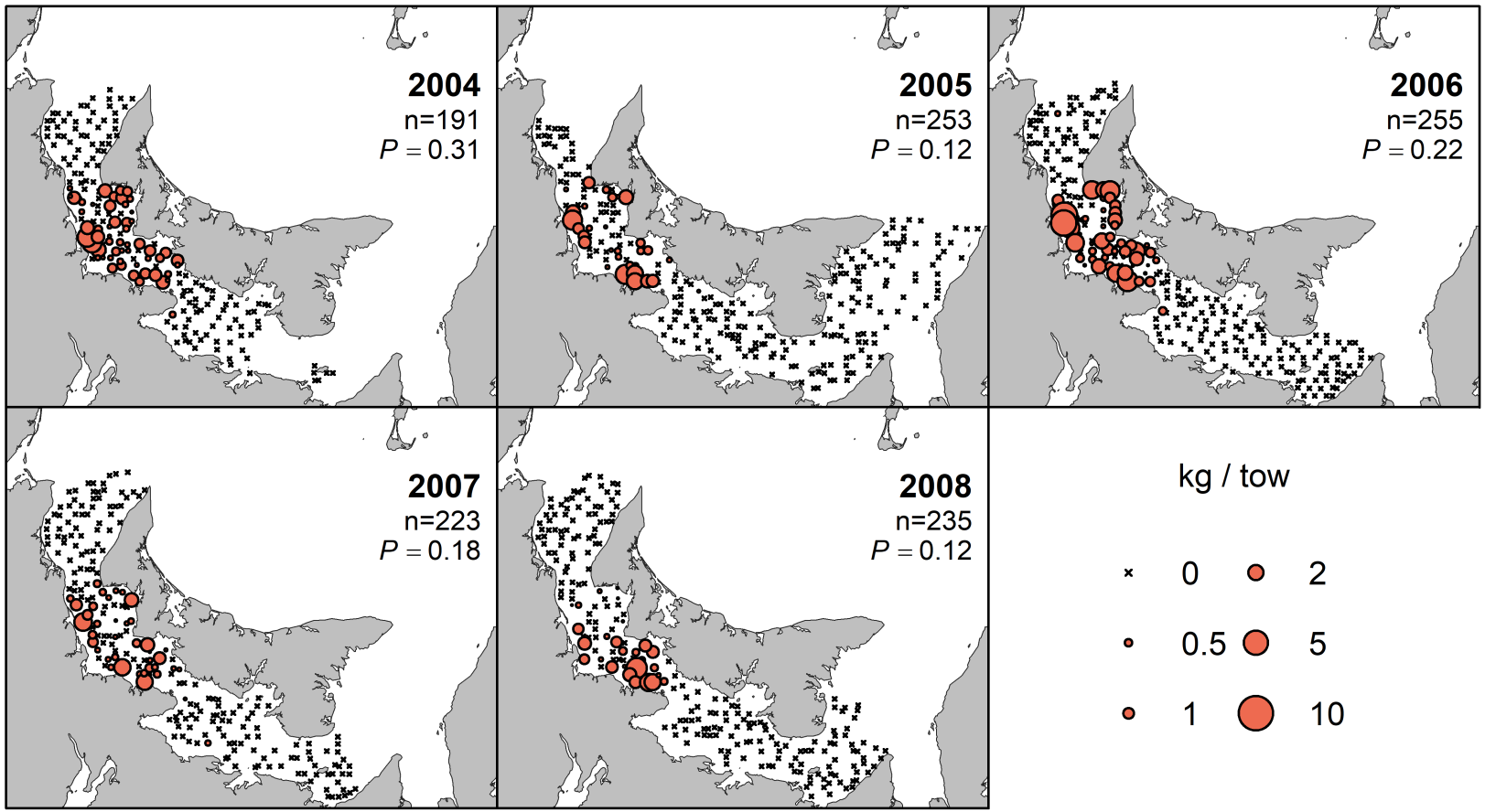

Figure 13. Relative density (kg/tow) of lady crab (*Ovalipes ocellatus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

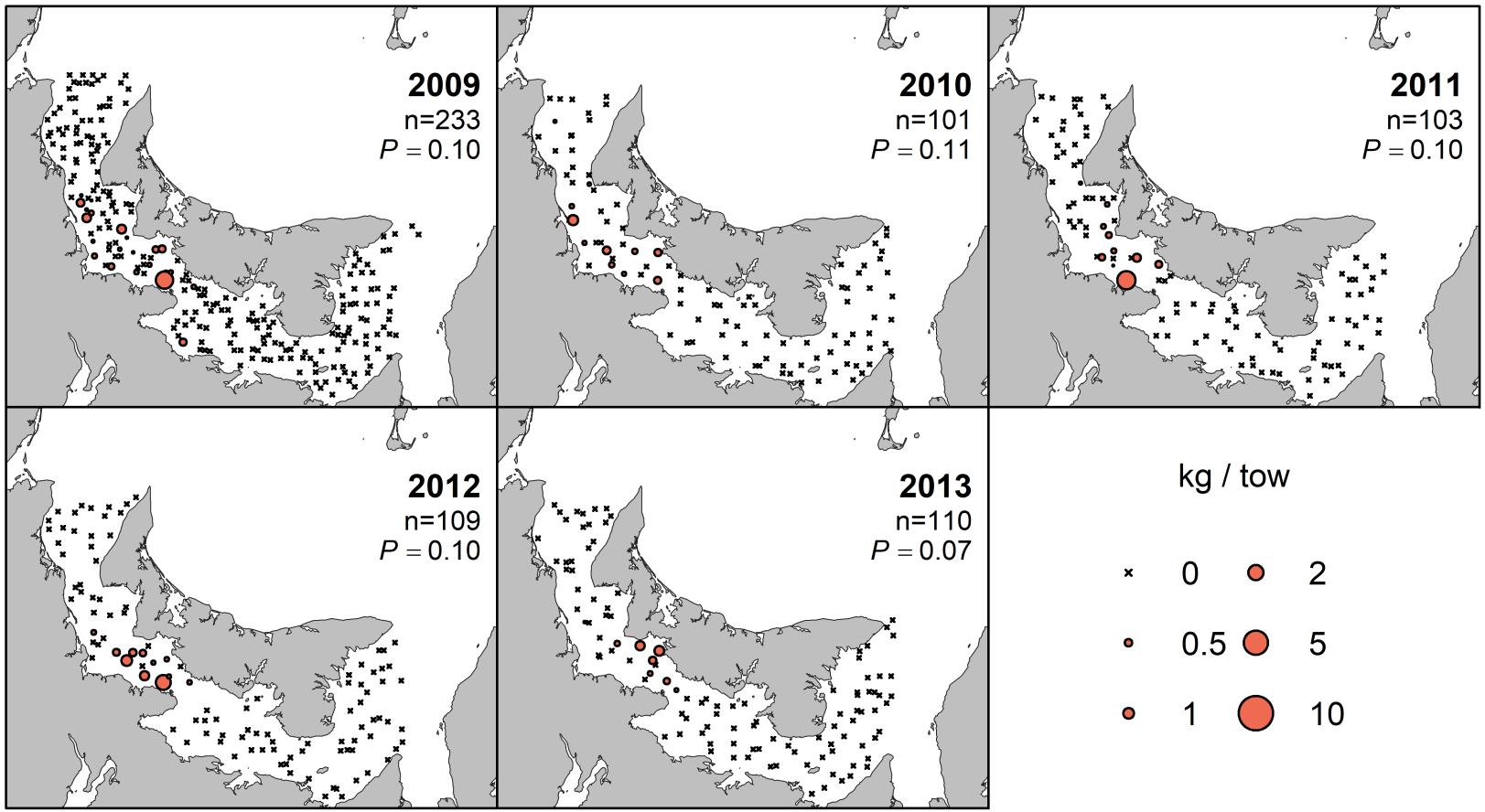

Figure 14. Relative density (kg/tow) of lady crab (*Ovalipes ocellatus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

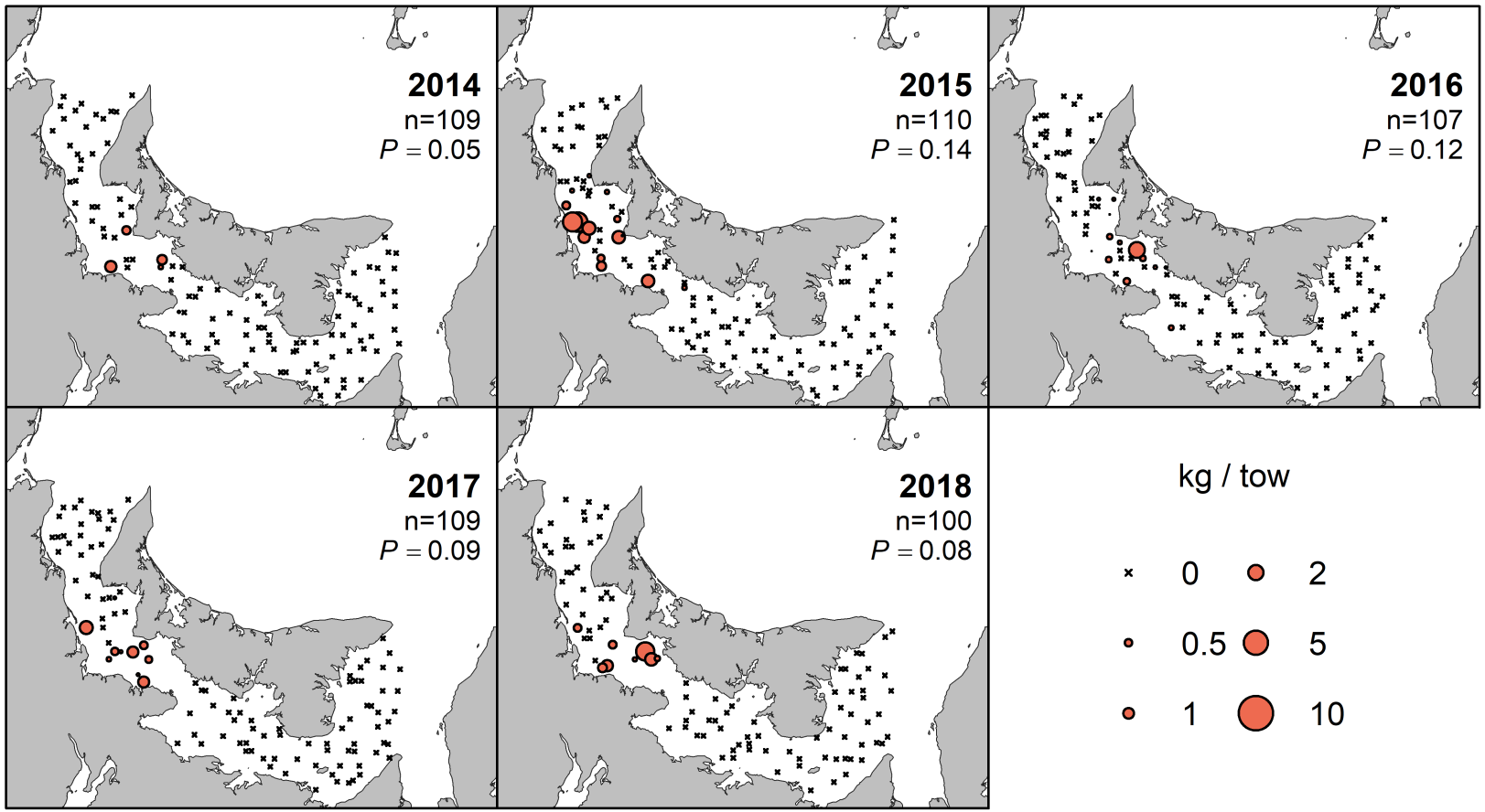

Figure 15. Relative density (kg/tow) of lady crab (*Ovalipes ocellatus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

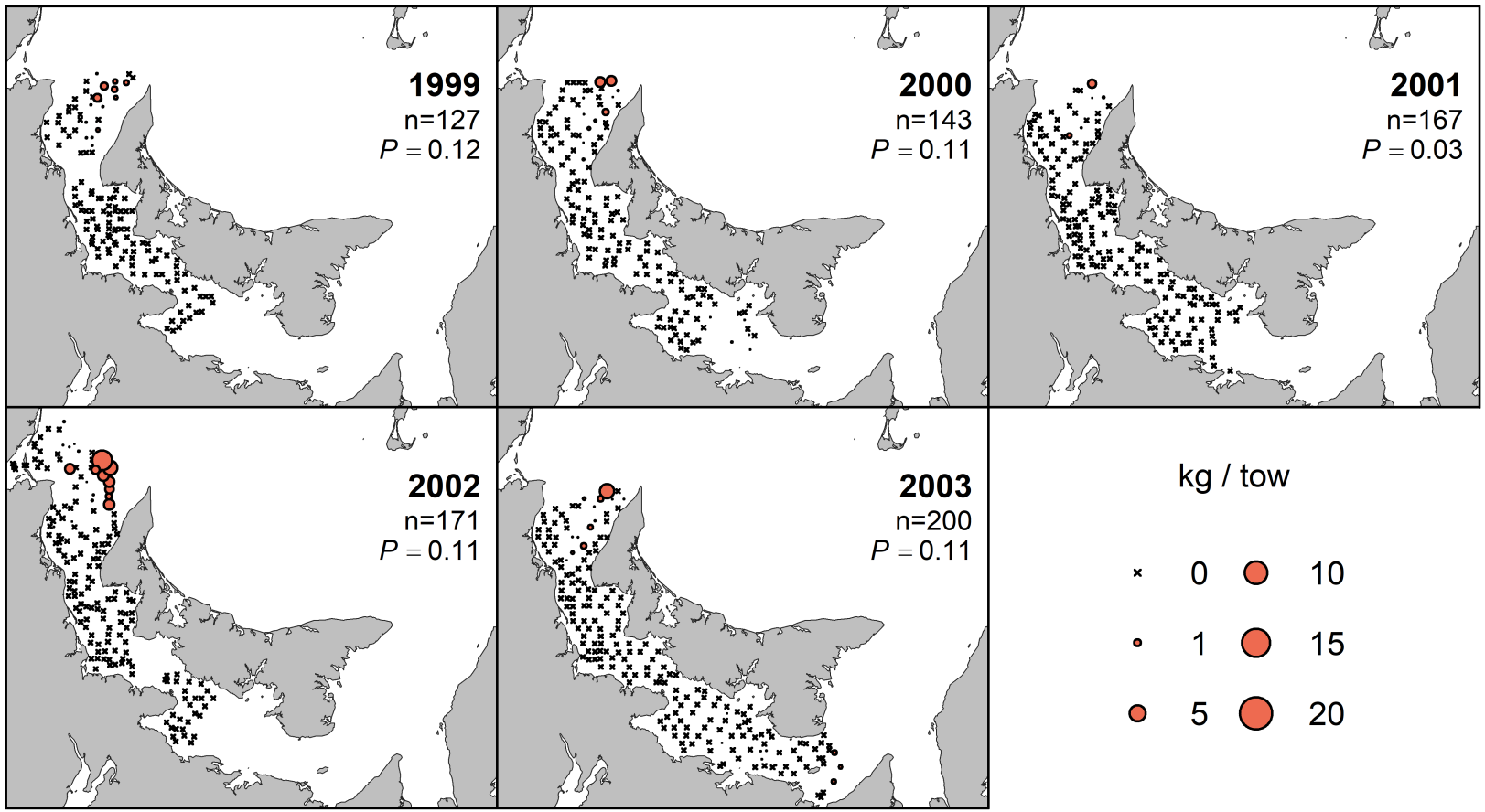

Figure 16. Relative density (kg/tow) of American plaice (*Hippoglossoides platessoides*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

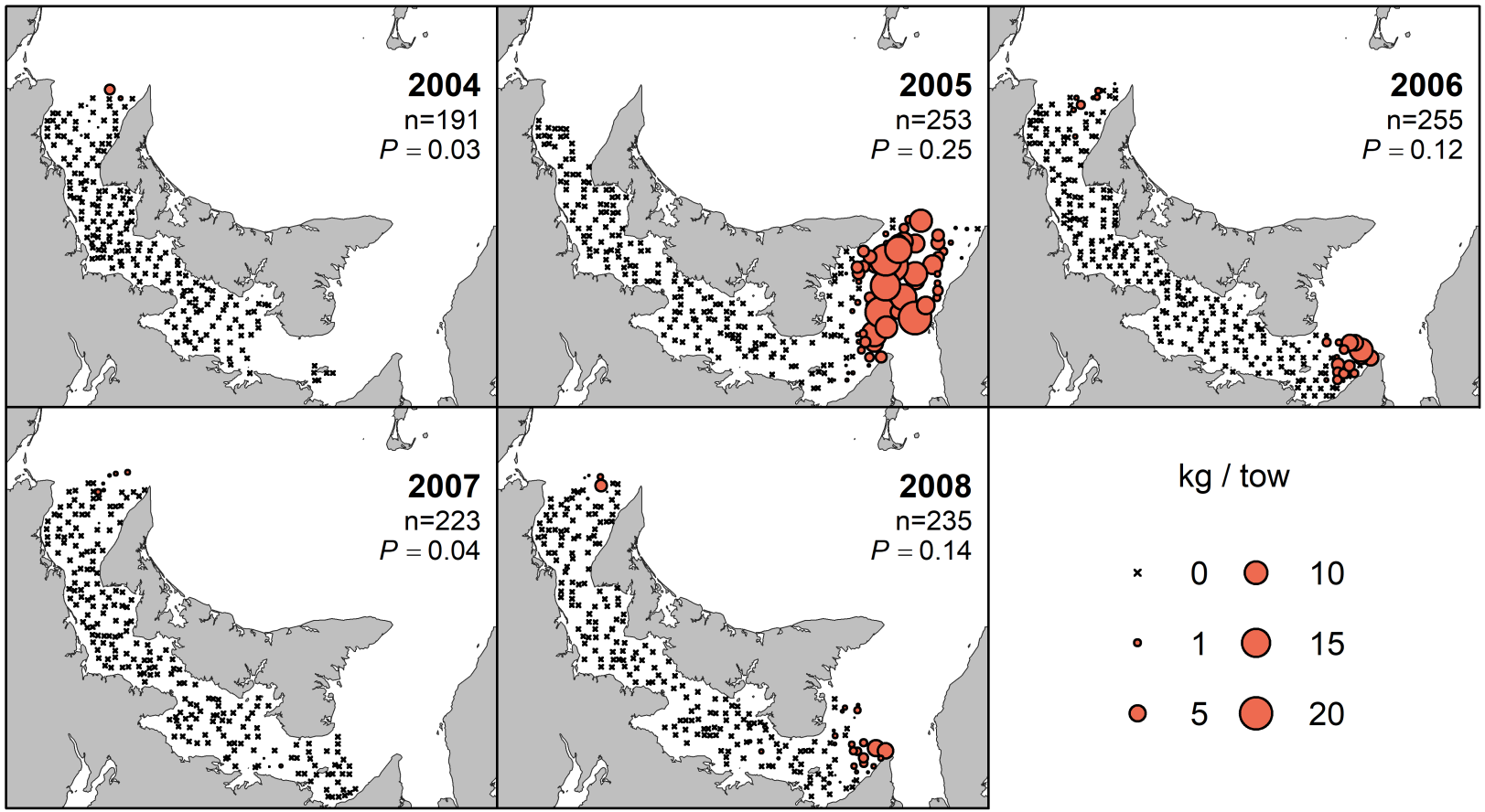

Figure 17. Relative density (kg/tow) of American plaice (*Hippoglossoides platessoides*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

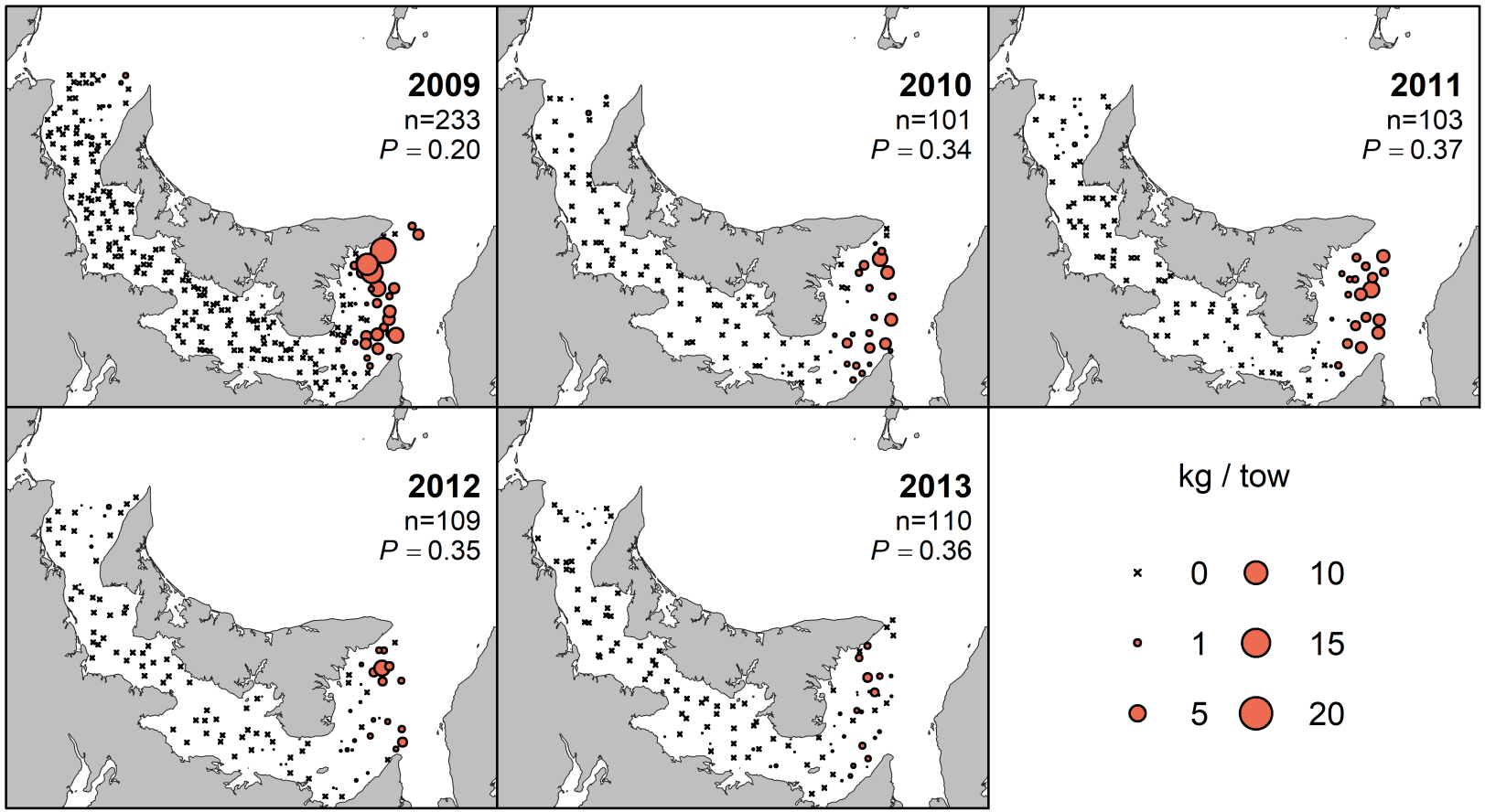

Figure 18. Relative density (kg/tow) of American plaice (*Hippoglossoides platessoides*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

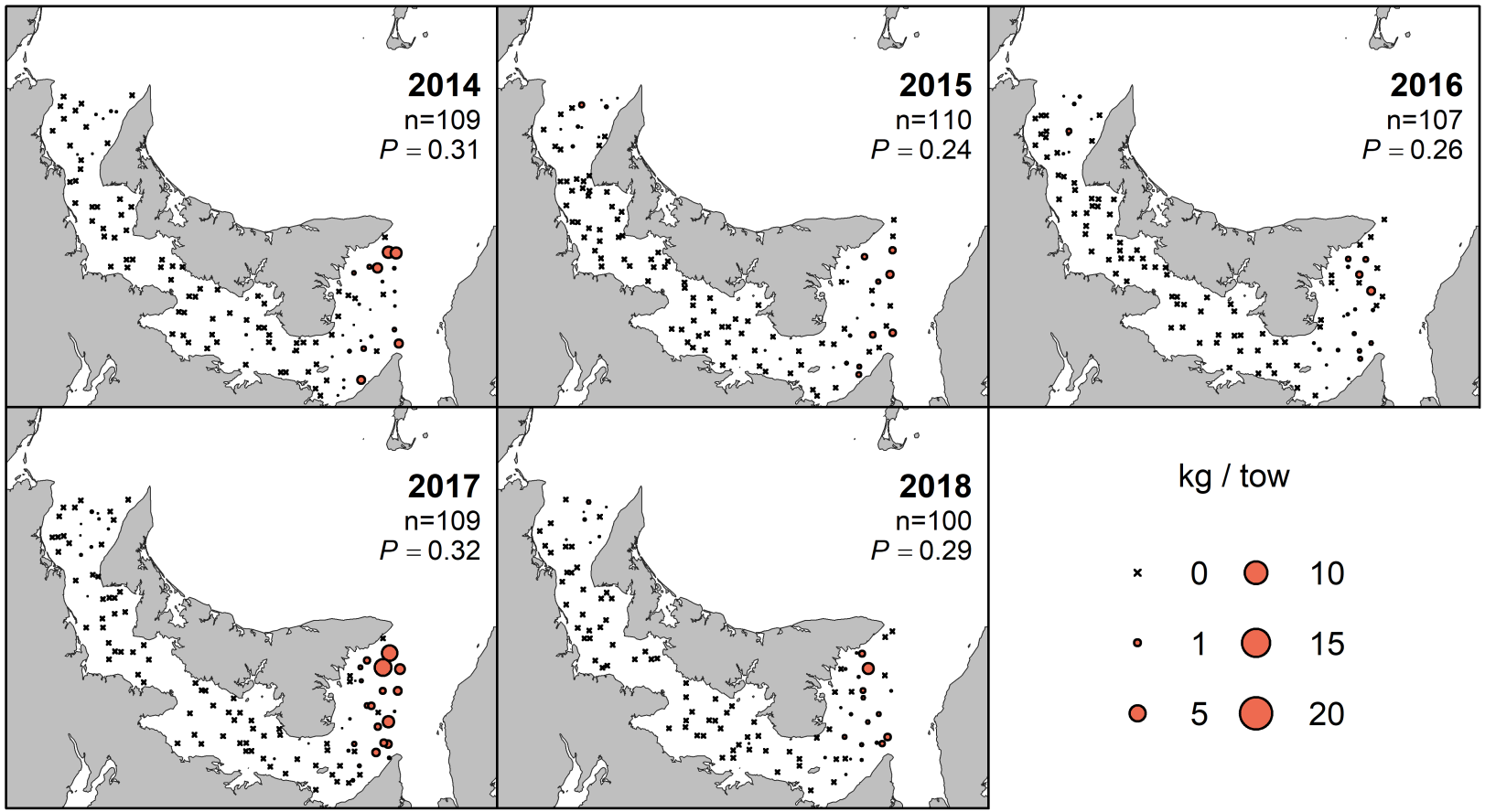

Figure 19. Relative density (kg/tow) of American plaice (*Hippoglossoides platessoides*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

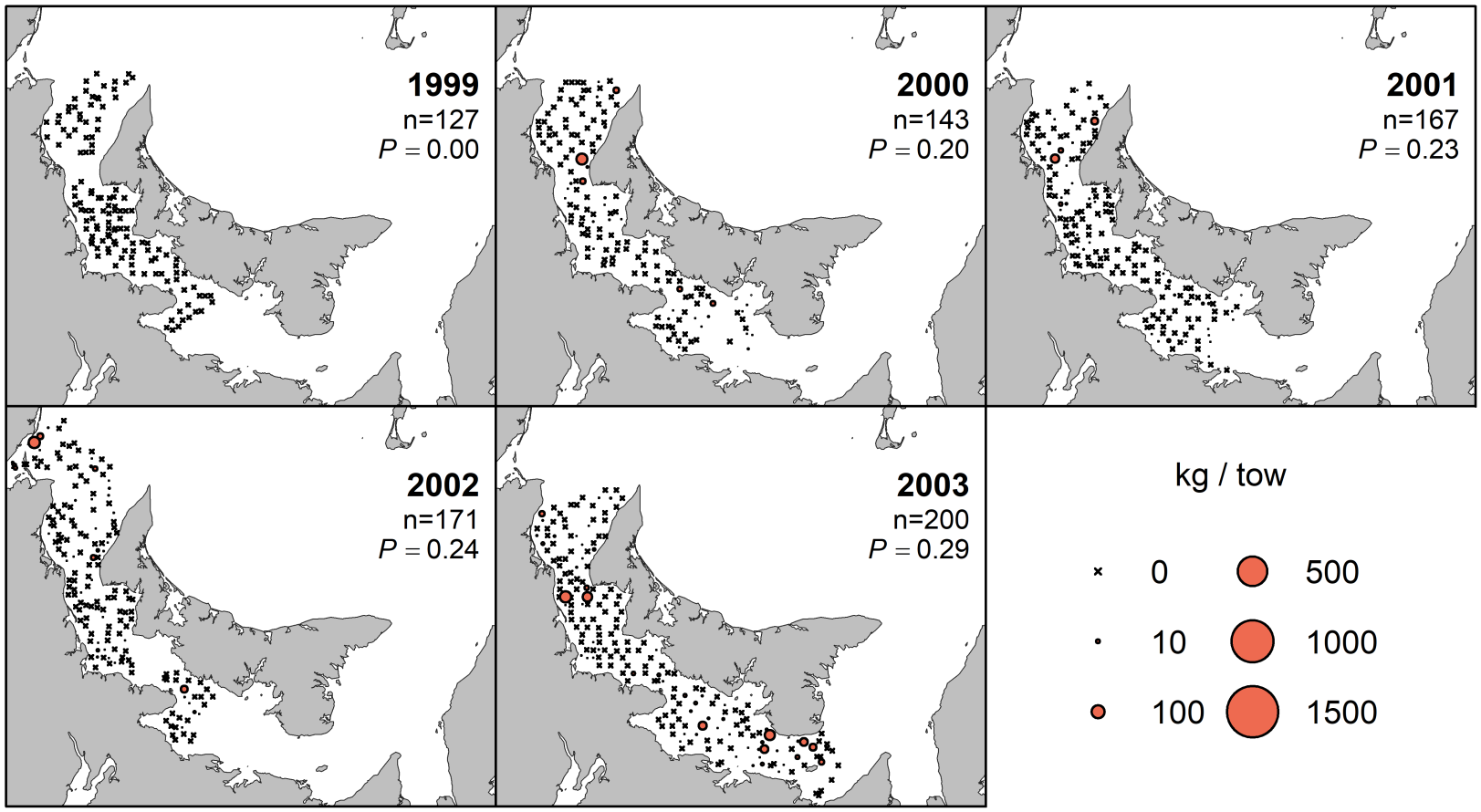

Figure 20. Relative density (kg/tow) of Atlantic herring (*Clupea harengus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

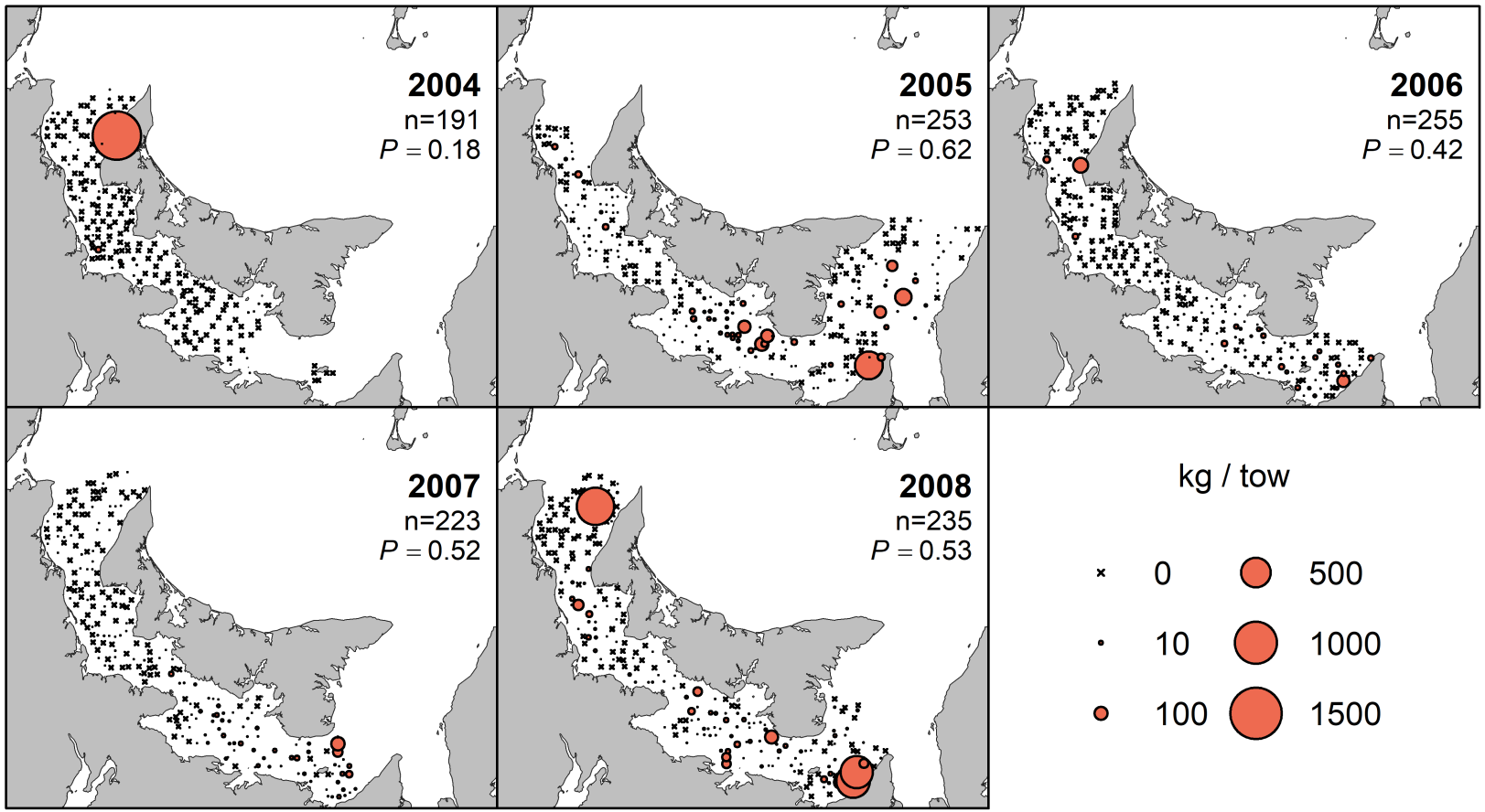

Figure 21. Relative density (kg/tow) of Atlantic herring (*Clupea harengus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

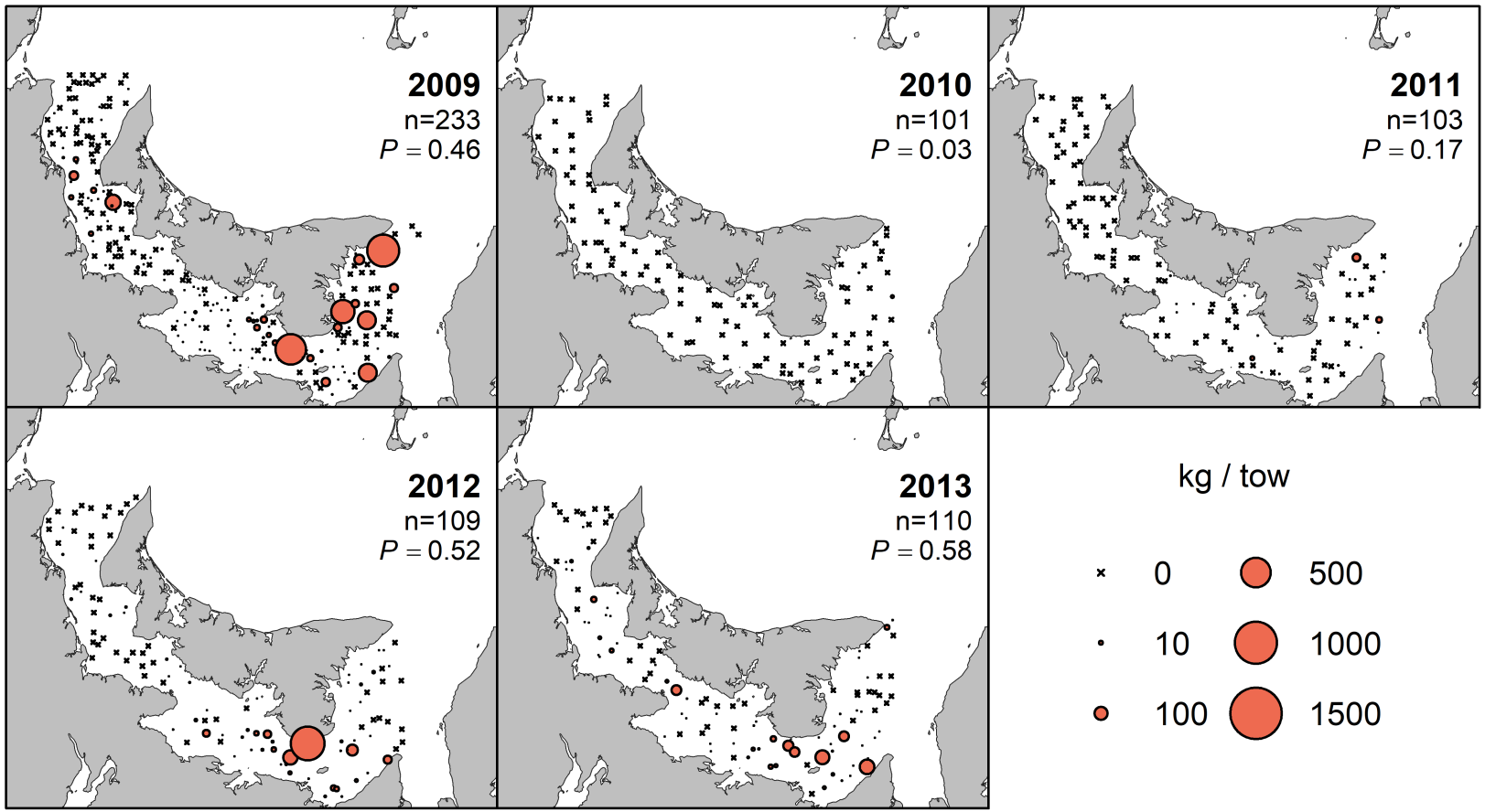

Figure 22. Relative density (kg/tow) of Atlantic herring (*Clupea harengus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

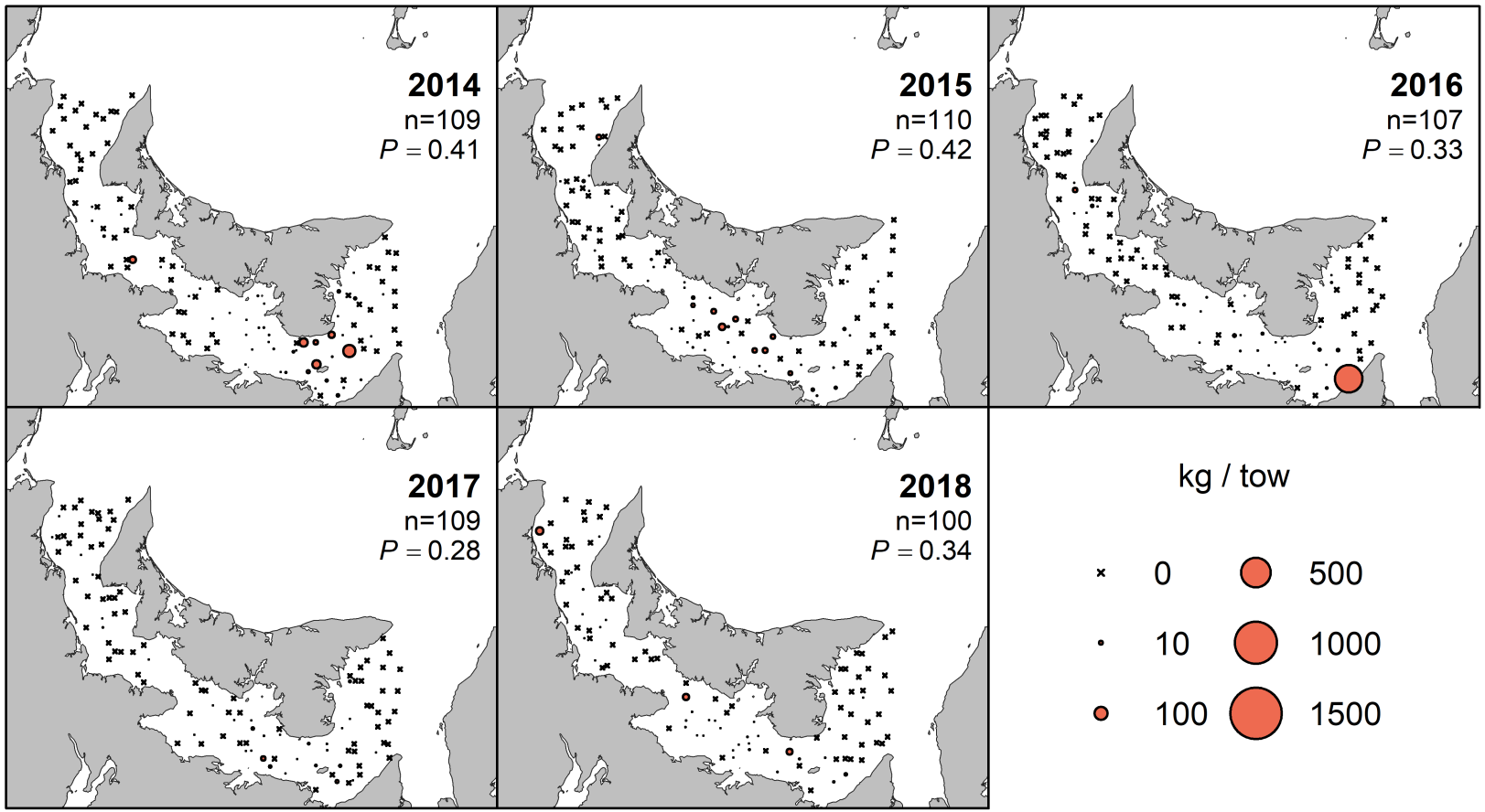

Figure 23. Relative density (kg/tow) of Atlantic herring (*Clupea harengus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

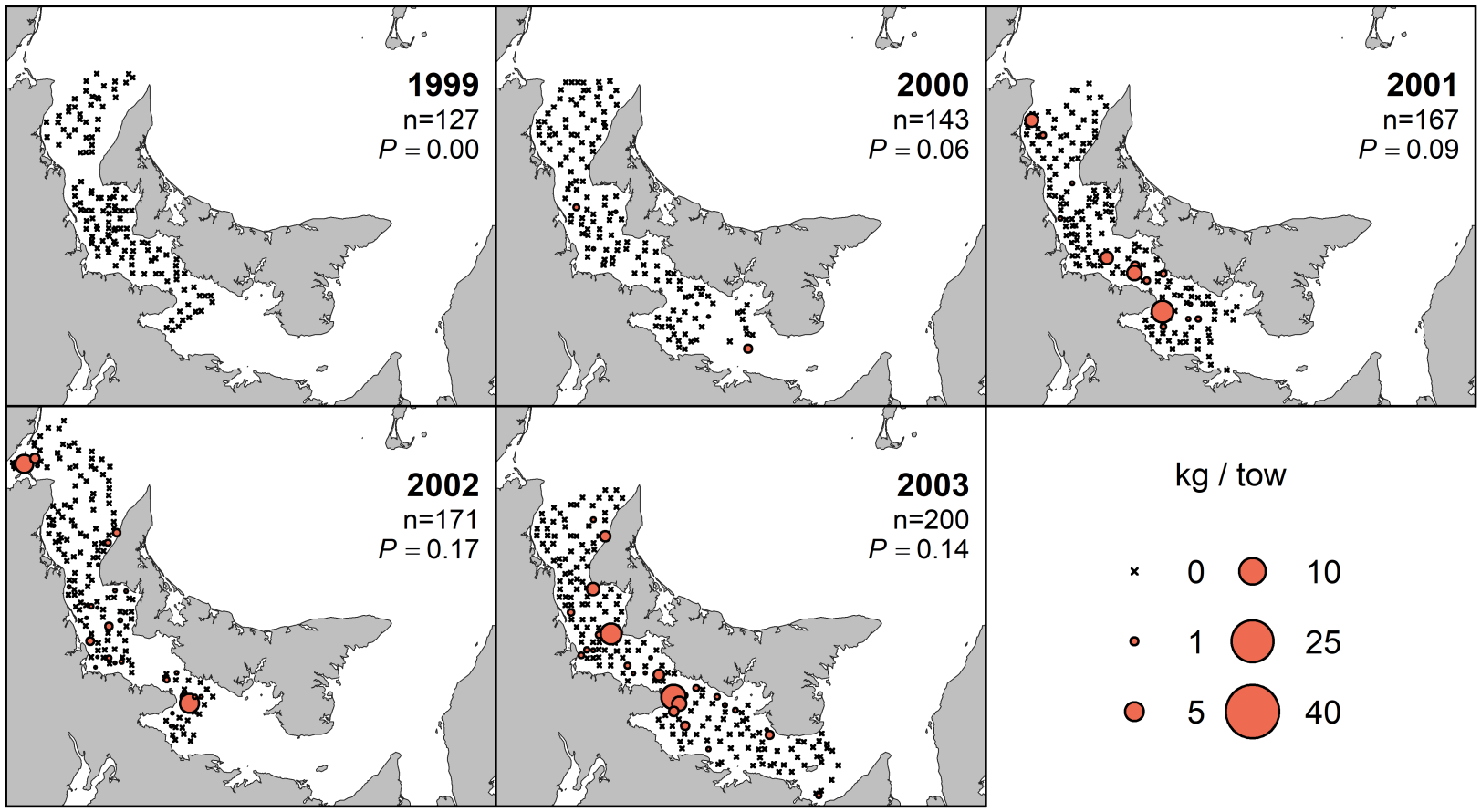

Figure 24. Relative density (kg/tow) of Atlantic mackerel (*Scomber scombrus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

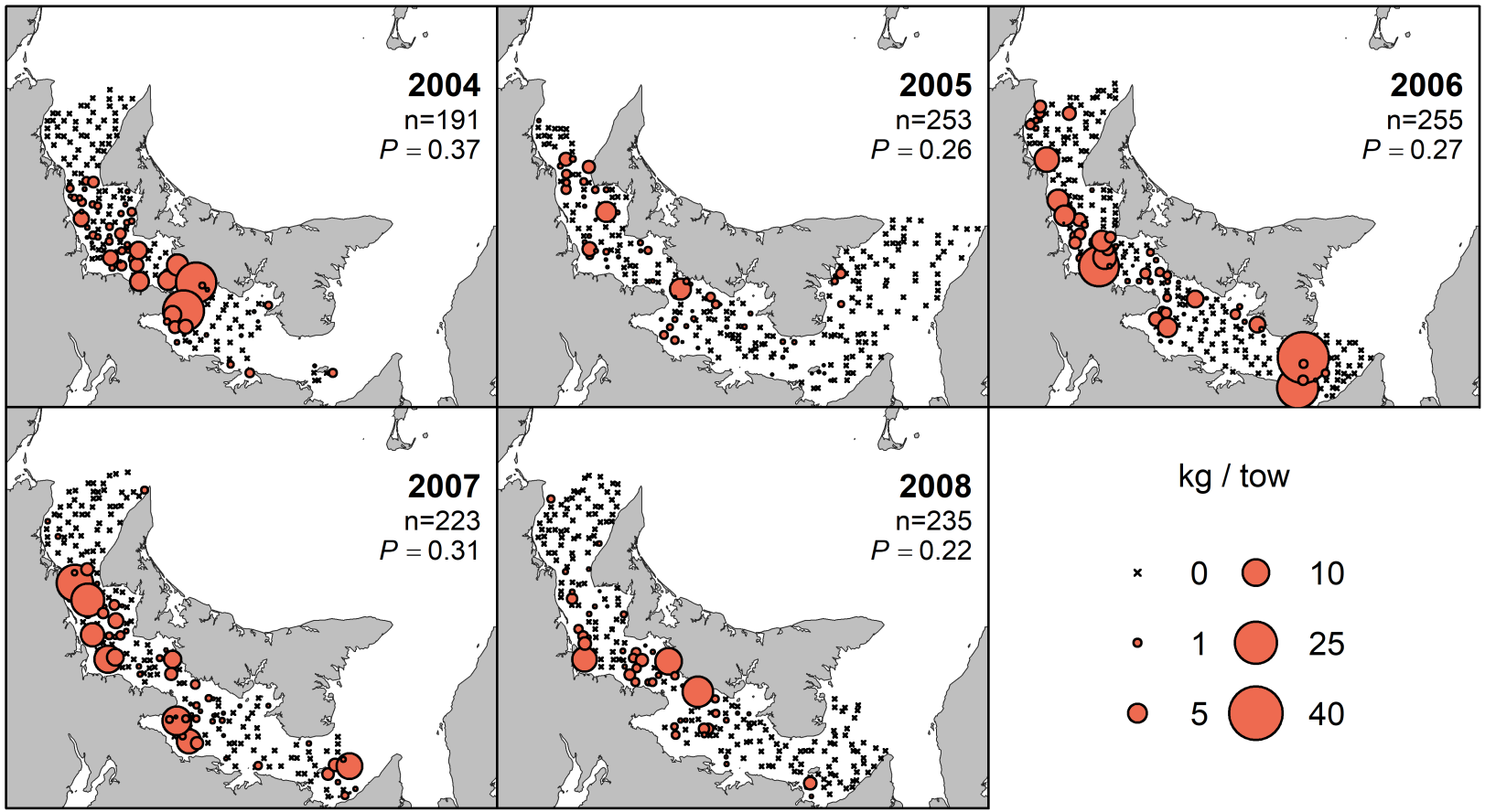

Figure 25. Relative density (kg/tow) of Atlantic mackerel (*Scomber scombrus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

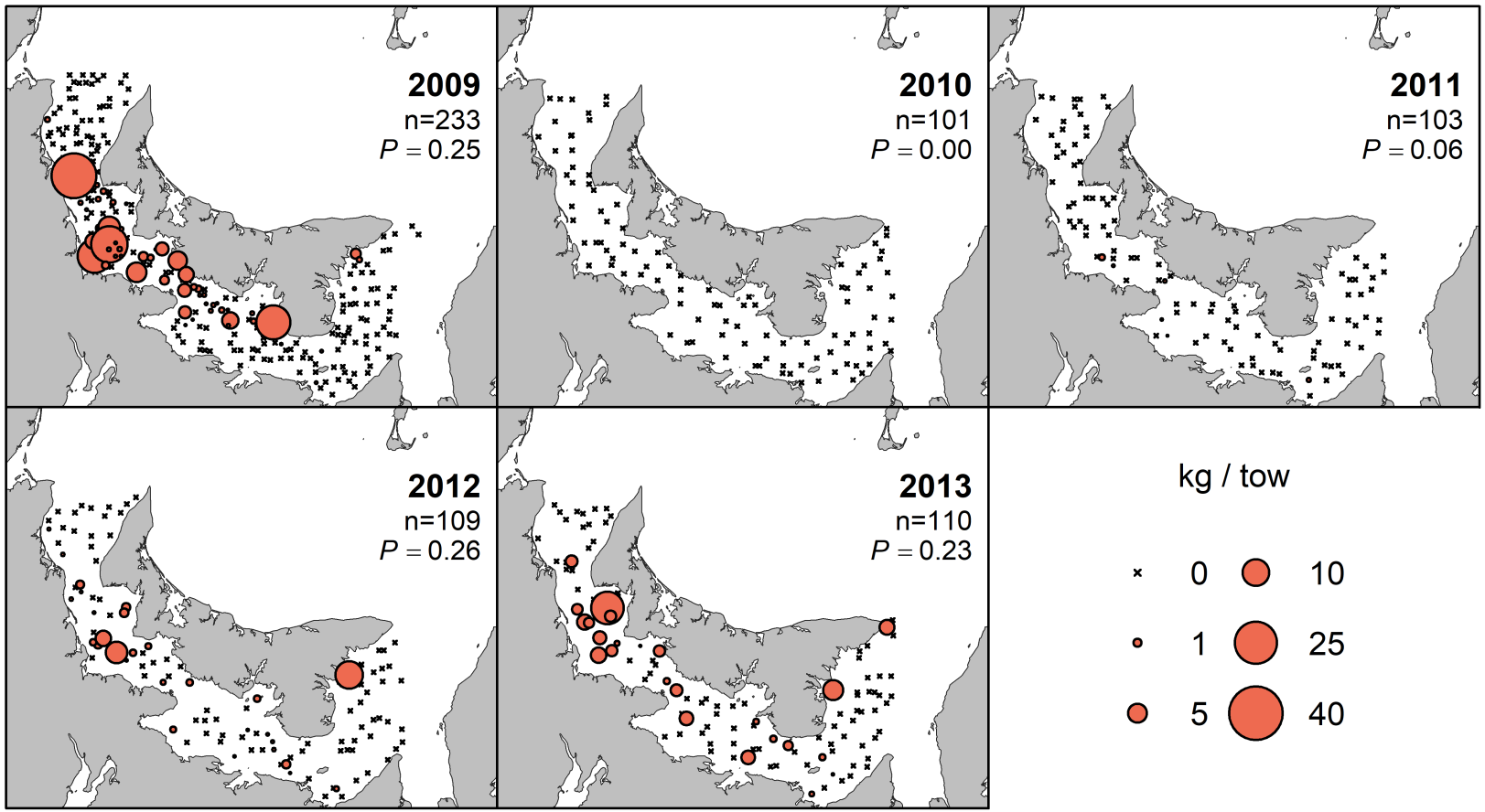

Figure 26. Relative density (kg/tow) of Atlantic mackerel (*Scomber scombrus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

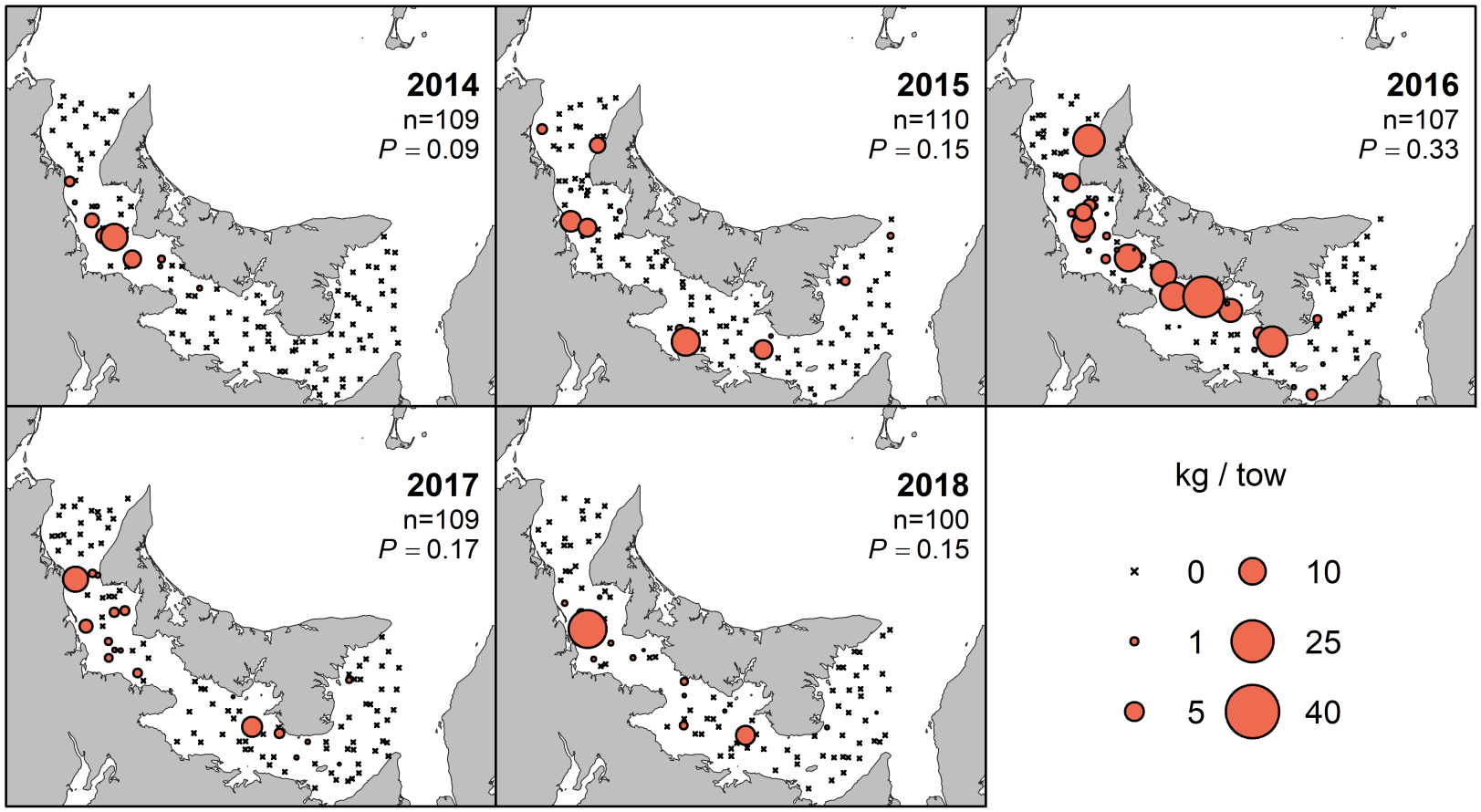

Figure 27. Relative density (kg/tow) of Atlantic mackerel (*Scomber scombrus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

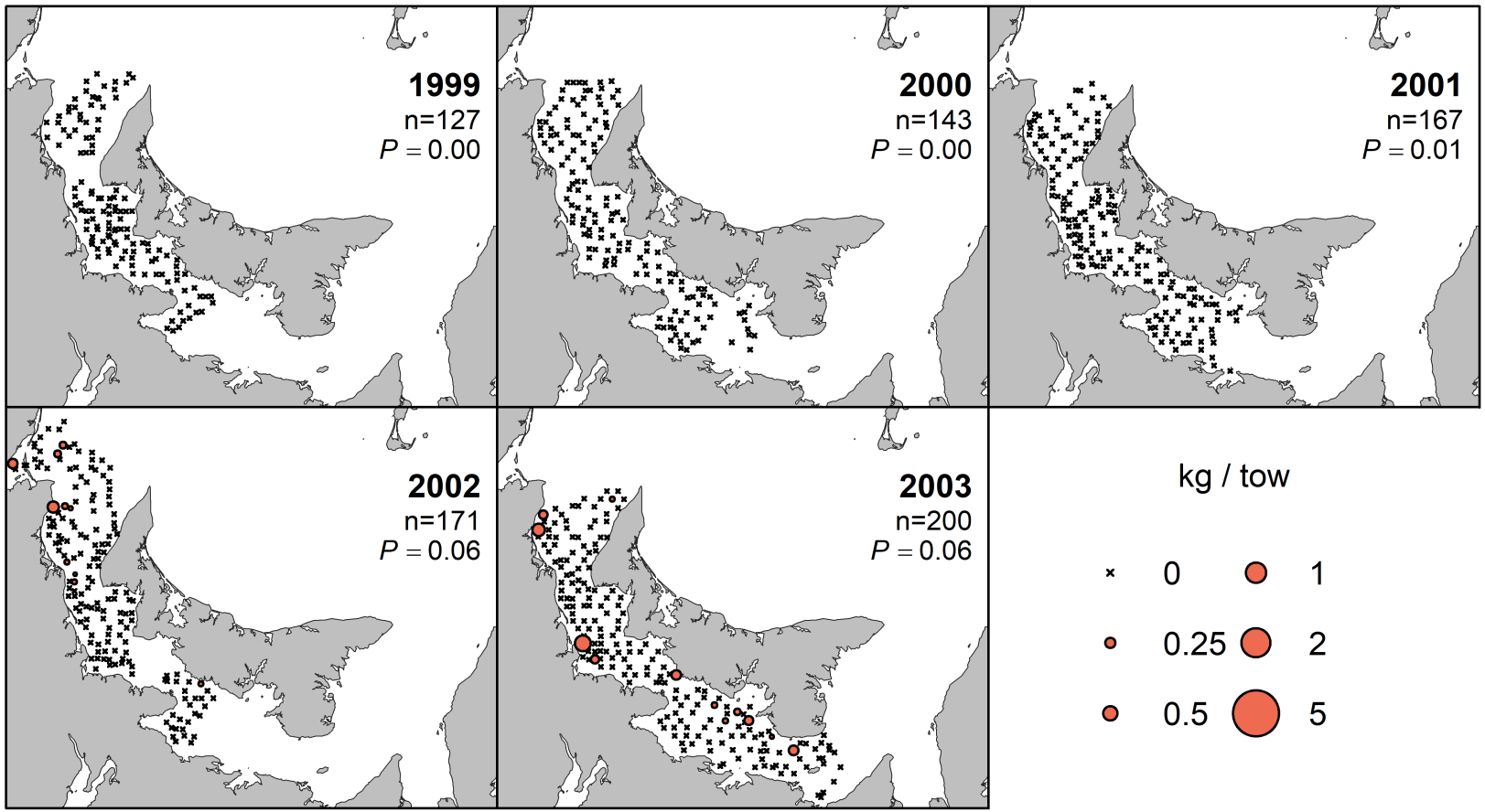

Figure 28. Relative density (kg/tow) of Atlantic tomcod (*Microgadus tomcod*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

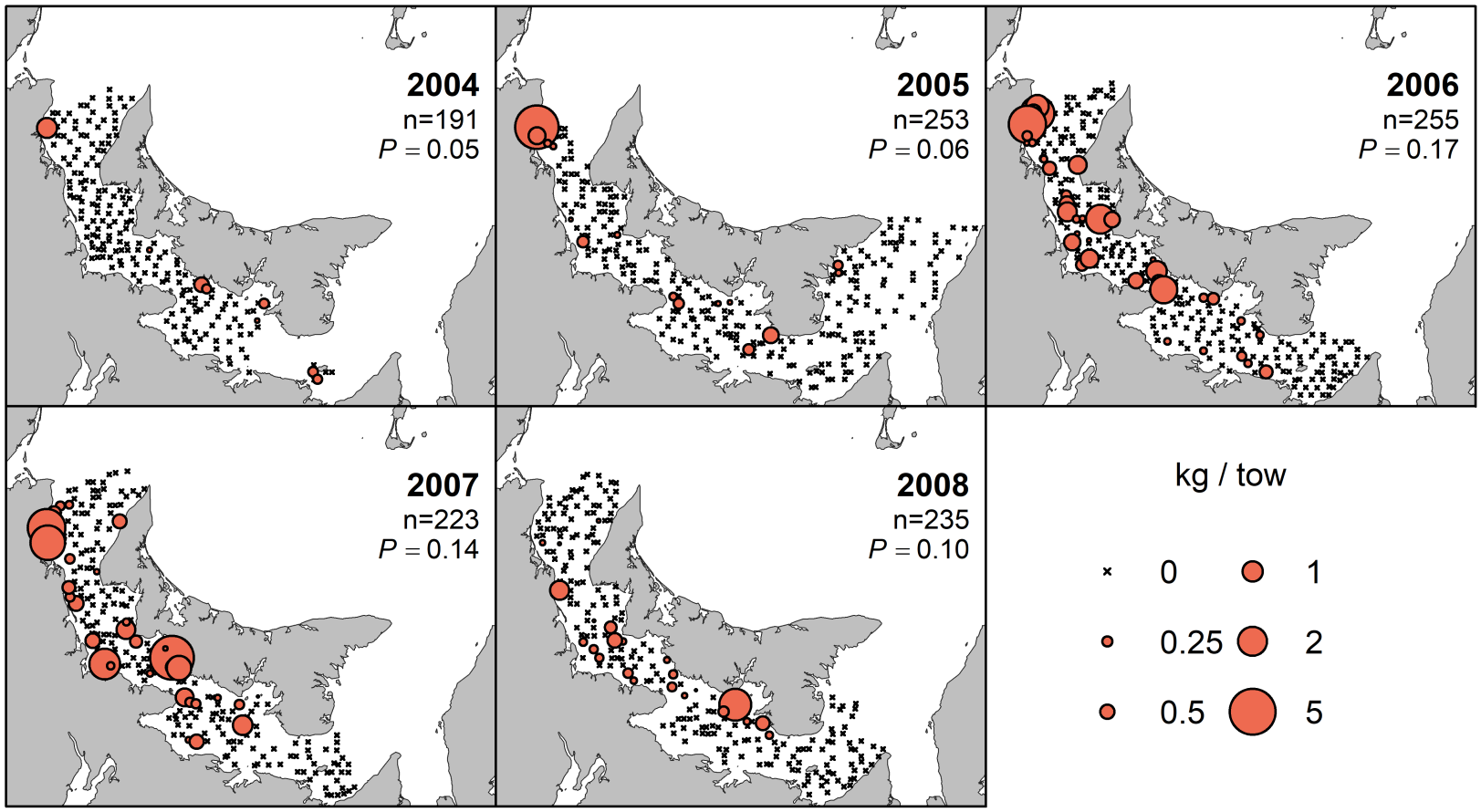

Figure 29. Relative density (kg/tow) of Atlantic tomcod (*Microgadus tomcod*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

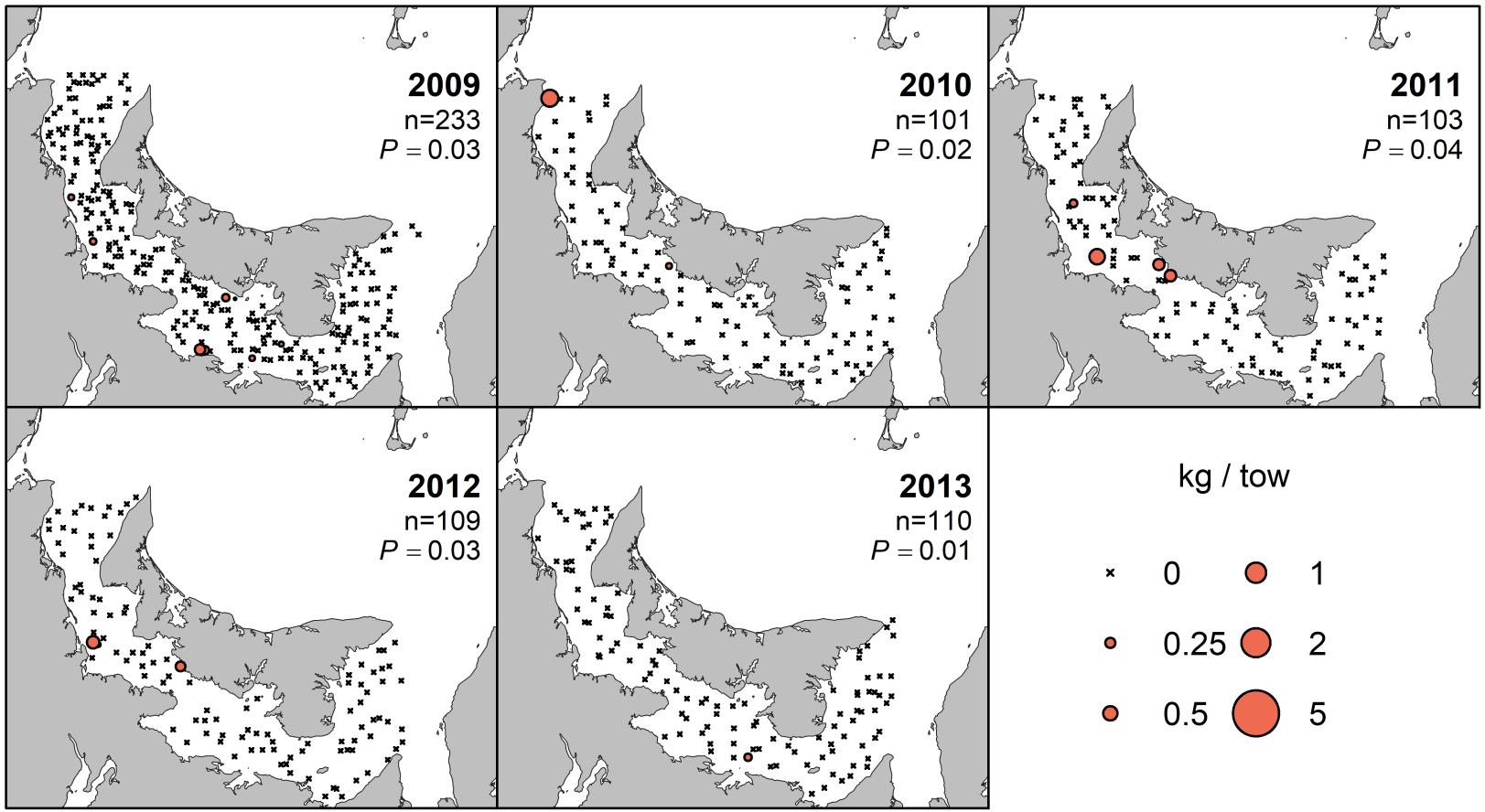

Figure 30. Relative density (kg/tow) of Atlantic tomcod (*Microgadus tomcod*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

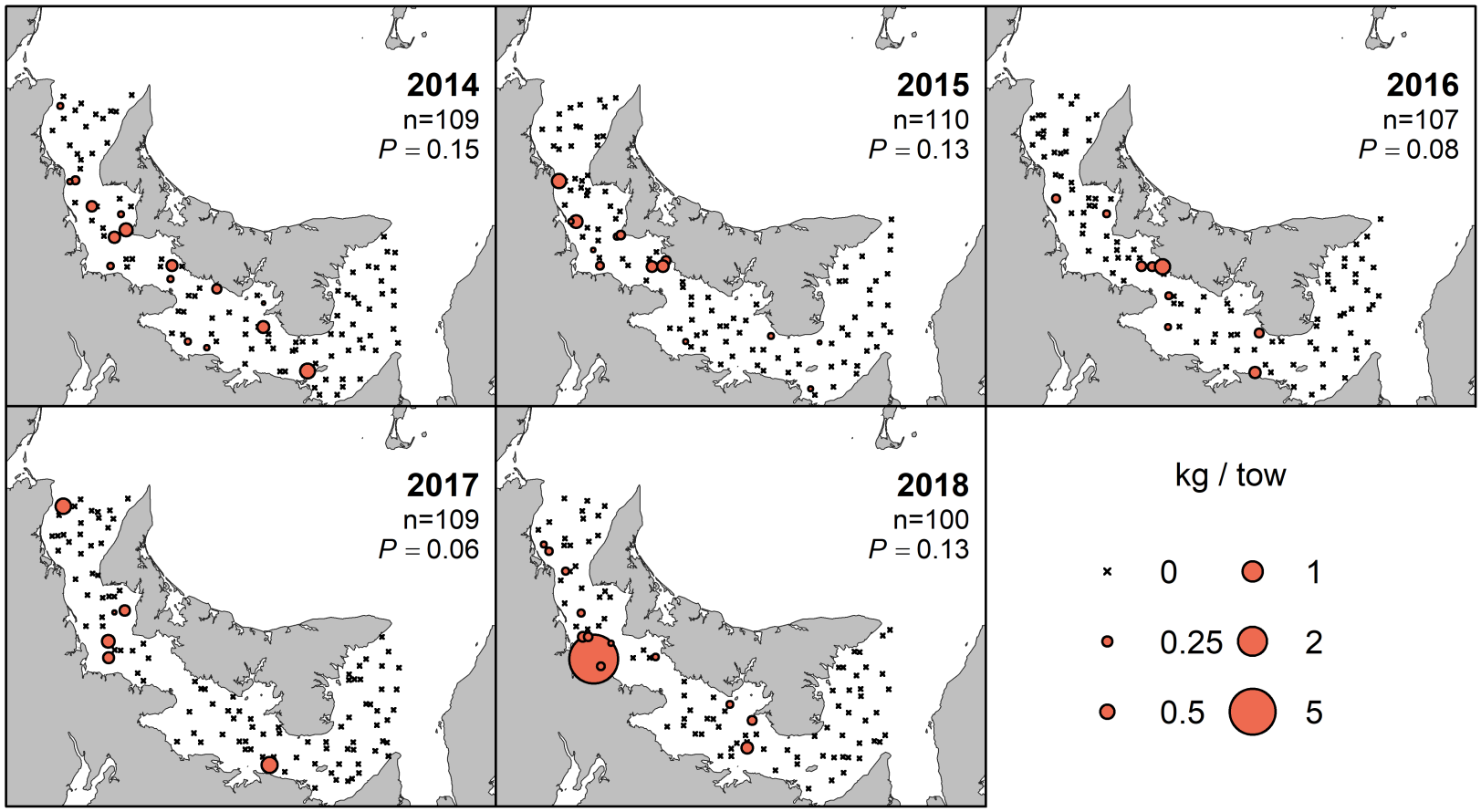

Figure 31. Relative density (kg/tow) of Atlantic tomcod (*Microgadus tomcod*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

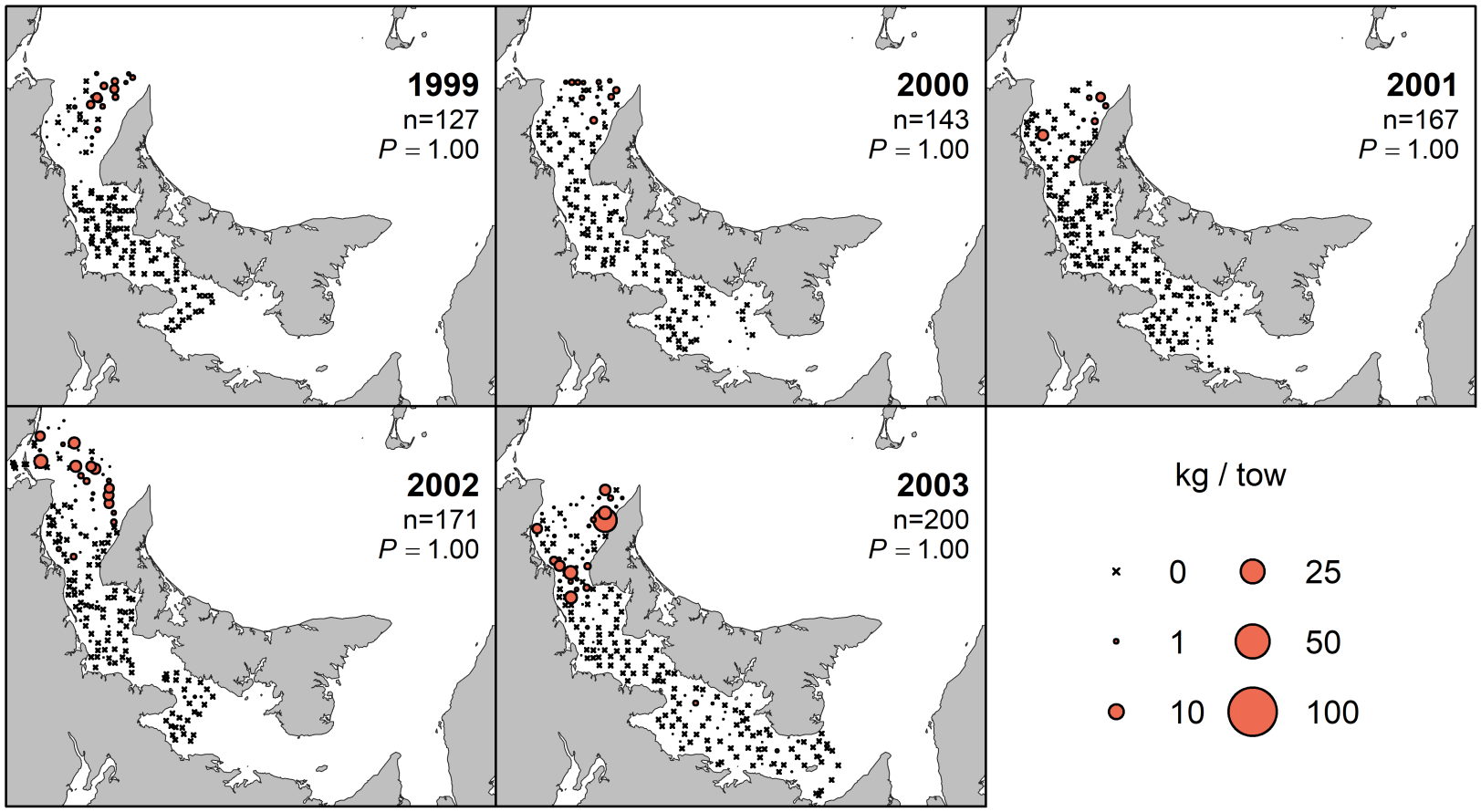

Figure 32. Relative density (kg/tow) of cod (Gadidae) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

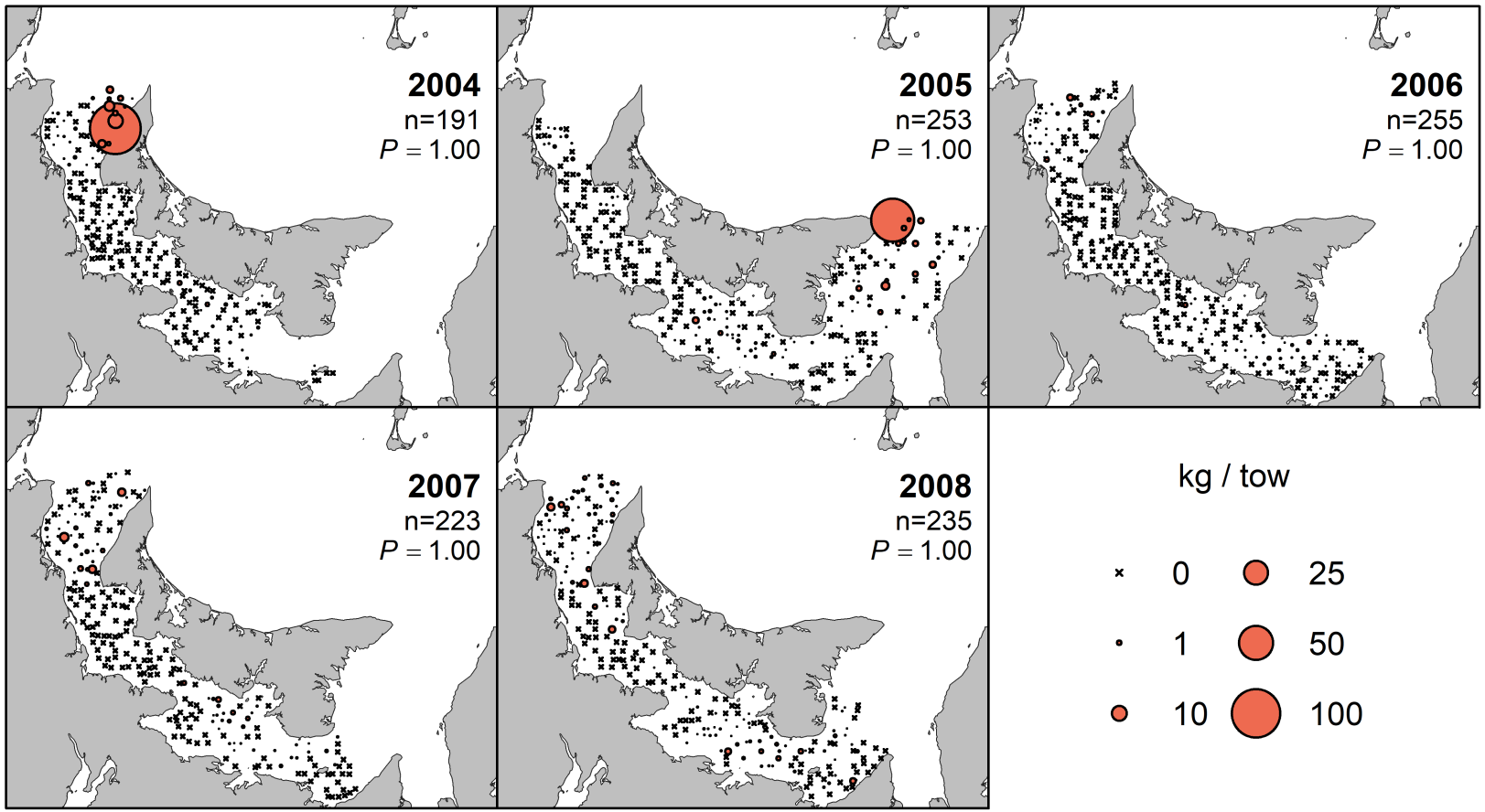

Figure 33. Relative density (kg/tow) of cod (Gadidae) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

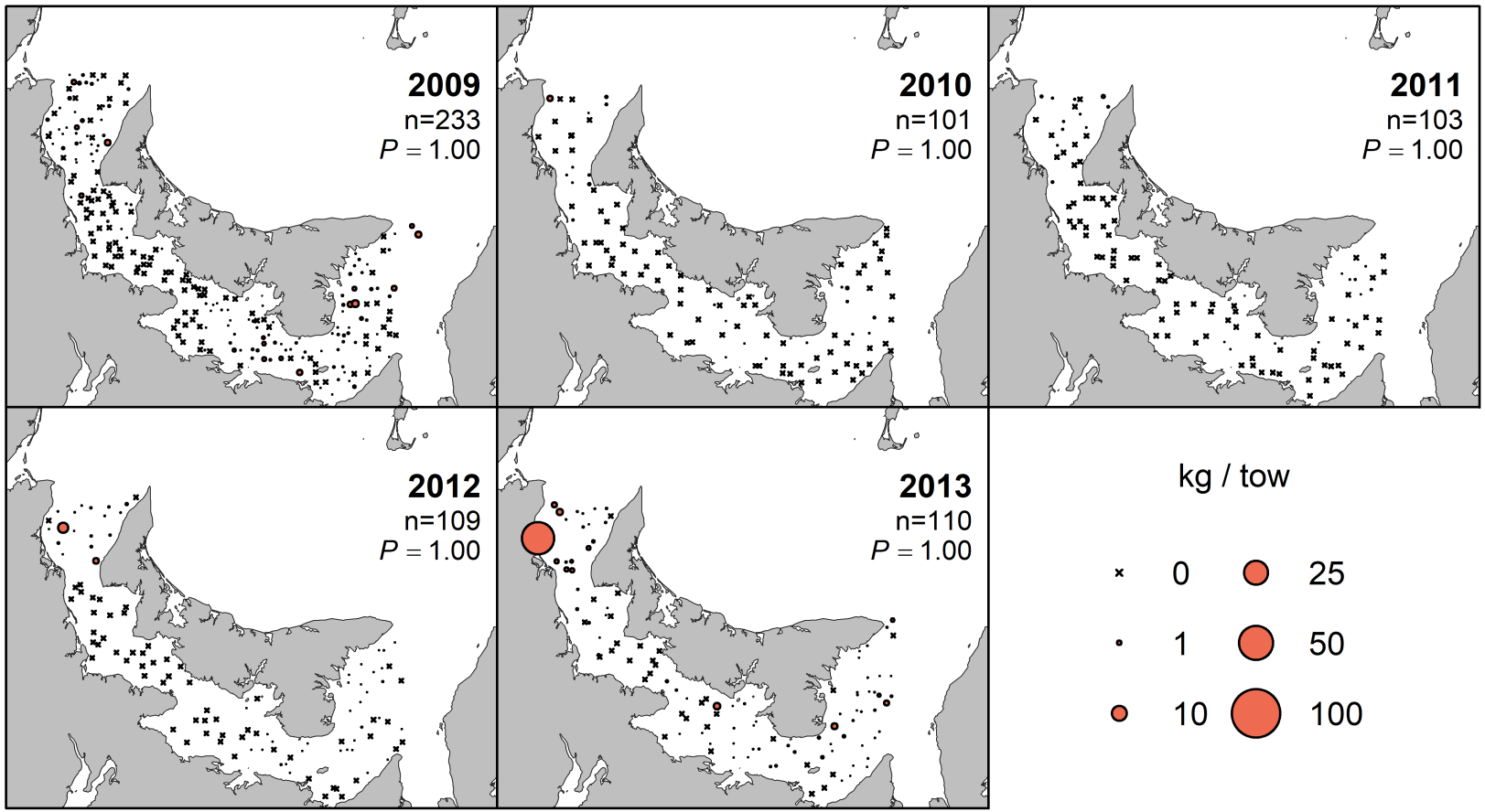

Figure 34. Relative density (kg/tow) of cod (Gadidae) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

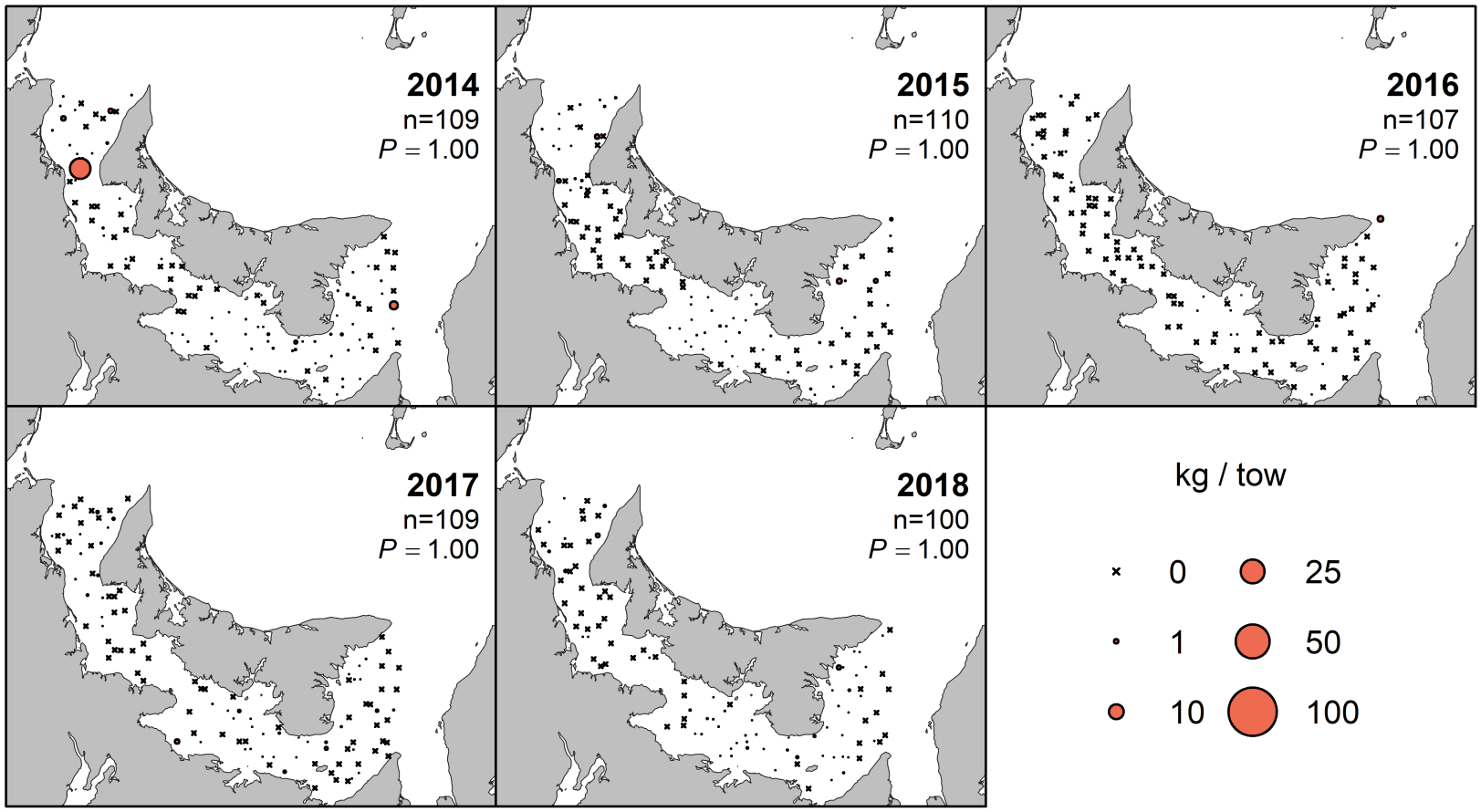

Figure 35. Relative density (kg/tow) of cod (Gadidae) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

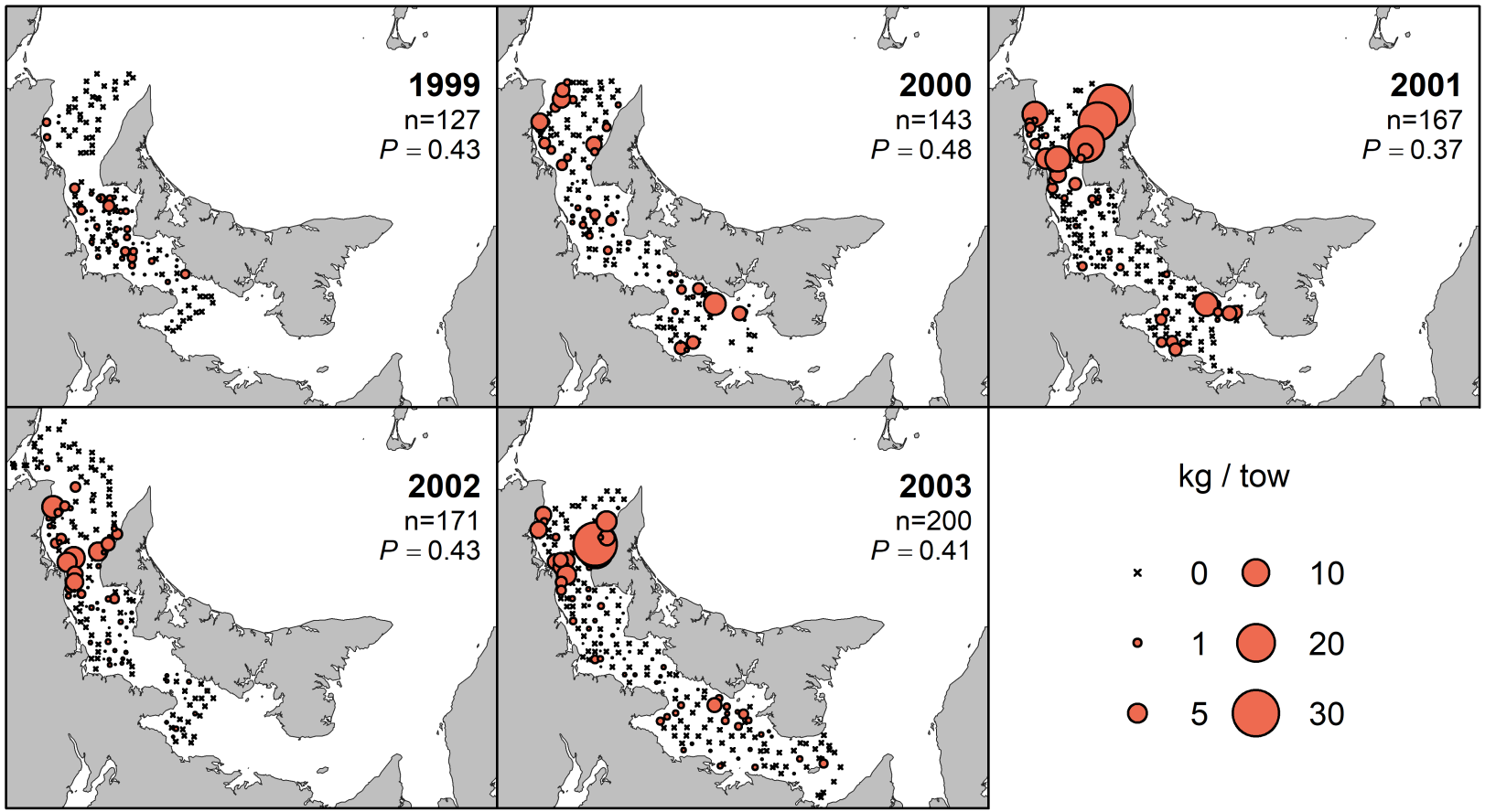

Figure 36. Relative density (kg/tow) of cunner (*Tautogolabrus adspersus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

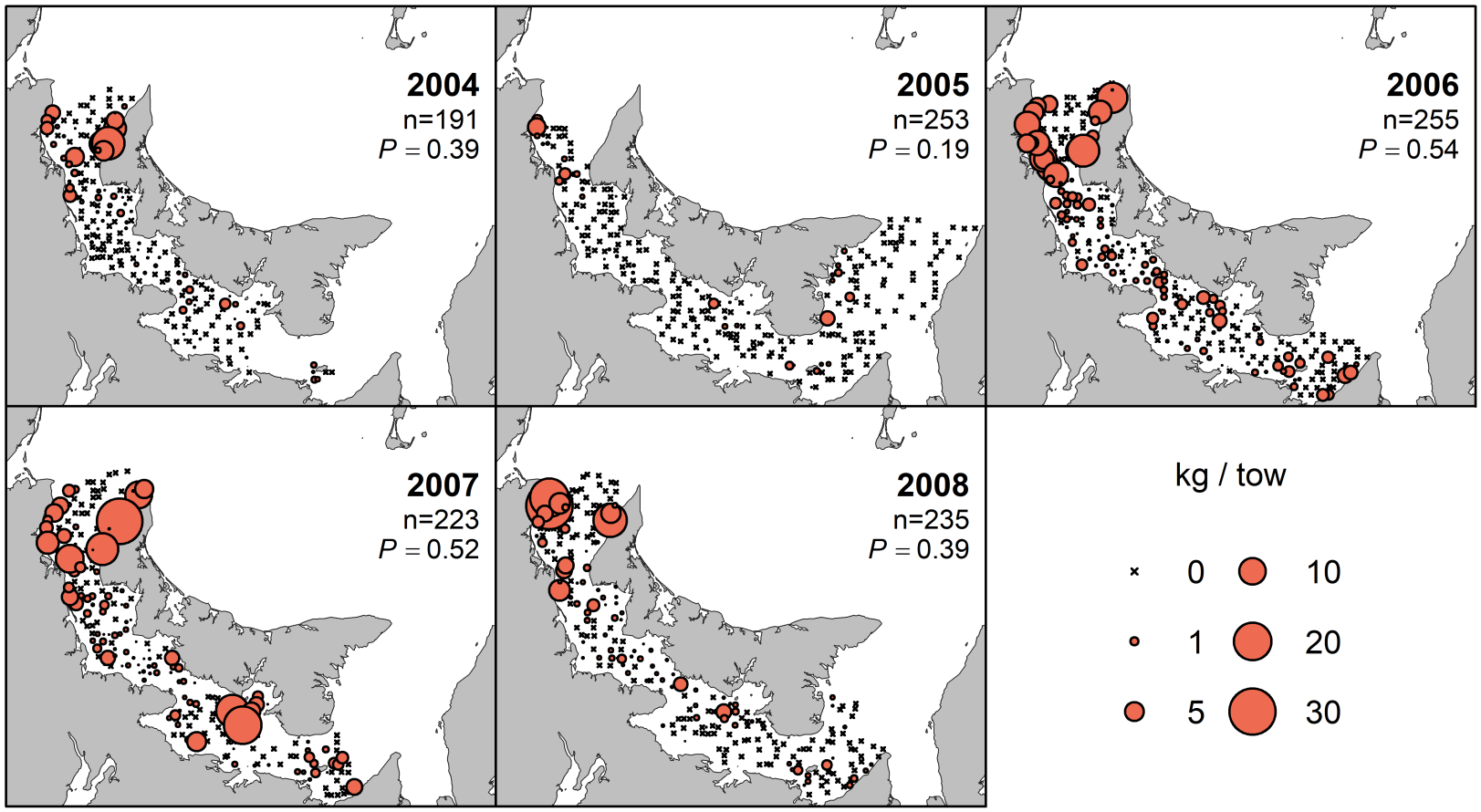

Figure 37. Relative density (kg/tow) of cunner (*Tautogolabrus adspersus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

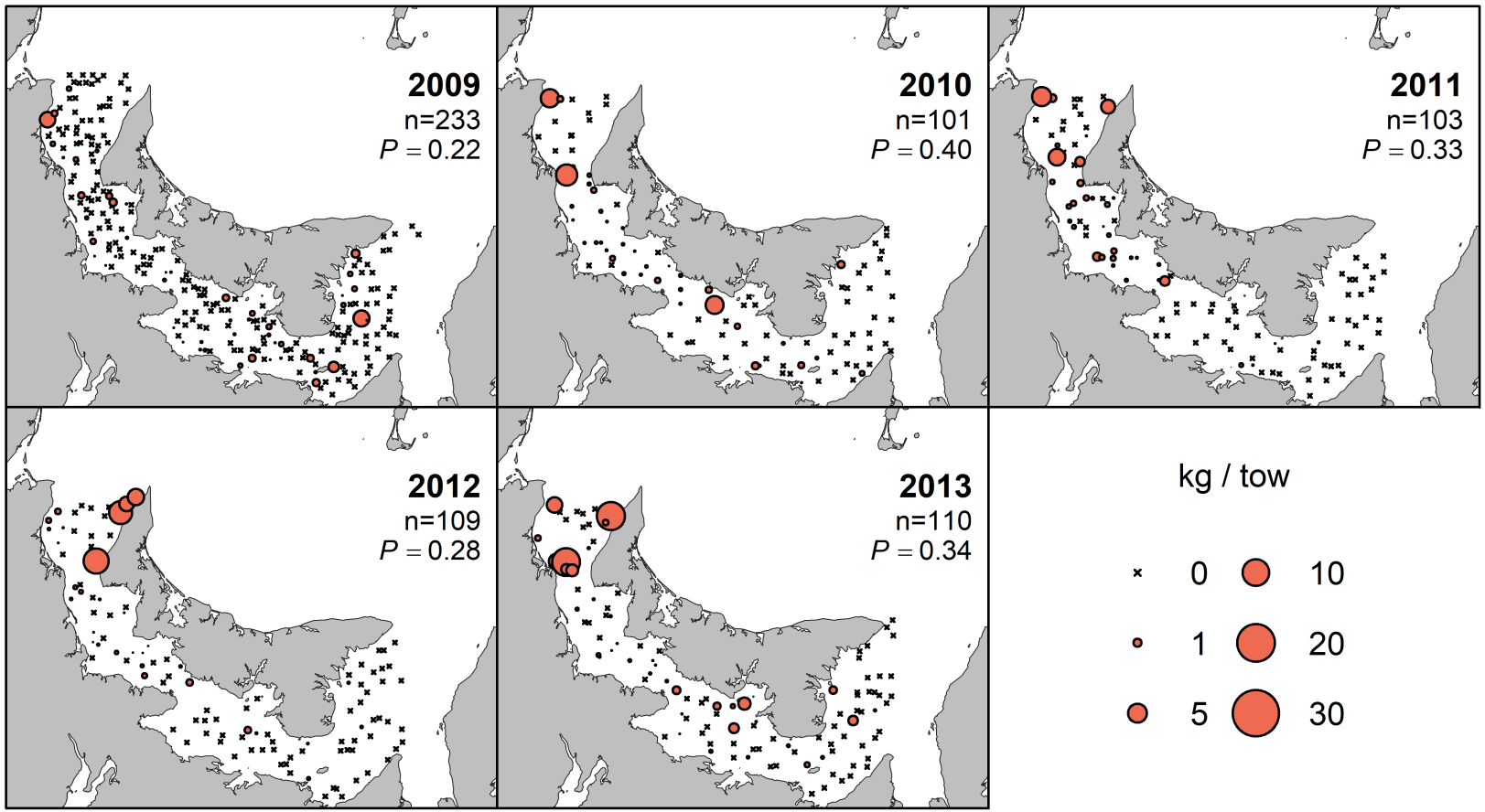

Figure 38. Relative density (kg/tow) of cunner (*Tautogolabrus adspersus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

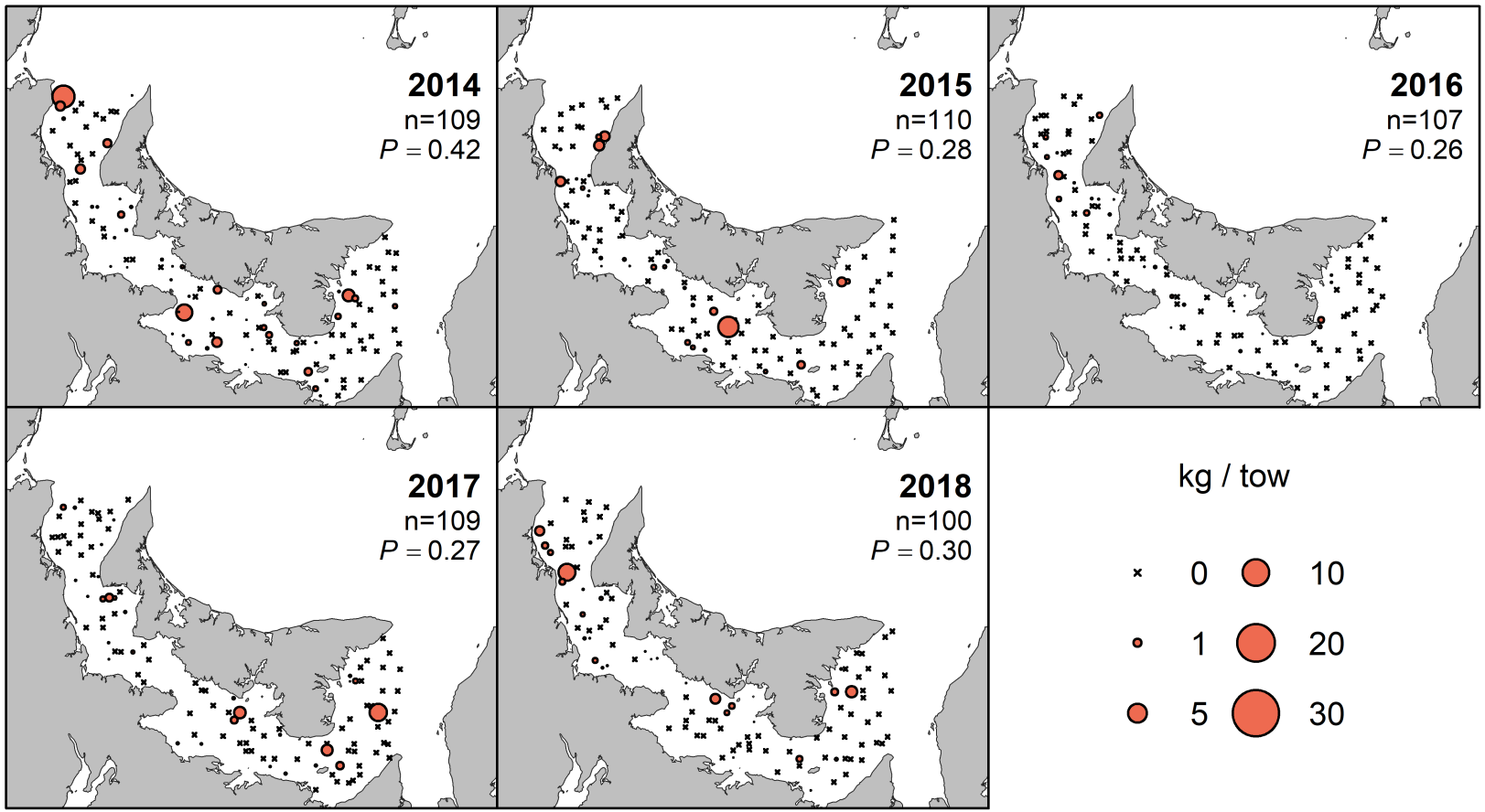

Figure 39. Relative density (kg/tow) of cunner (*Tautogolabrus adspersus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

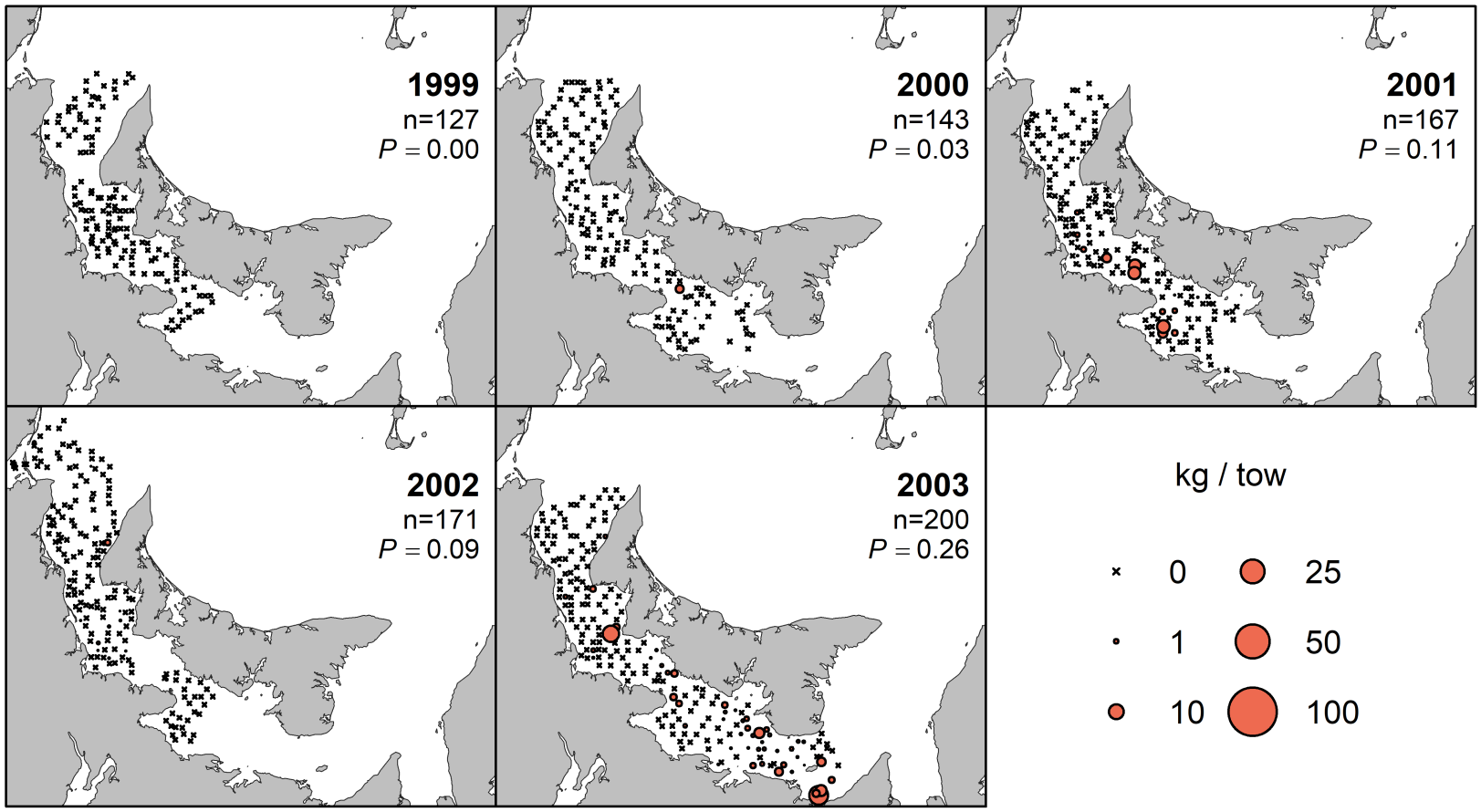

Figure 40. Relative density (kg/tow) of gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

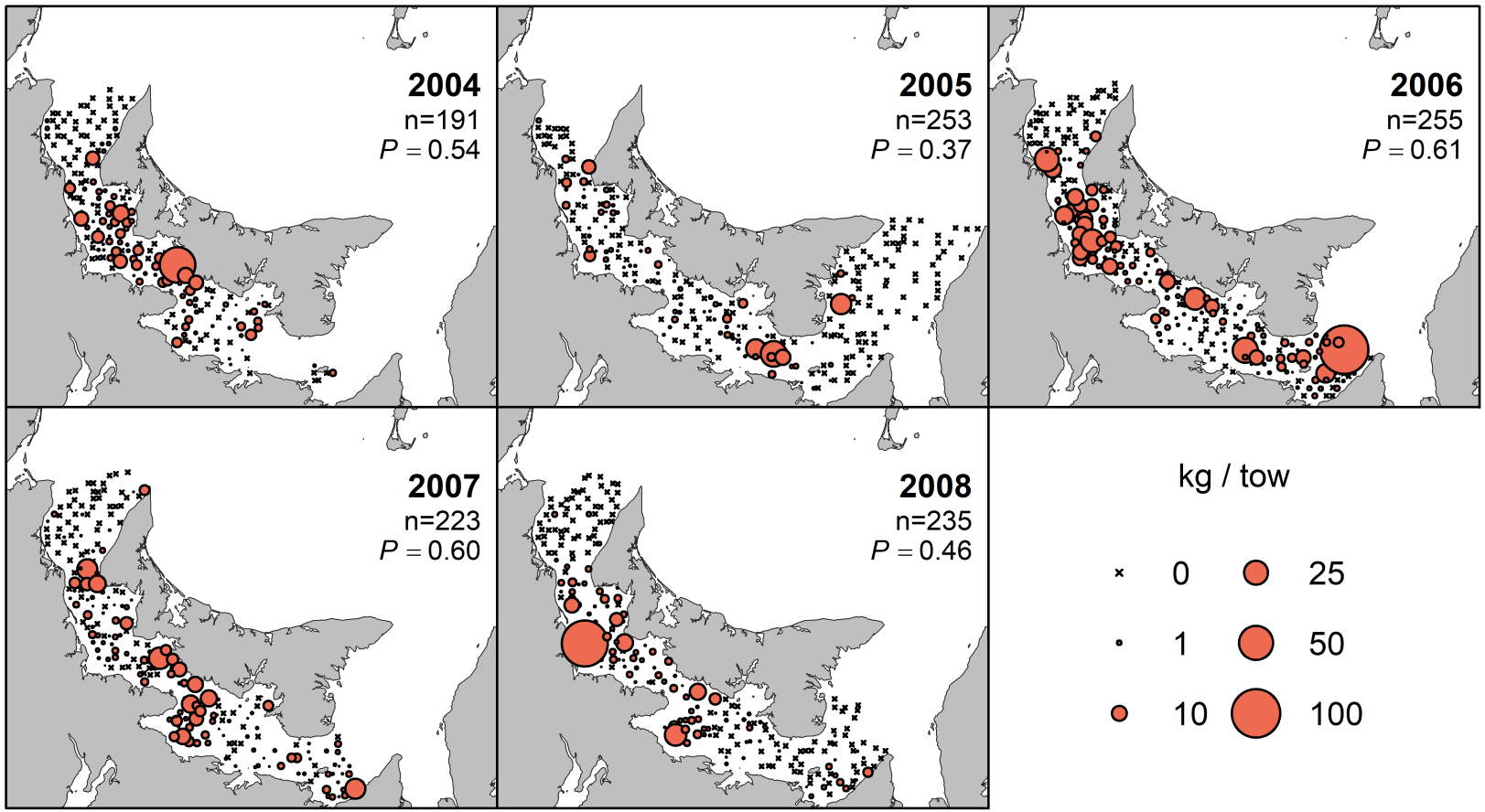

Figure 41. Relative density (kg/tow) of gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

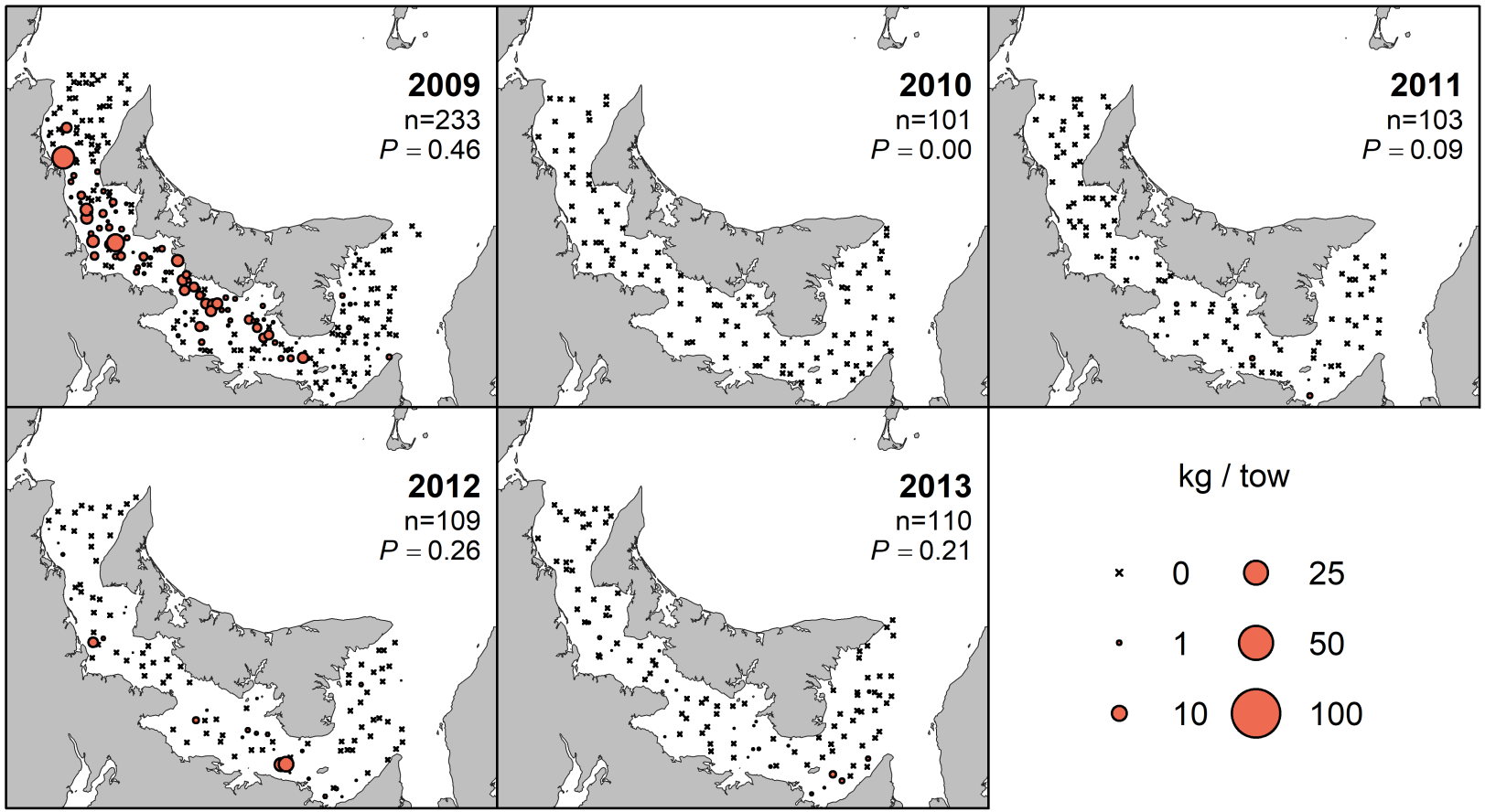

Figure 42. Relative density (kg/tow) of gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

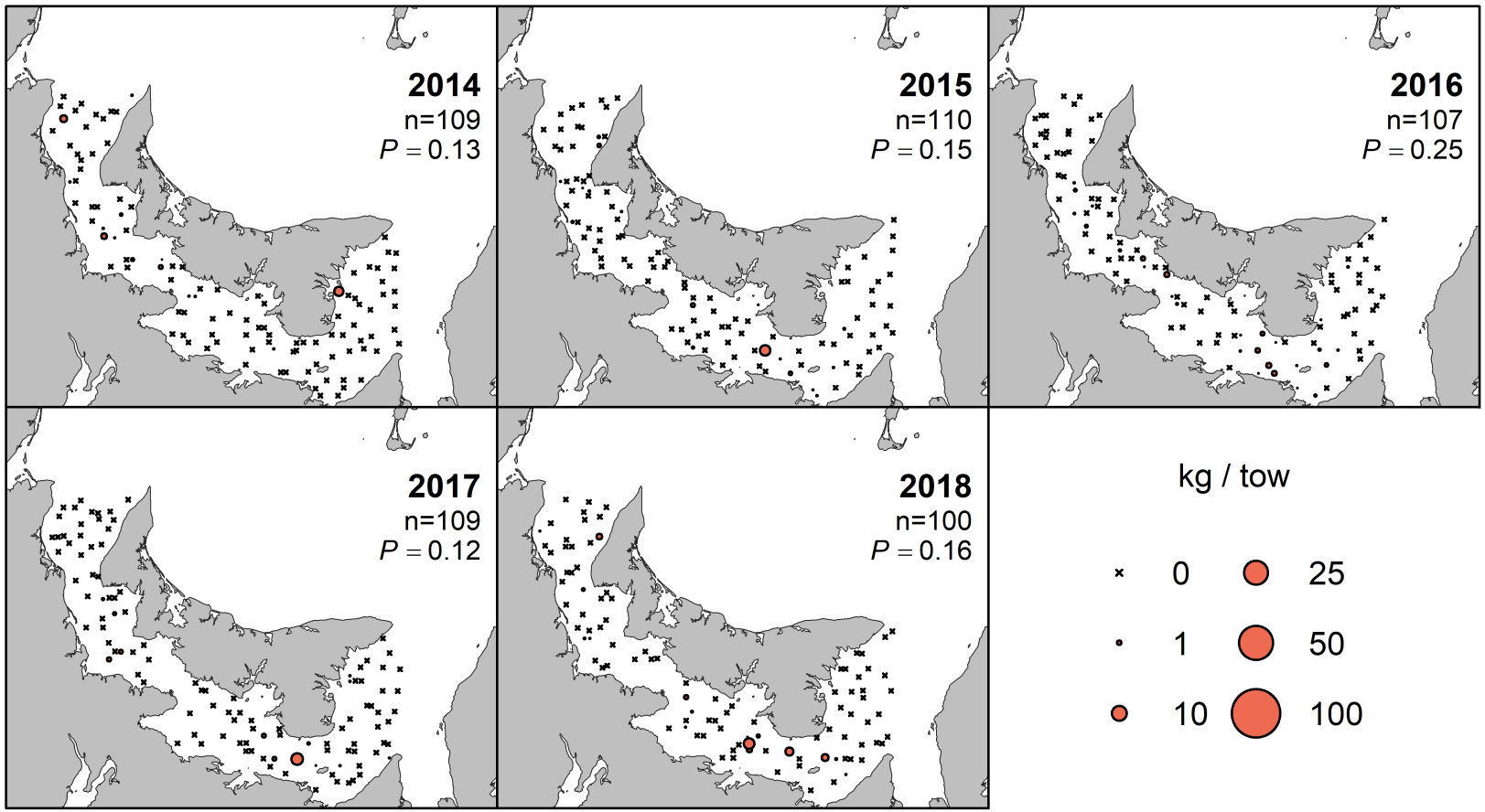

Figure 43. Relative density (kg/tow) of gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

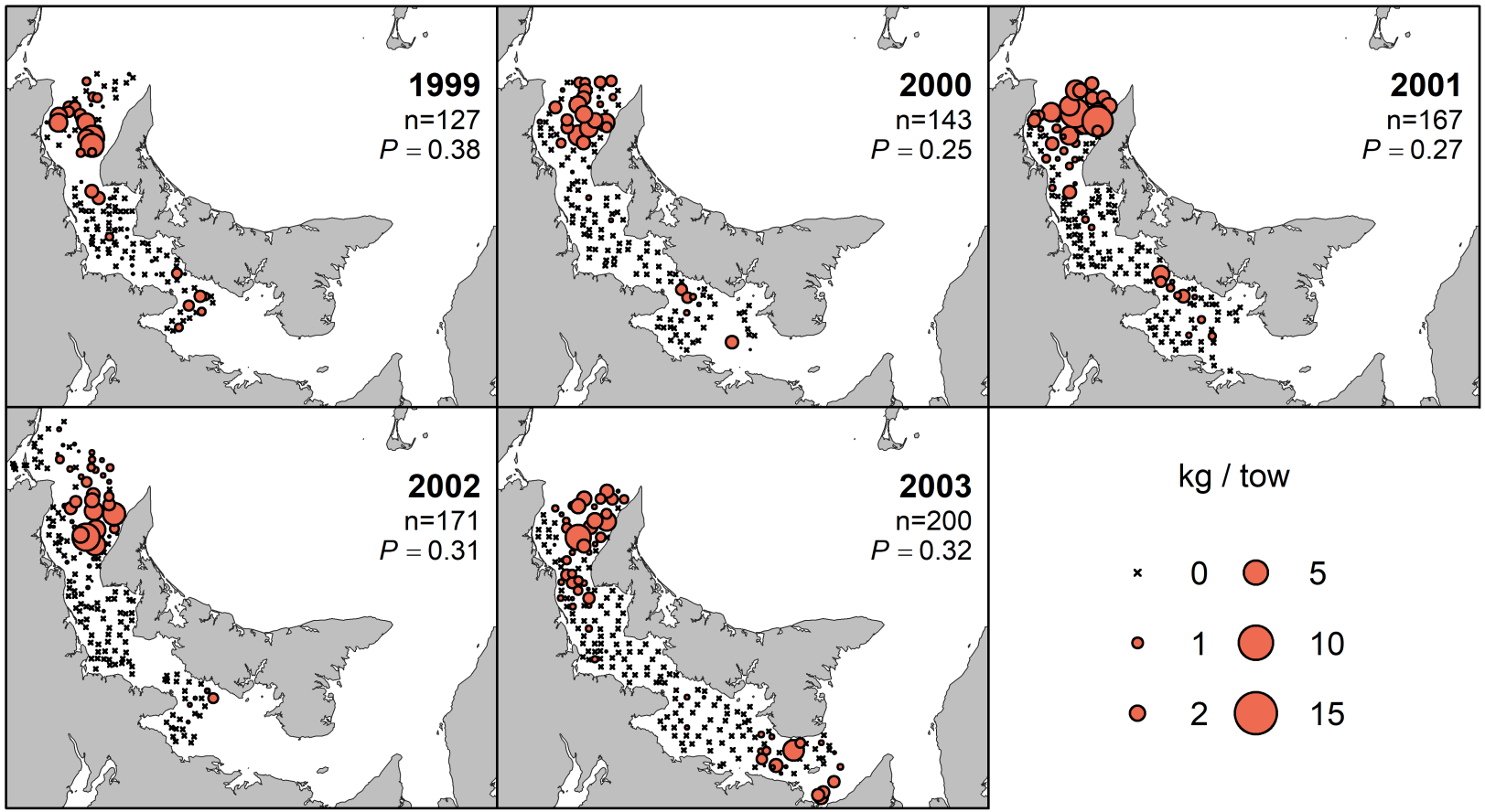

Figure 44. Relative density (kg/tow) of longhorn sculpin (*Myoxocephalus octodecemspinosus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

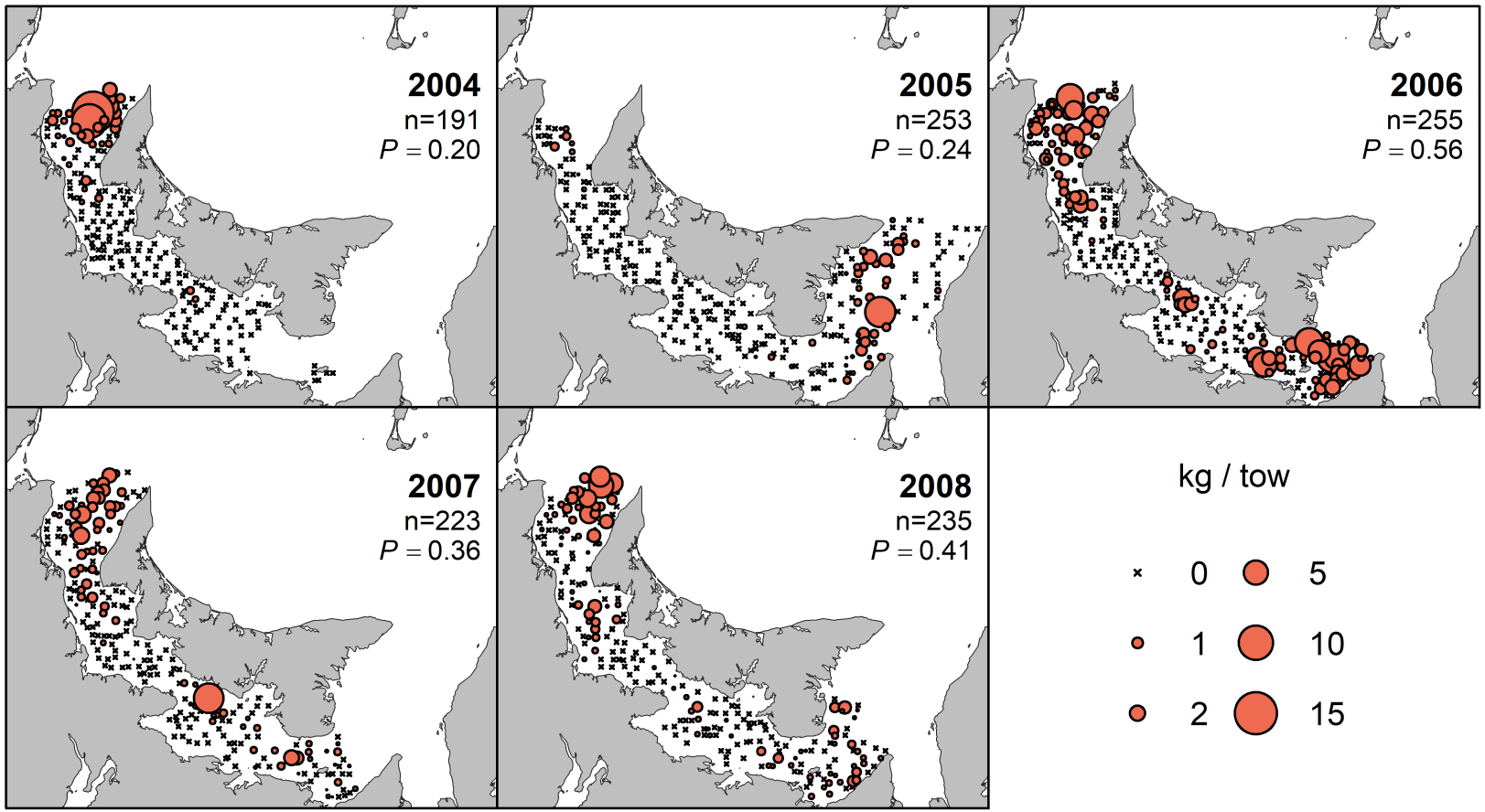

Figure 45. Relative density (kg/tow) of longhorn sculpin (*Myoxocephalus octodecemspinosus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

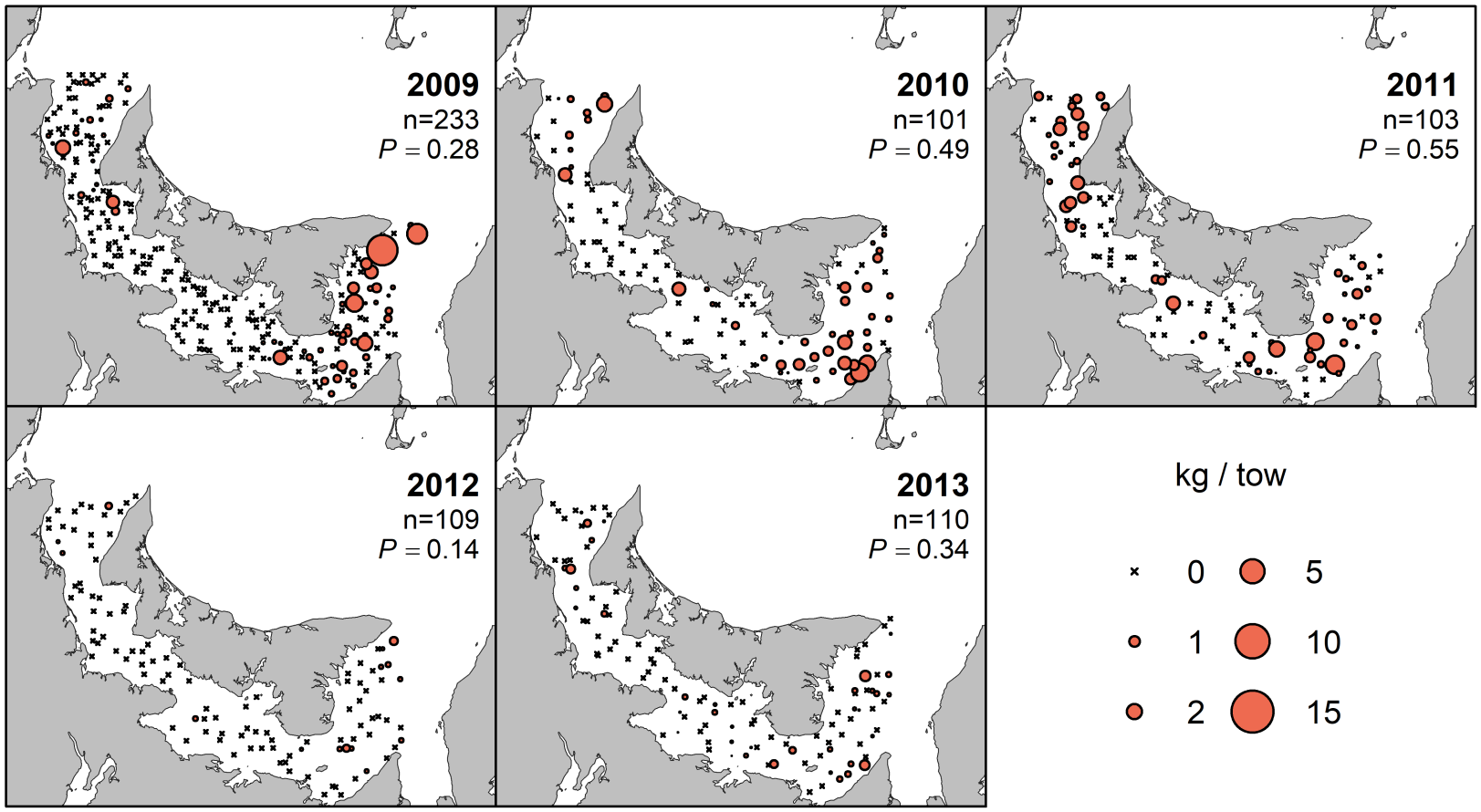

Figure 46. Relative density (kg/tow) of longhorn sculpin (*Myoxocephalus octodecemspinosus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

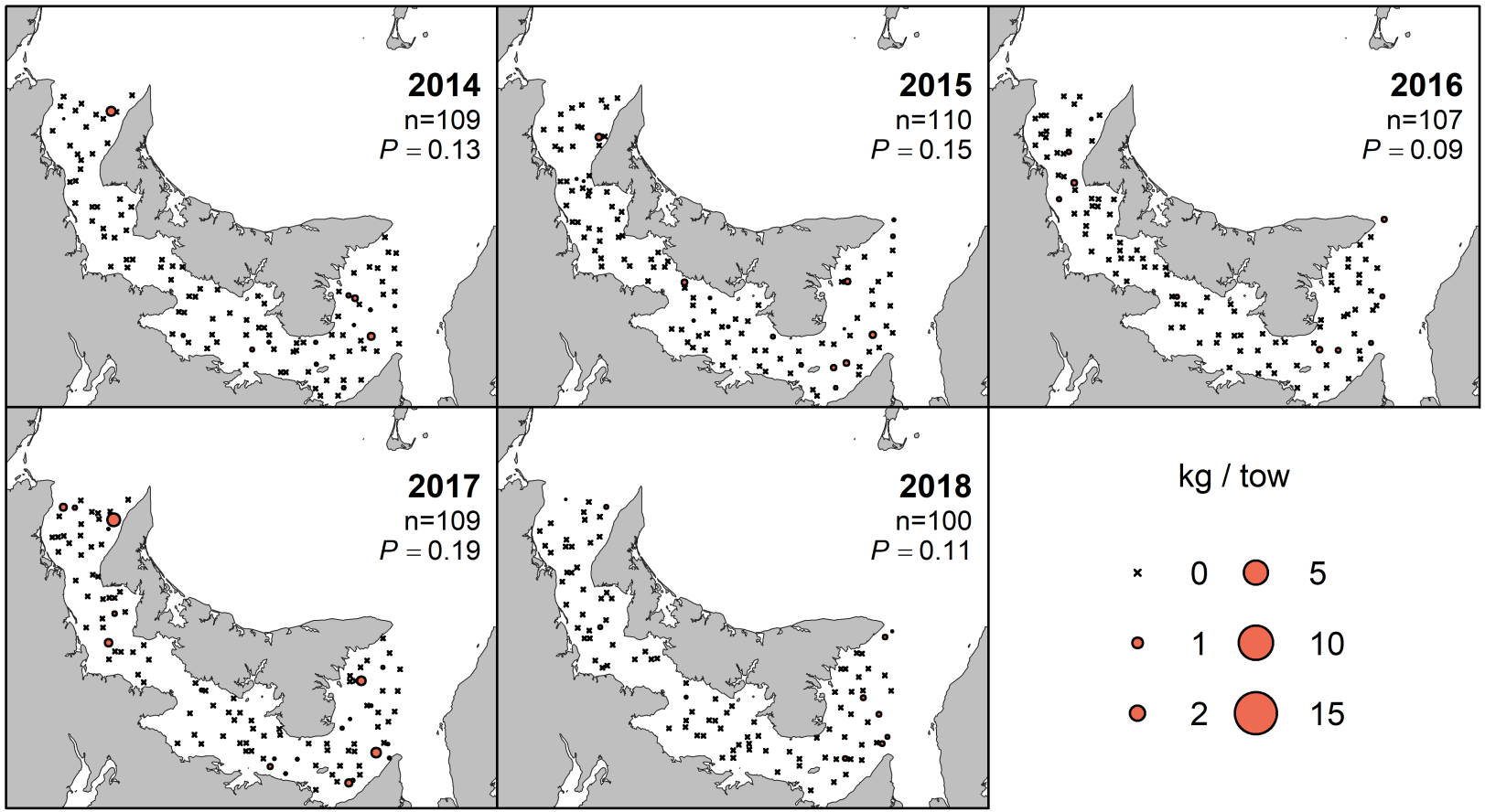

Figure 47. Relative density (kg/tow) of longhorn sculpin (*Myoxocephalus octodecemspinosus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

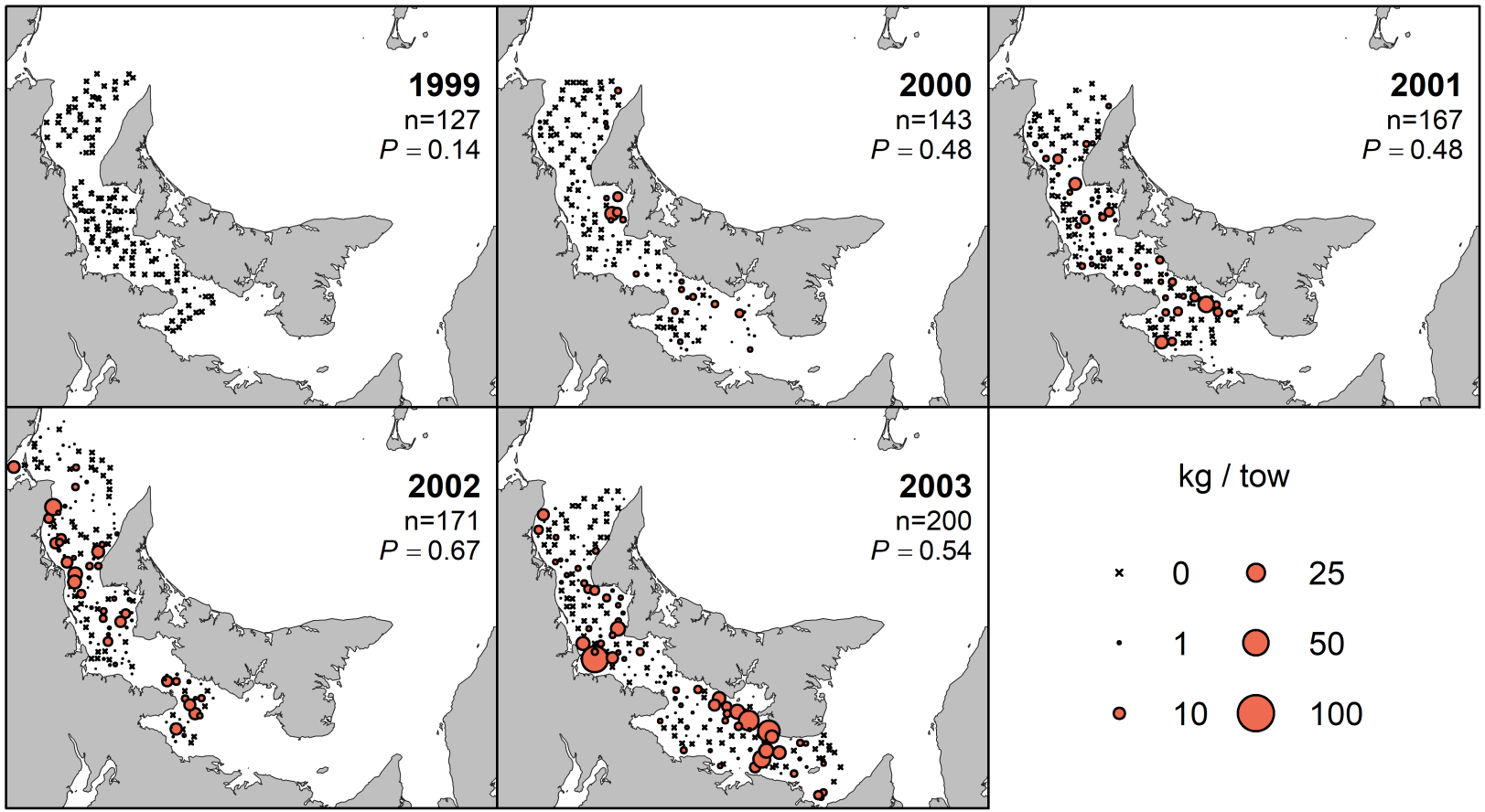

Figure 48. Relative density (kg/tow) of rainbow smelt (*Osmerus mordax*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

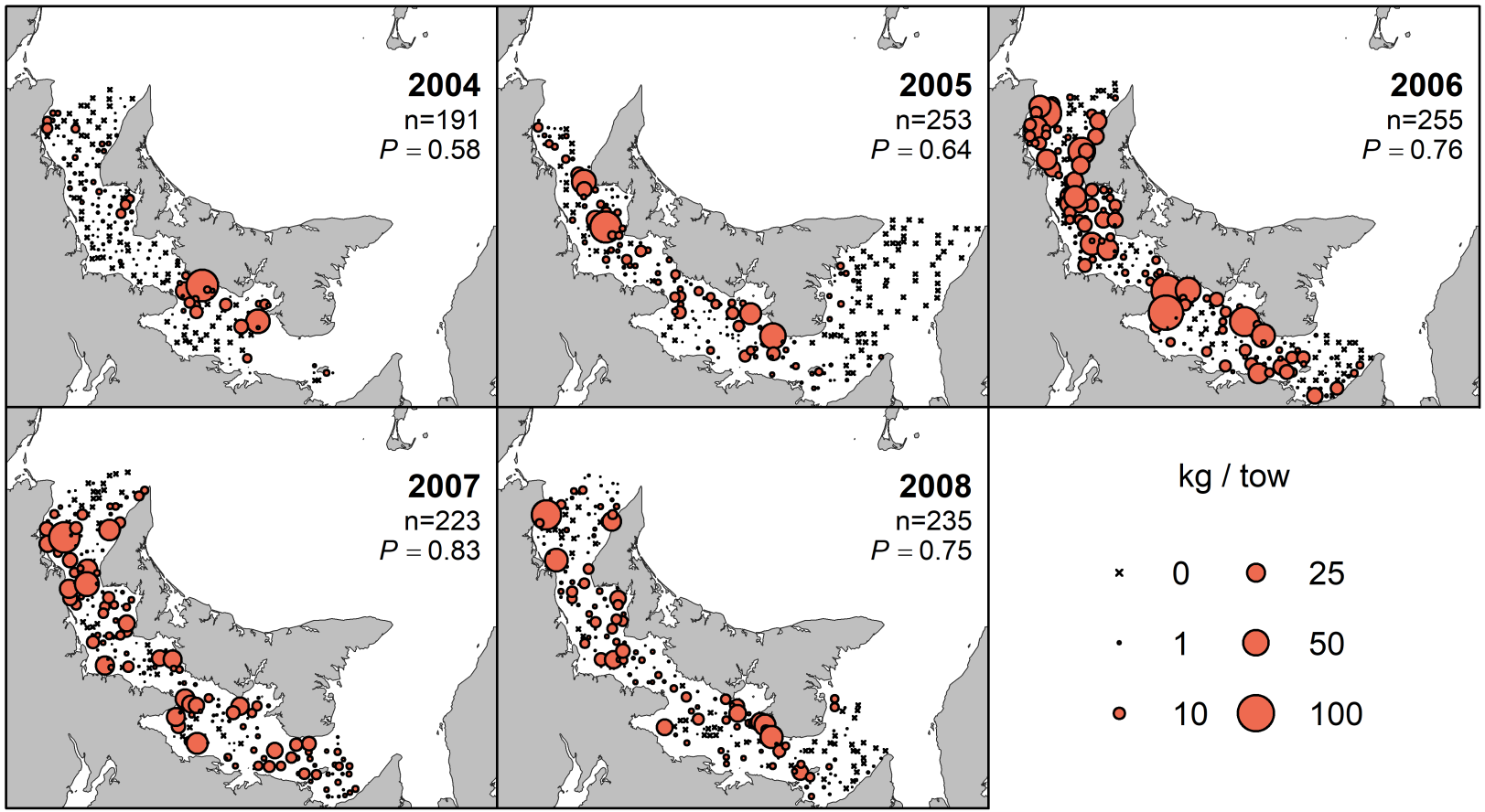

Figure 49. Relative density (kg/tow) of rainbow smelt (*Osmerus mordax*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

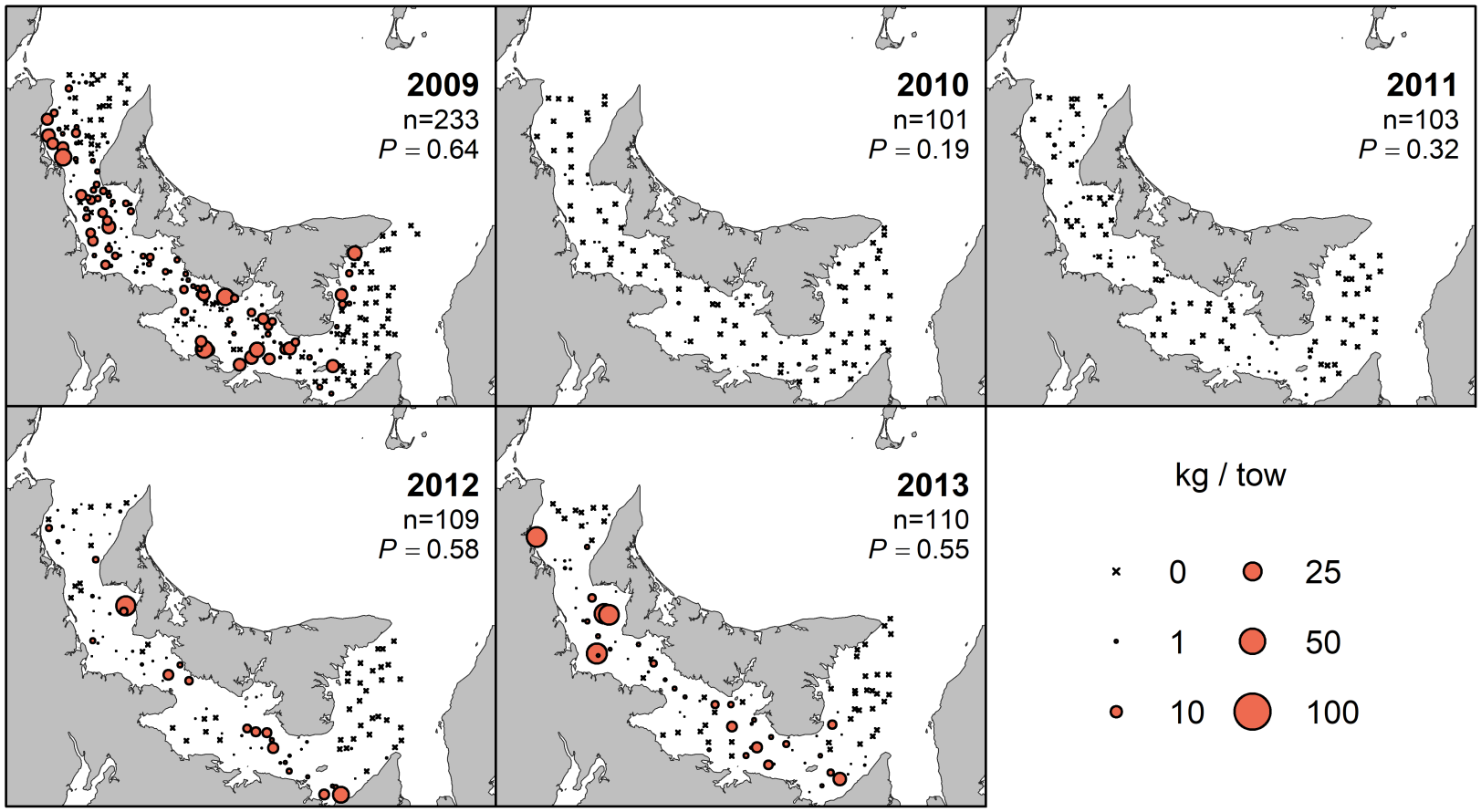

Figure 50. Relative density (kg/tow) of rainbow smelt (*Osmerus mordax*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

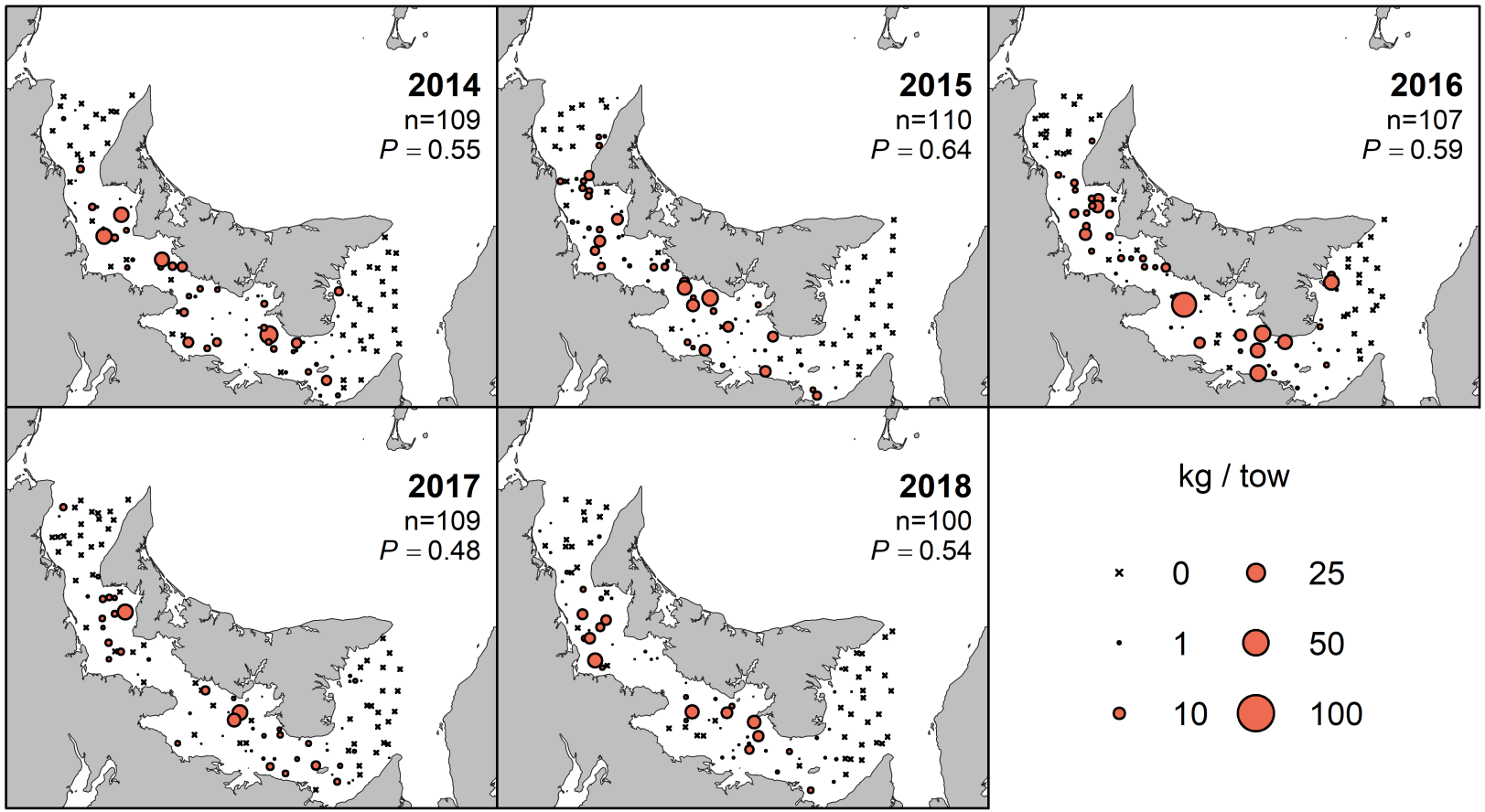

Figure 51. Relative density (kg/tow) of rainbow smelt (*Osmerus mordax*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

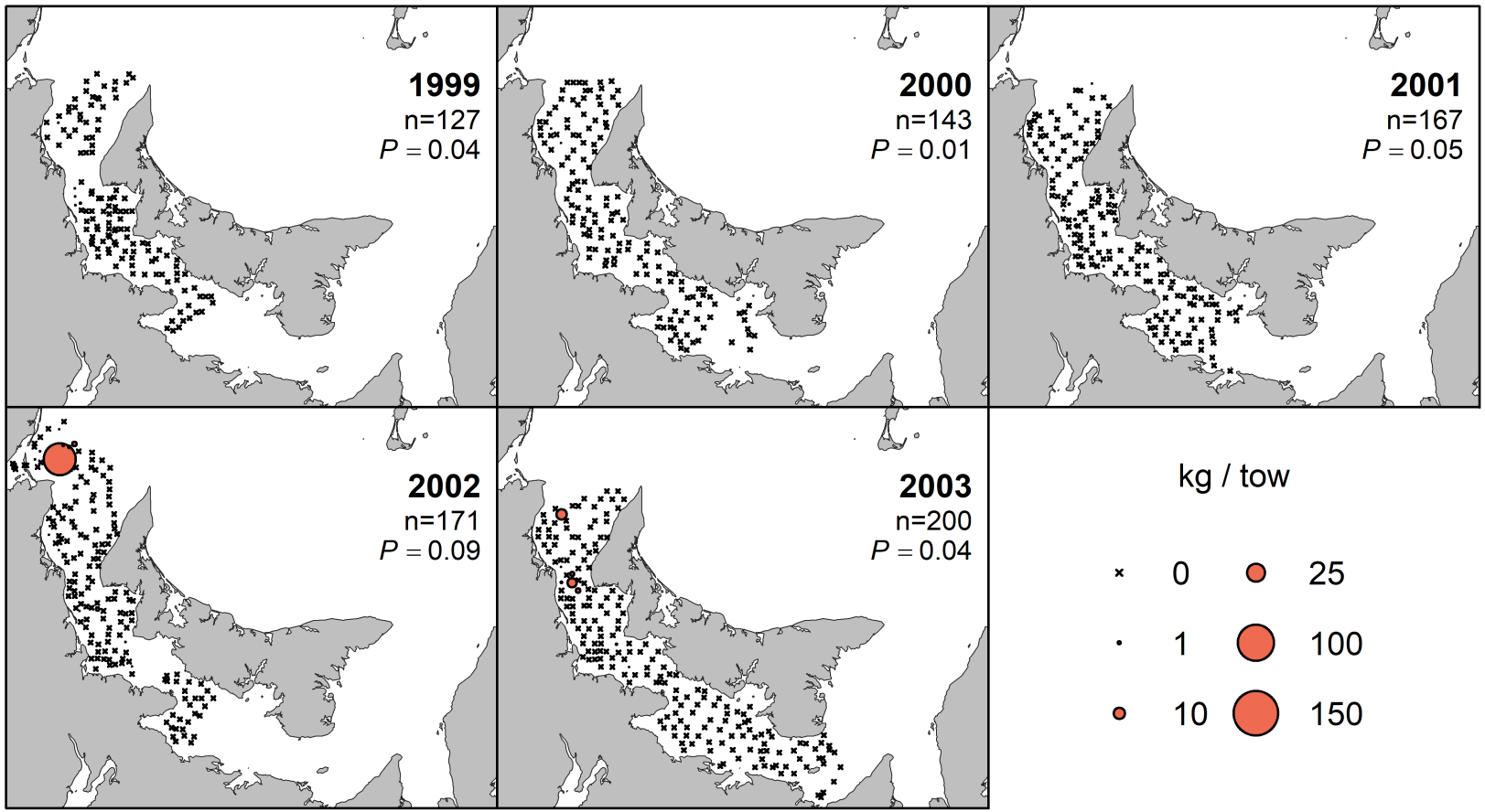

Figure 52. Relative density (kg/tow) of sand lance (*Ammodytes* sp.) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

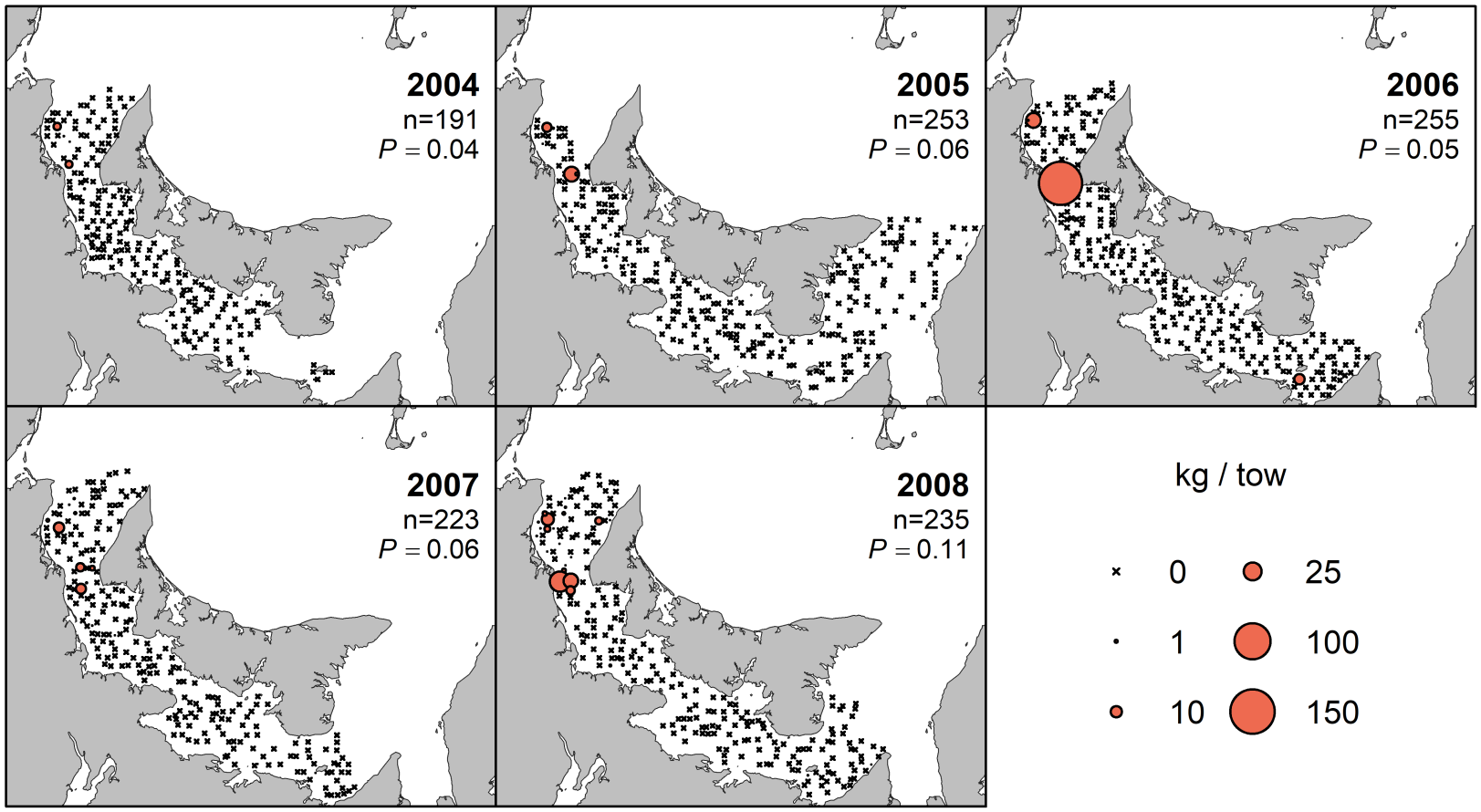

Figure 53. Relative density (kg/tow) of sand lance (*Ammodytes* sp.) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

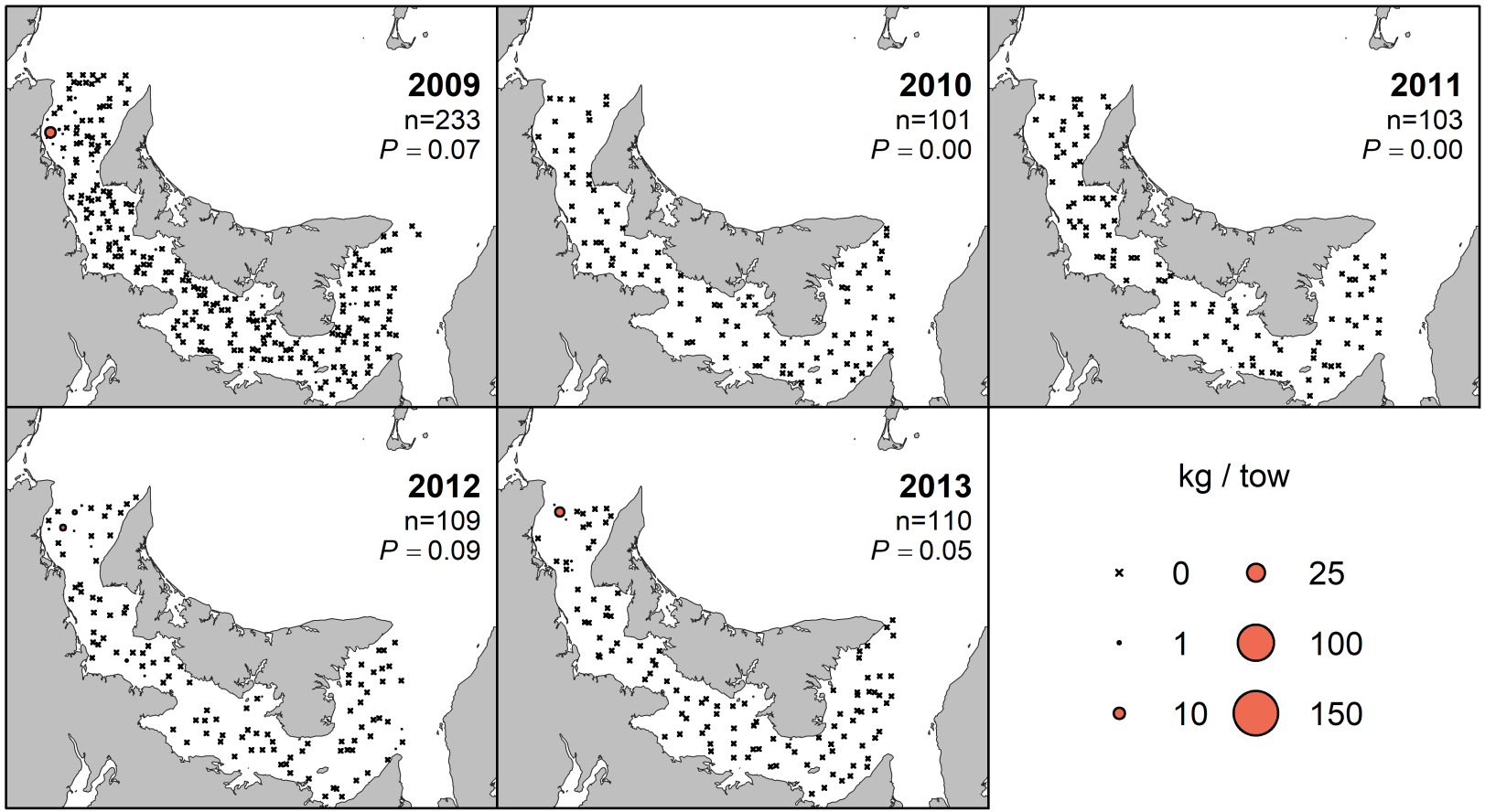

Figure 54. Relative density (kg/tow) of sand lance (*Ammodytes* sp.) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

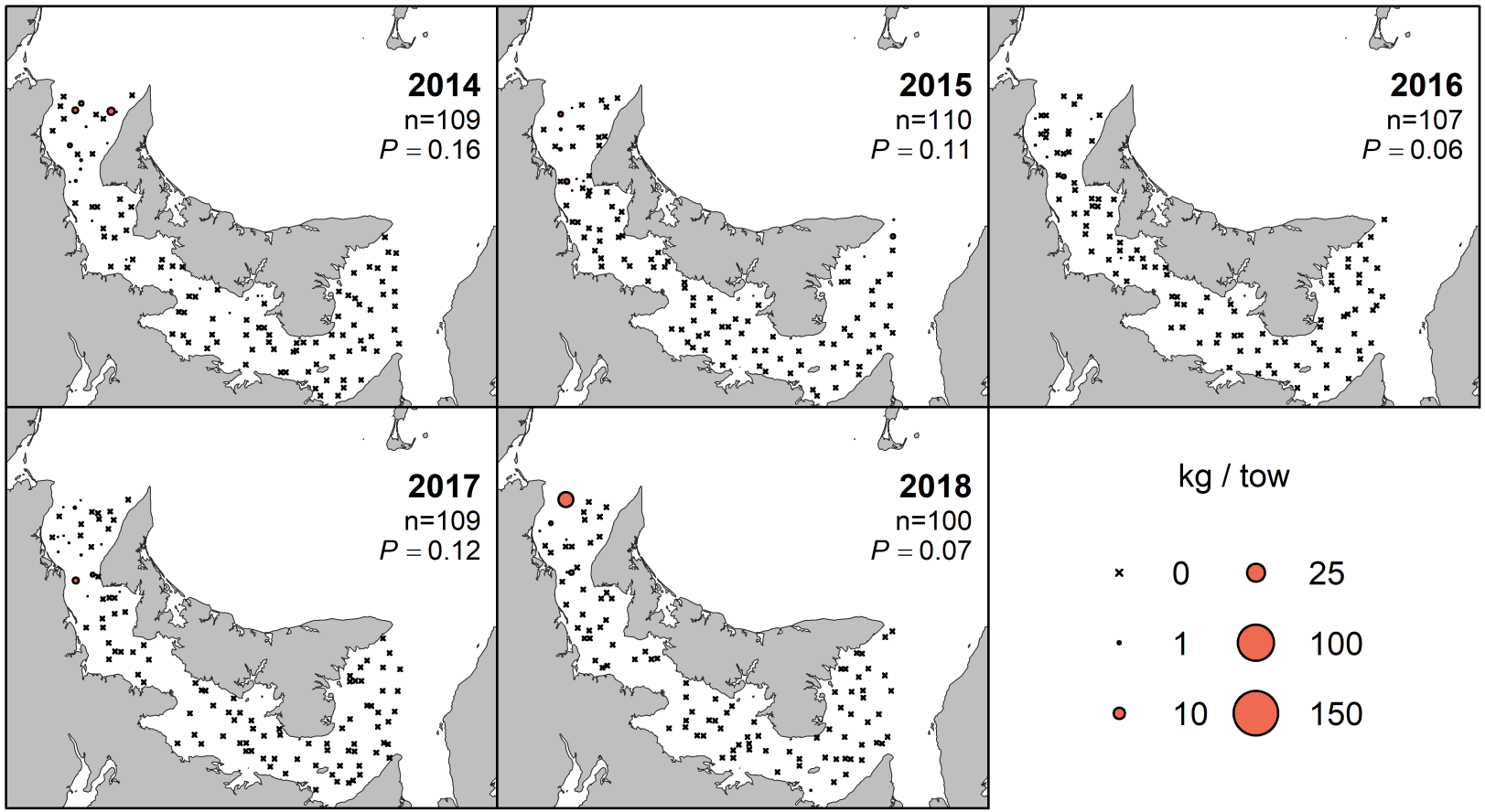

Figure 55. Relative density (kg/tow) of sand lance (*Ammodytes* sp.) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

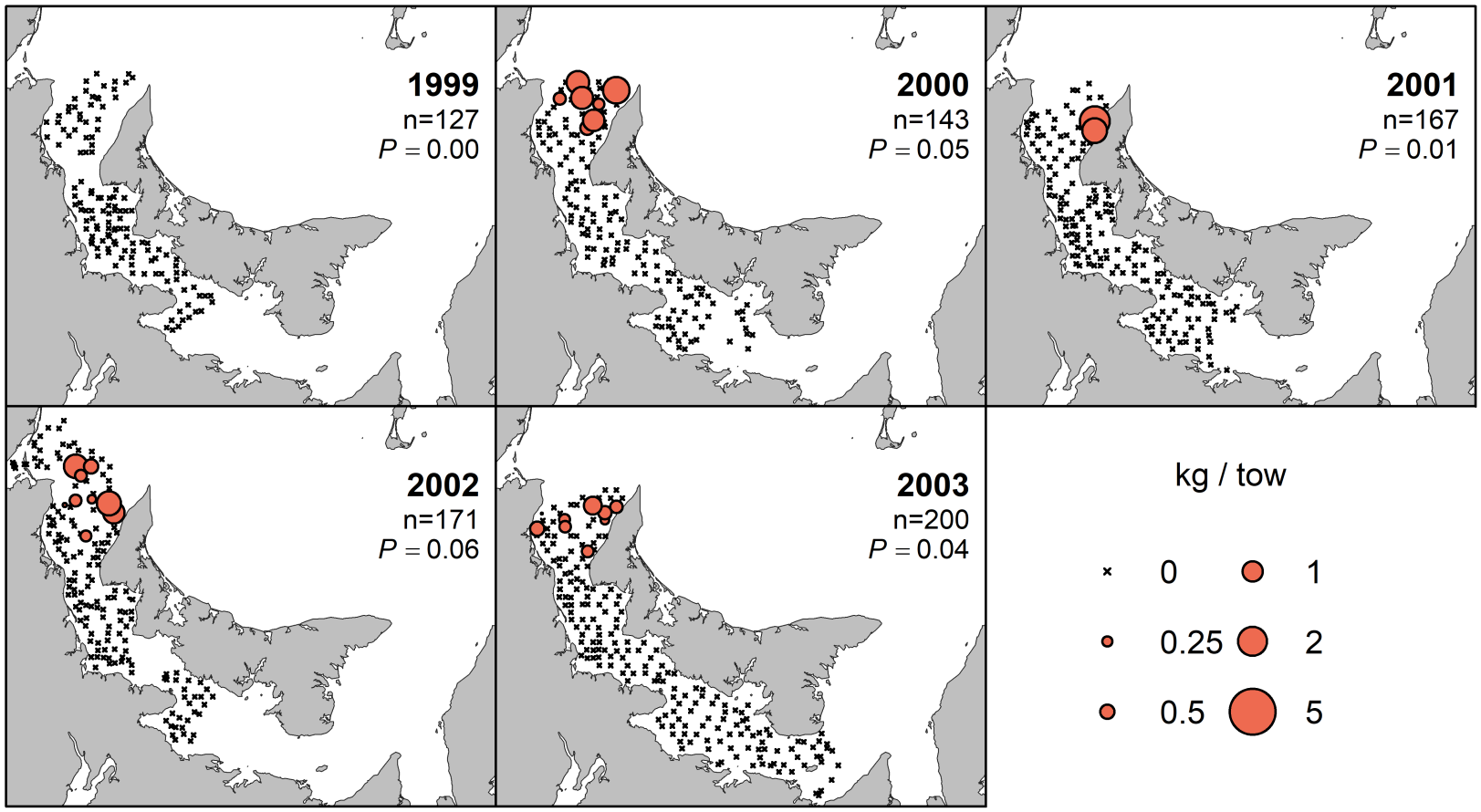

Figure 56. Relative density (kg/tow) of shorthorn sculpin (*Myoxocephalus scorpius*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

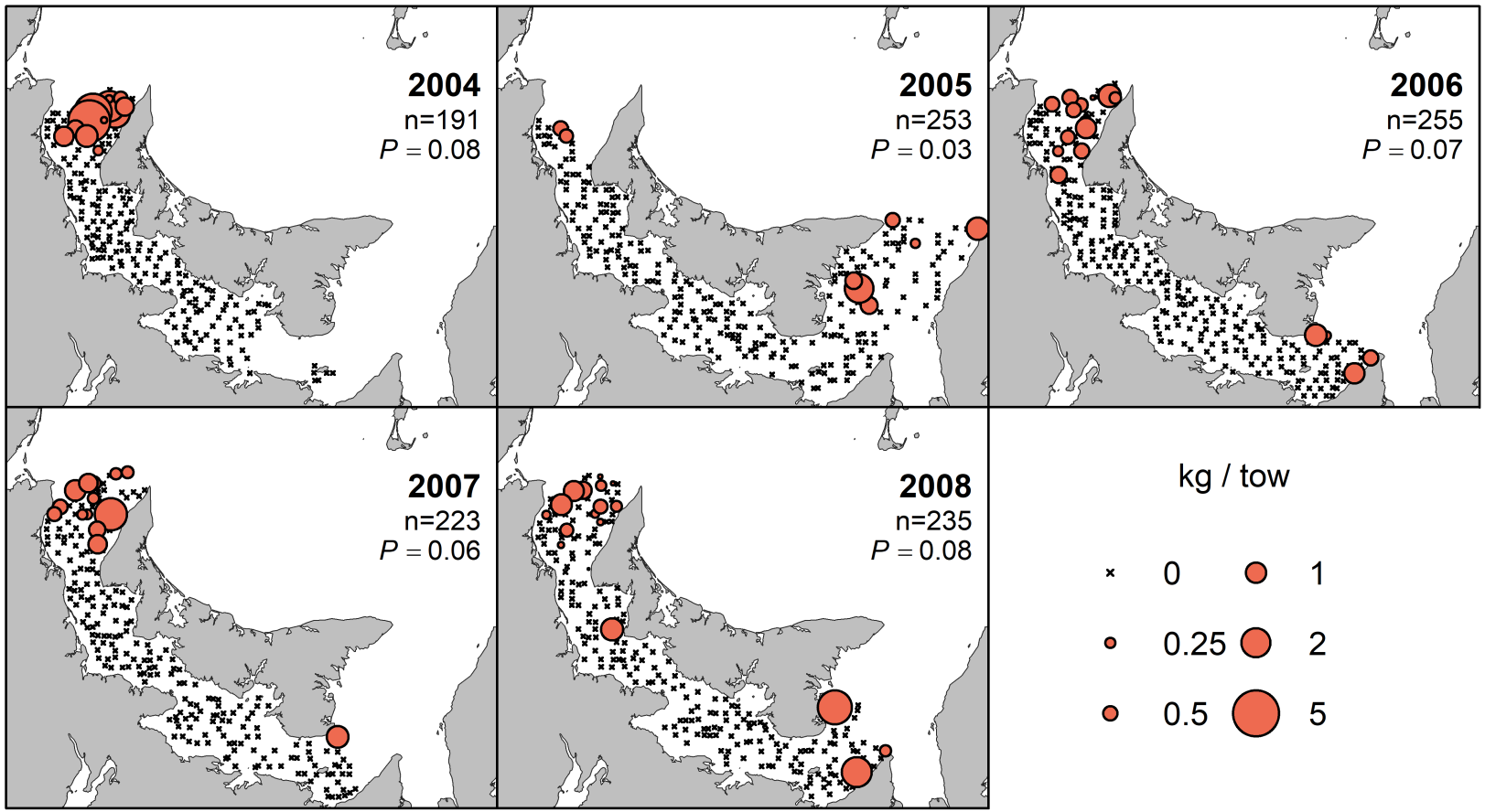

Figure 57. Relative density (kg/tow) of shorthorn sculpin (*Myoxocephalus scorpius*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

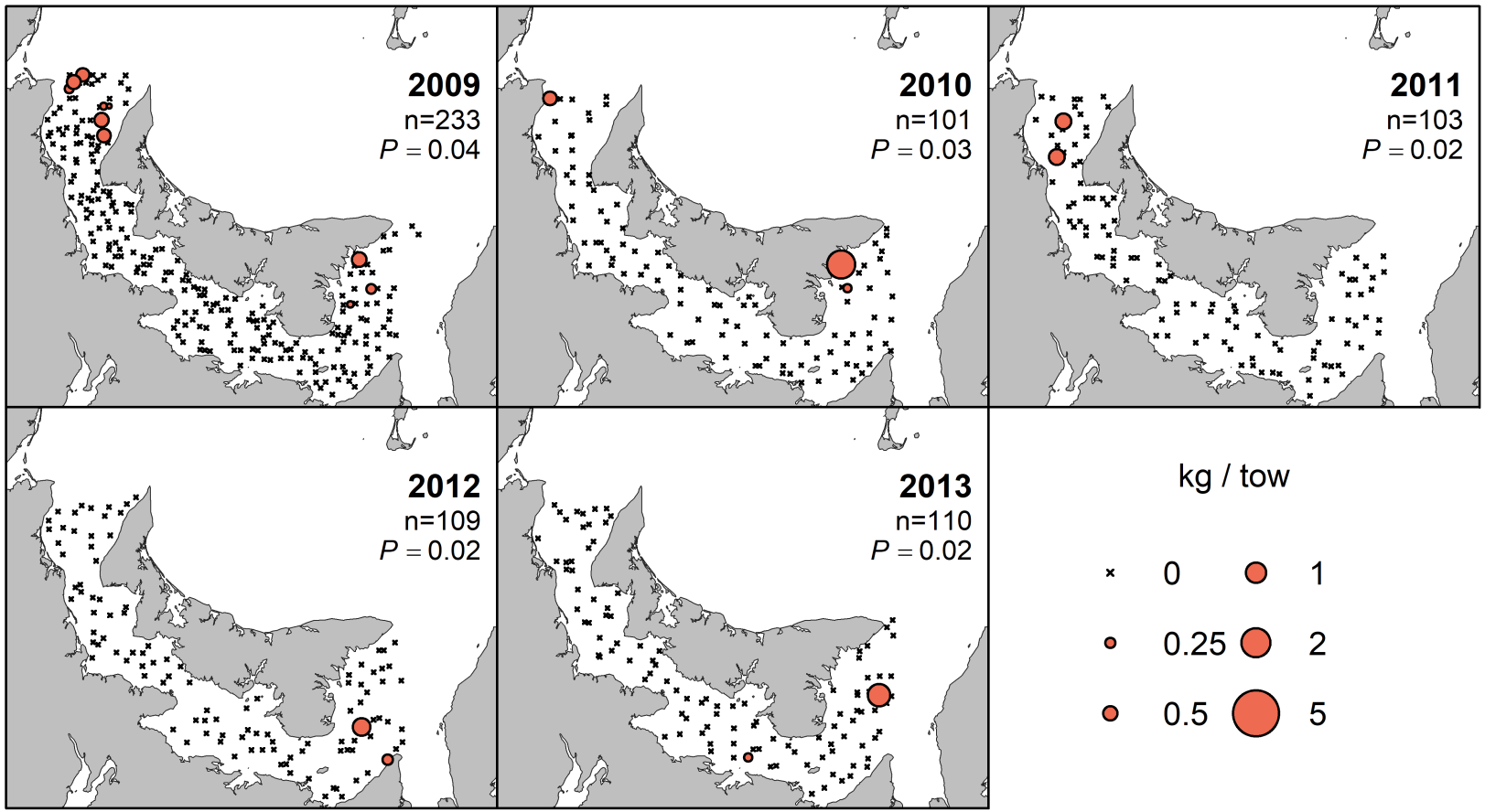

Figure 58. Relative density (kg/tow) of shorthorn sculpin (*Myoxocephalus scorpius*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

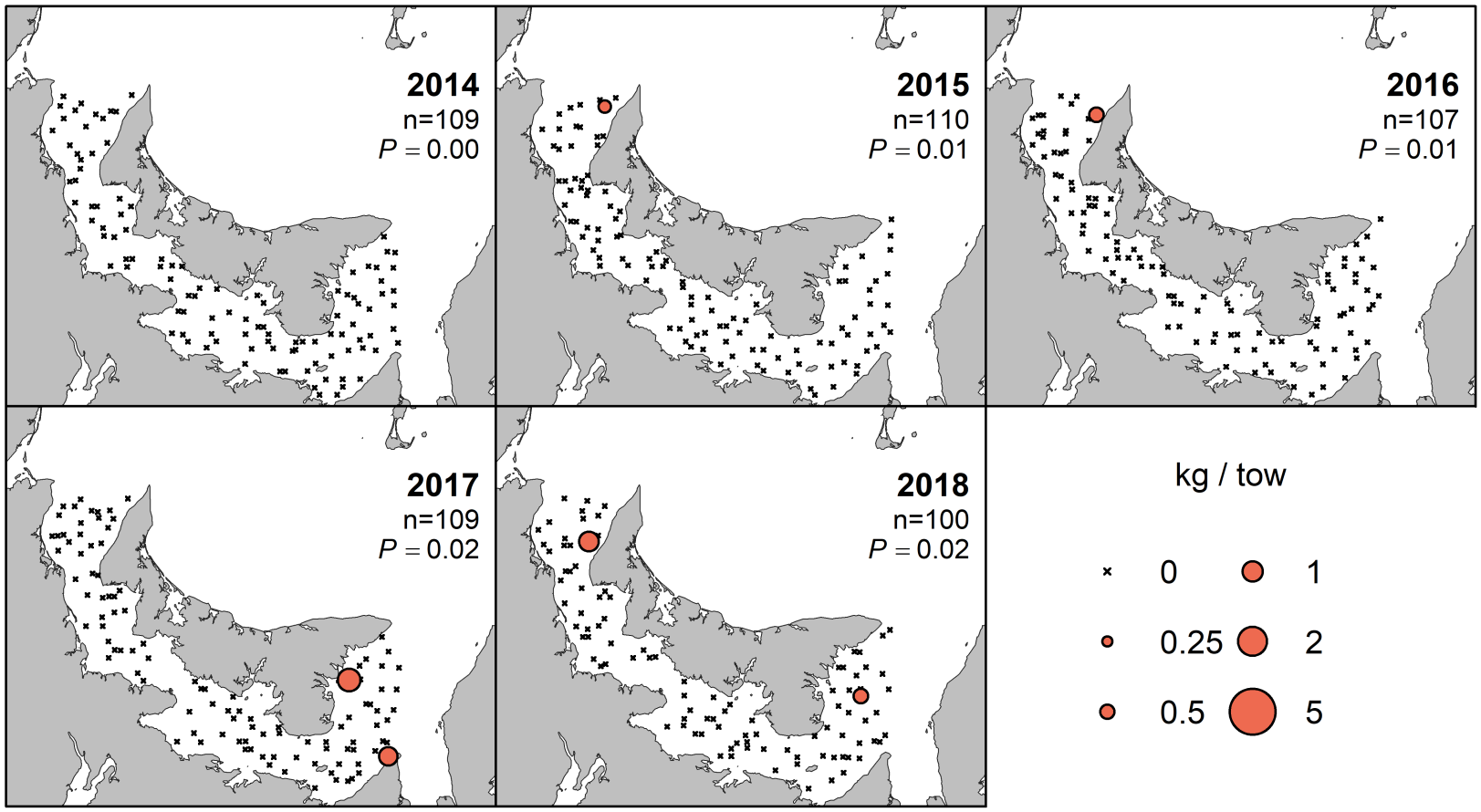

Figure 59. Relative density (kg/tow) of shorthorn sculpin (*Myoxocephalus scorpius*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

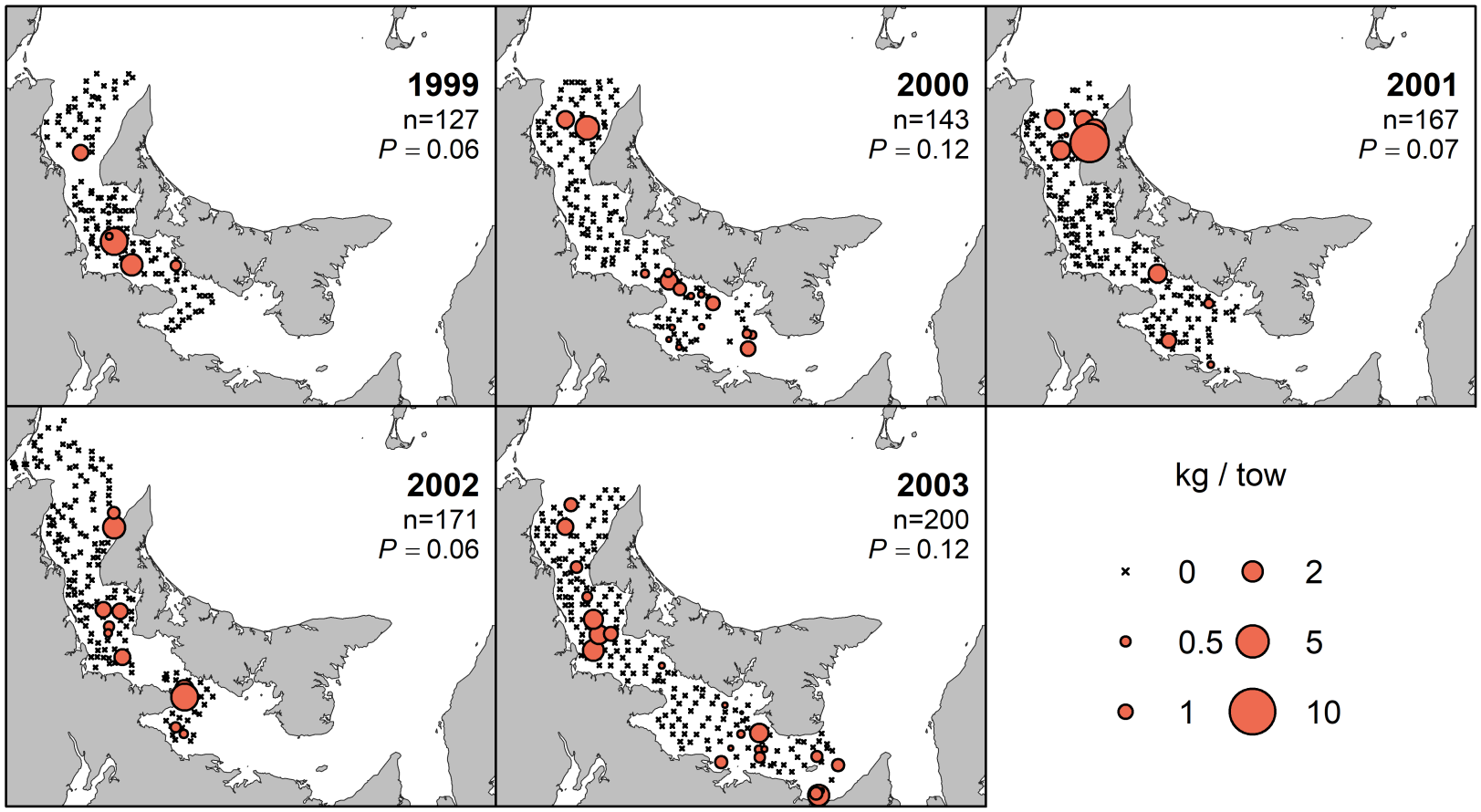

Figure 60. Relative density (kg/tow) of white hake (*Urophycis tenuis*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

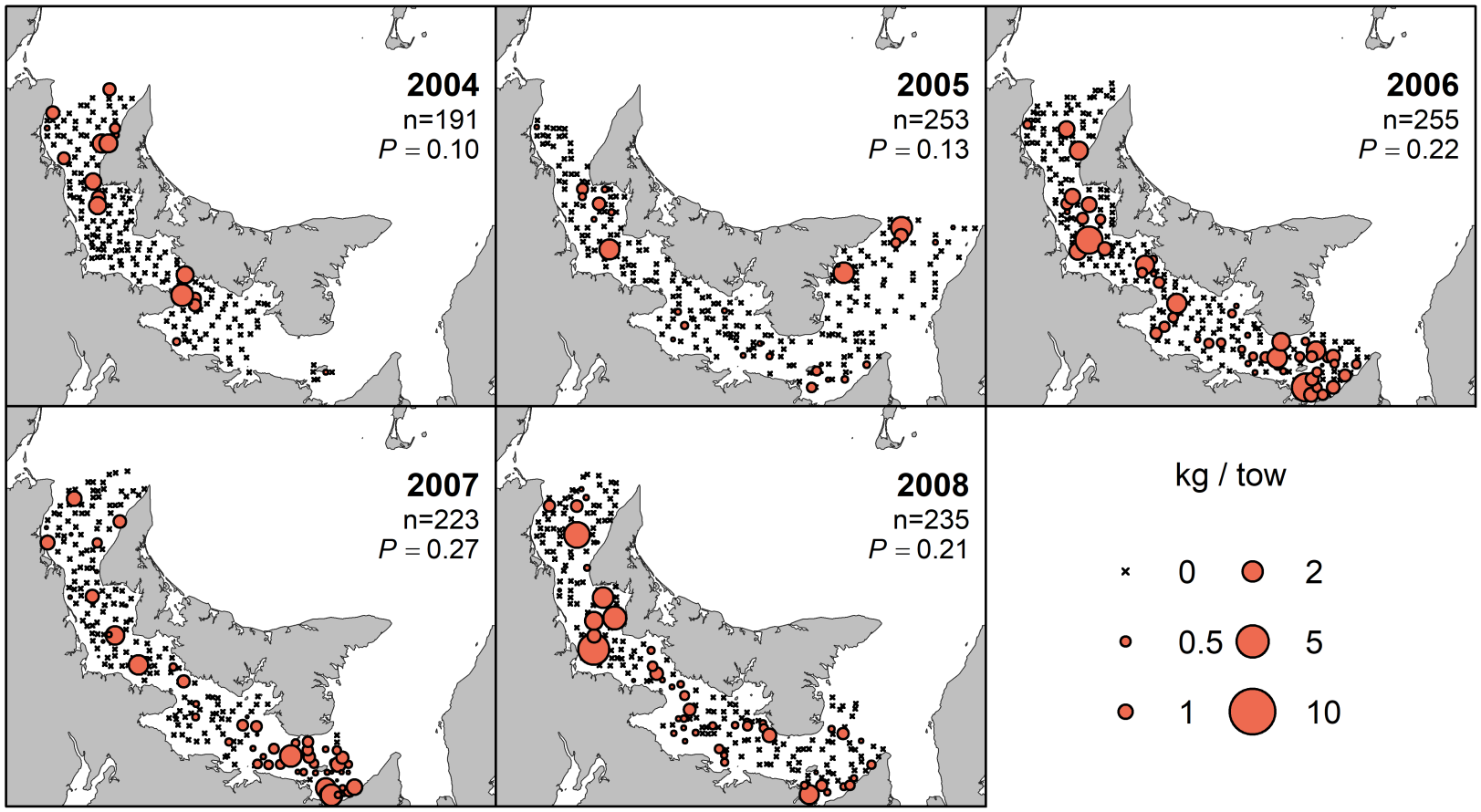

Figure 61. Relative density (kg/tow) of white hake (*Urophycis tenuis*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

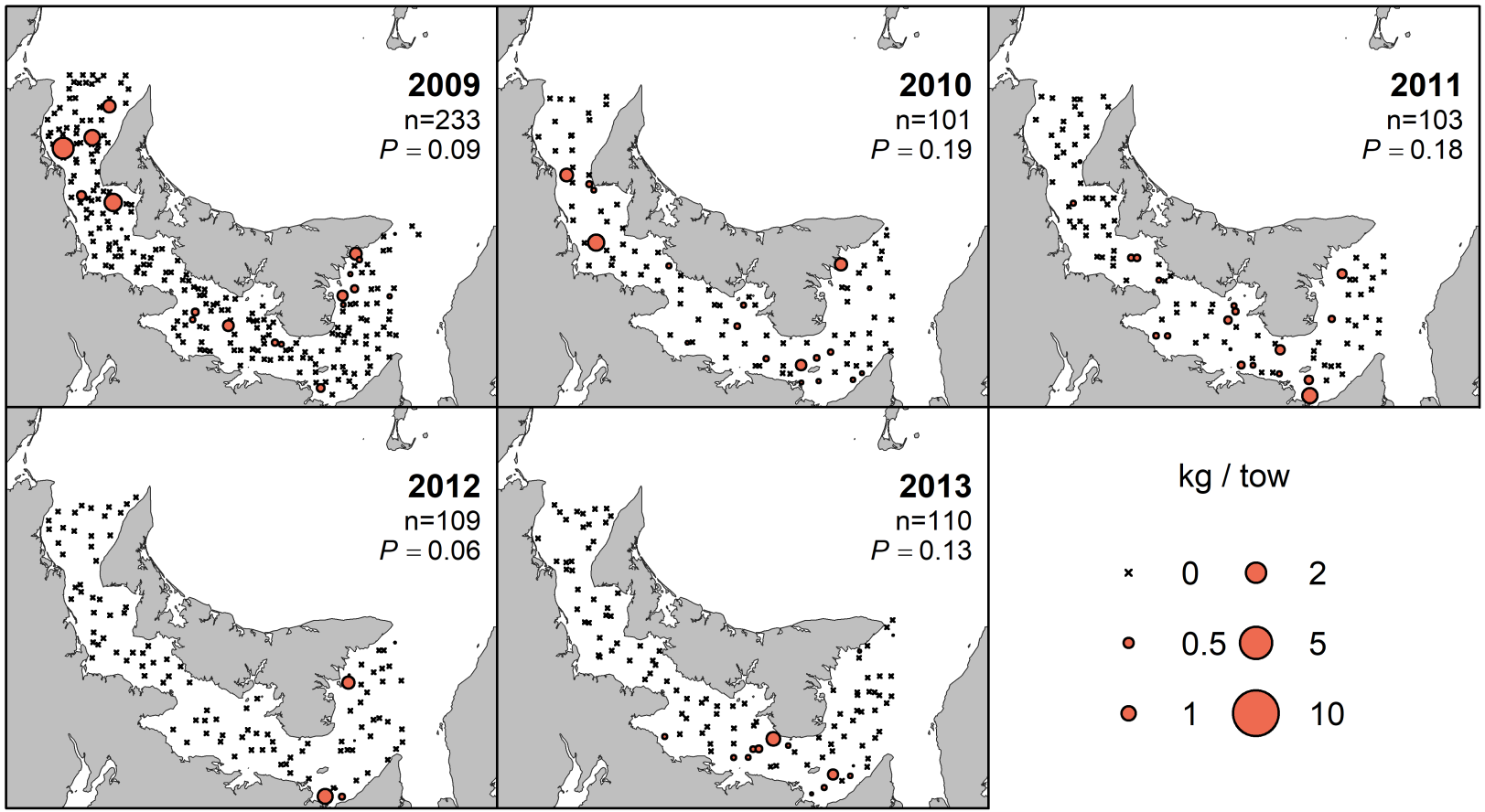

Figure 62. Relative density (kg/tow) of white hake (*Urophycis tenuis*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

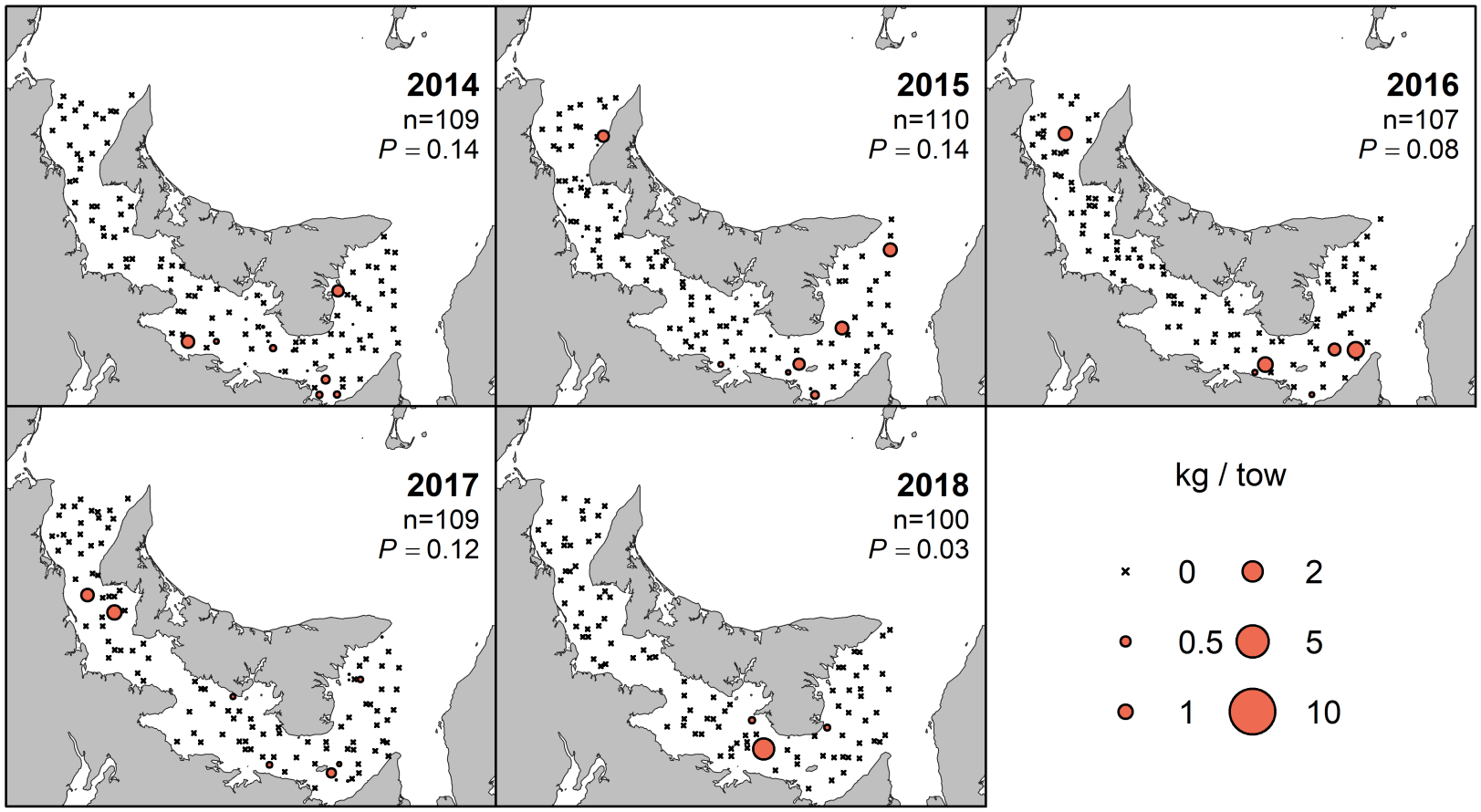

Figure 63. Relative density (kg/tow) of white hake (*Urophycis tenuis*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

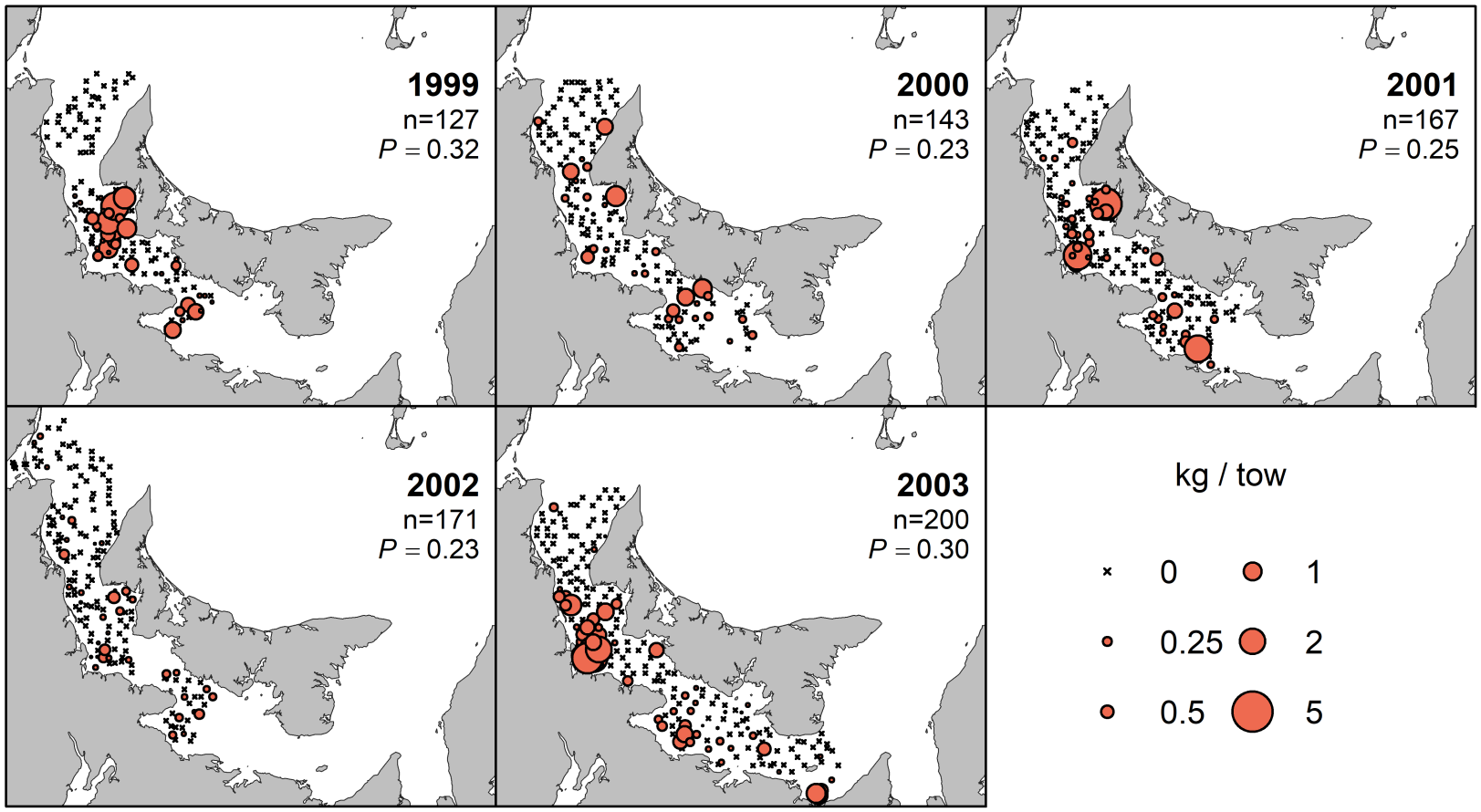

Figure 64. Relative density (kg/tow) of windowpane flounder (*Scophthalmus aquosus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

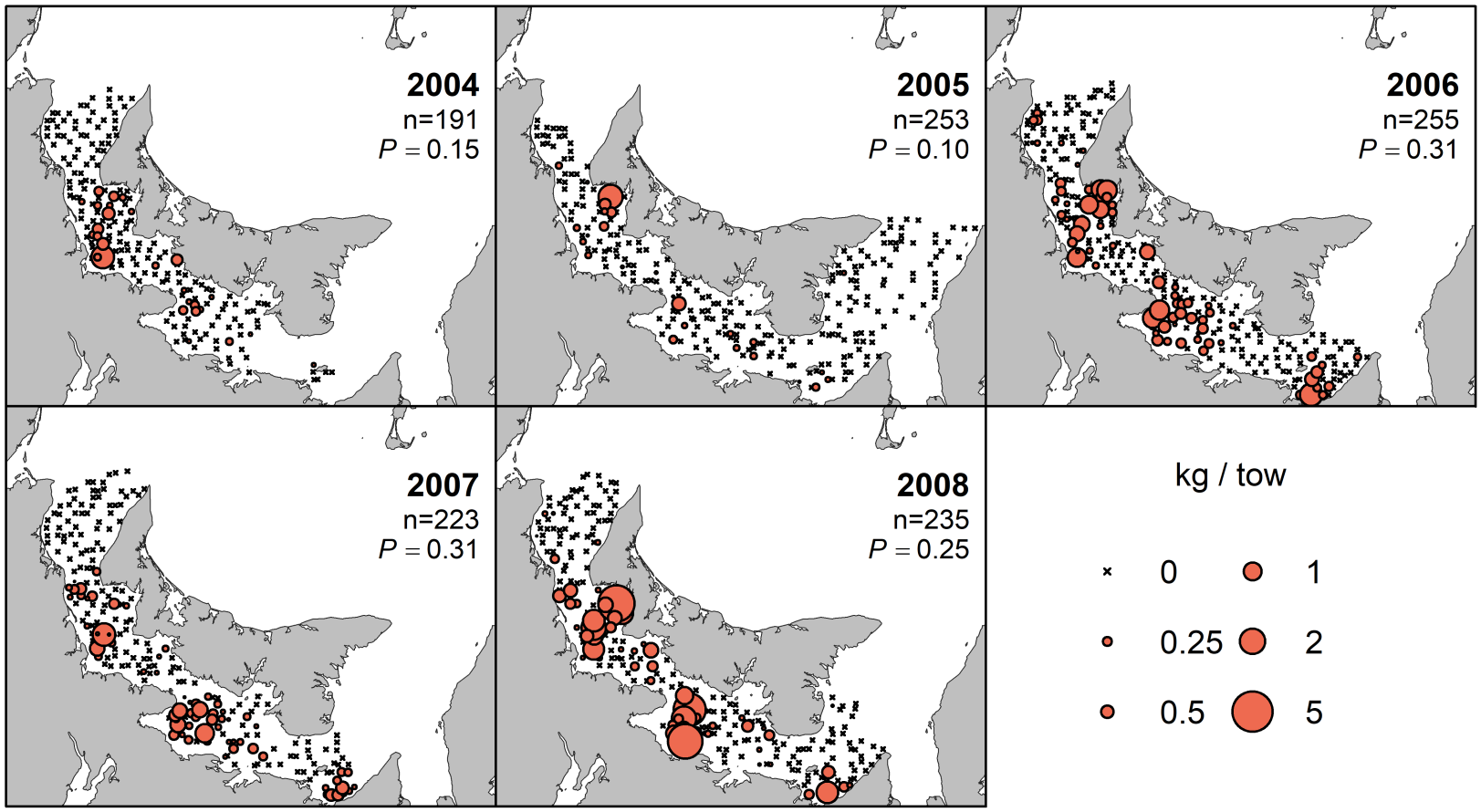

Figure 65. Relative density (kg/tow) of windowpane flounder (*Scophthalmus aquosus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

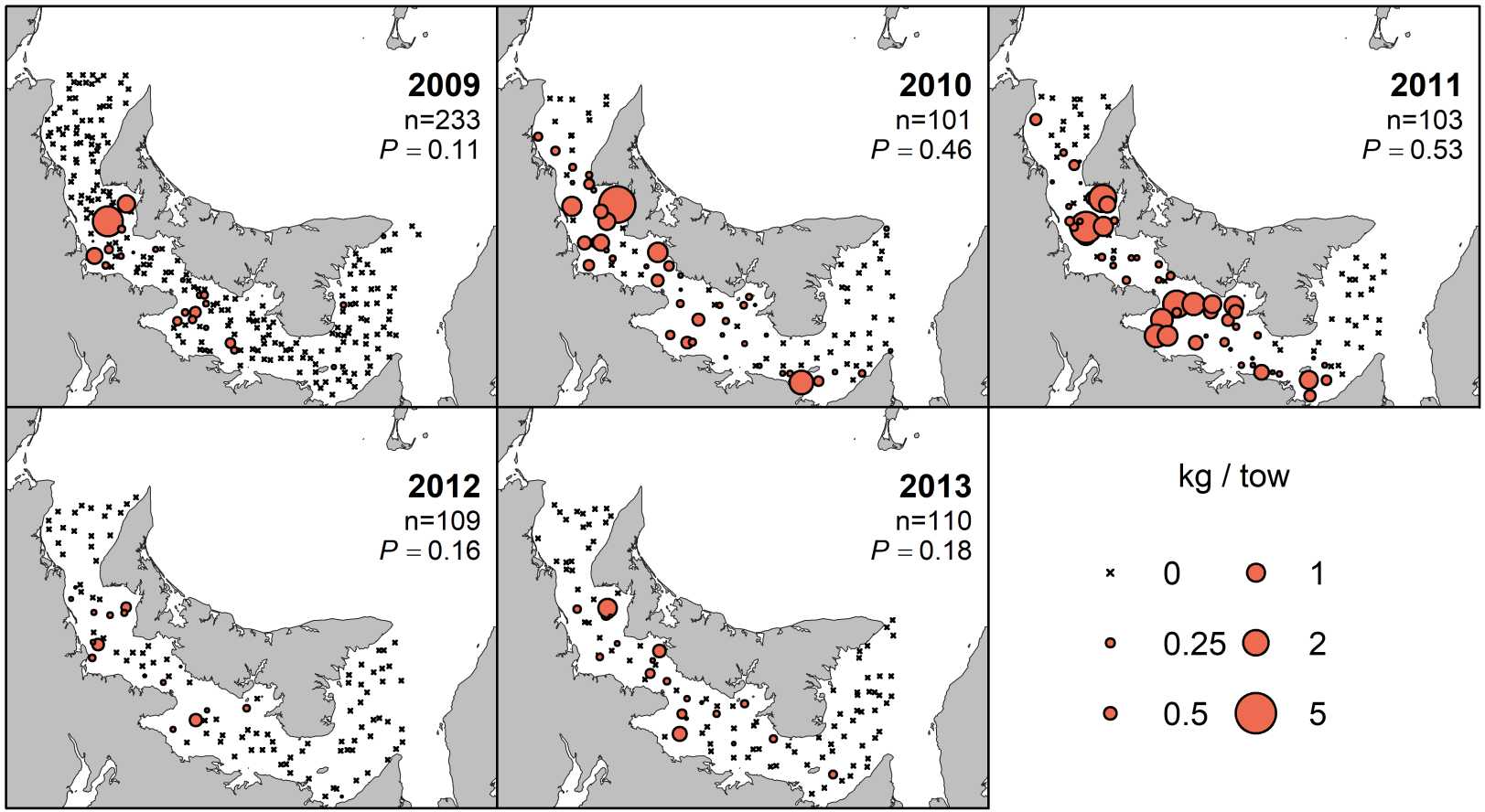

Figure 66. Relative density (kg/tow) of windowpane flounder (*Scophthalmus aquosus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

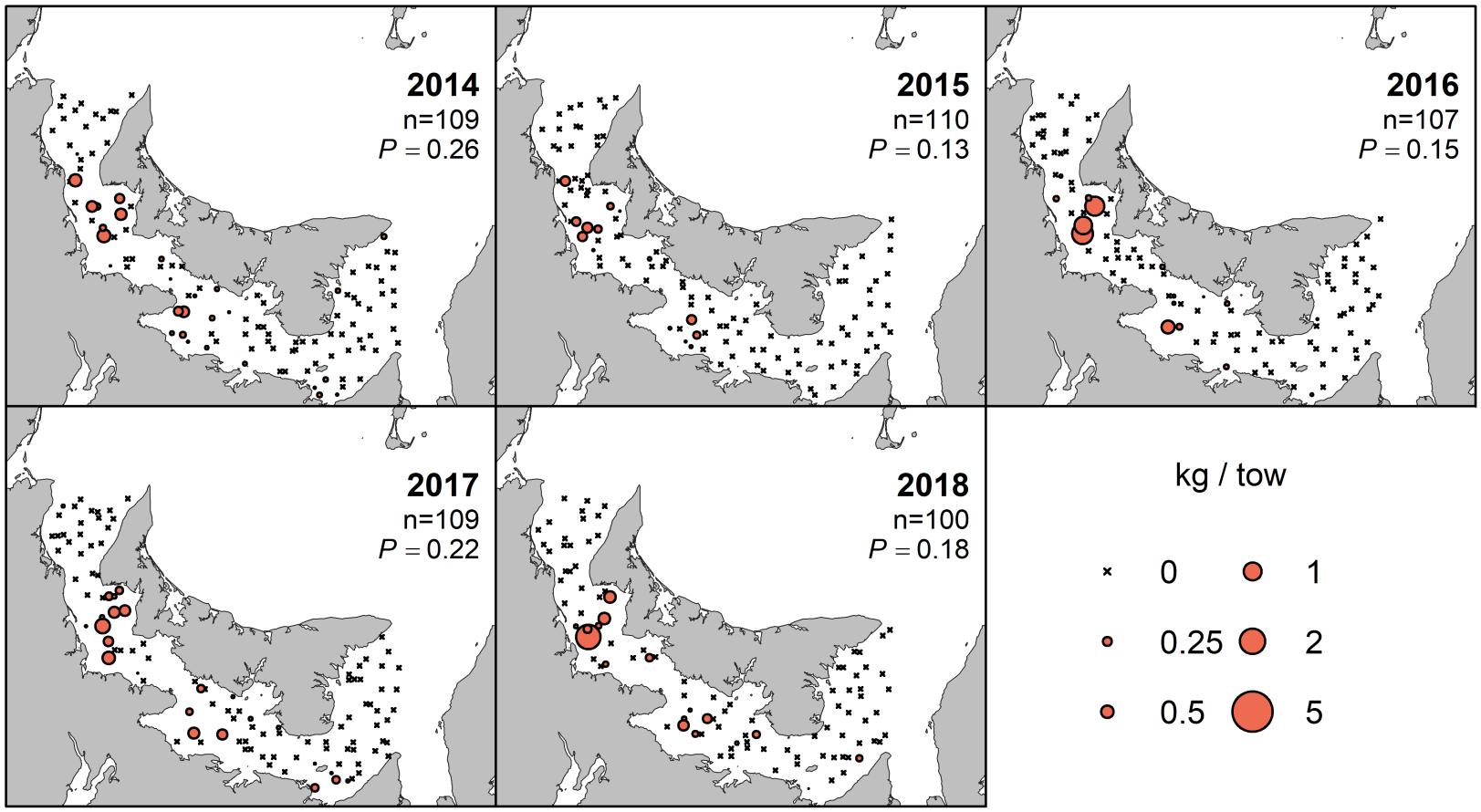

Figure 67. Relative density (kg/tow) of windowpane flounder (*Scophthalmus aquosus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

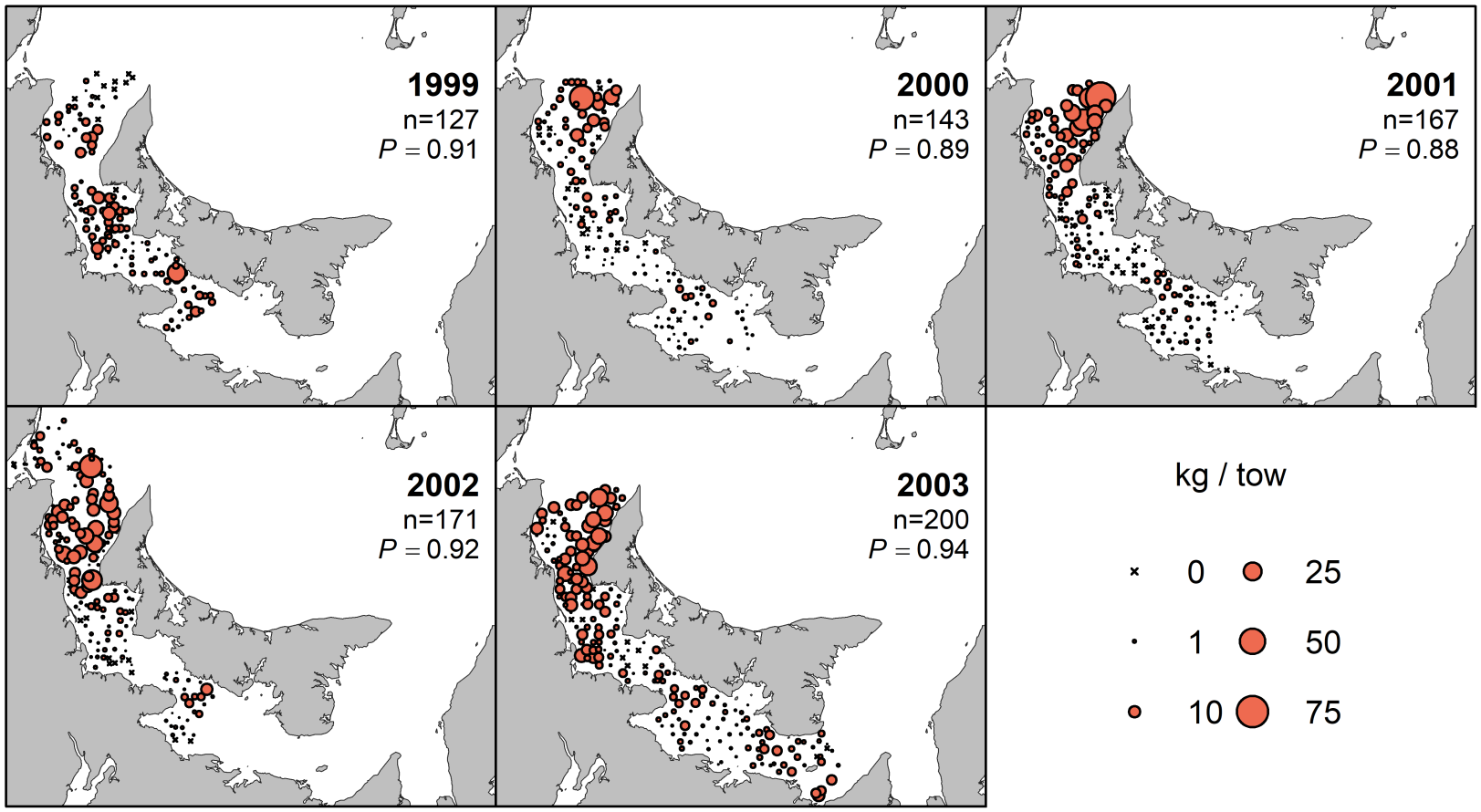

Figure 68. Relative density (kg/tow) of winter flounder (*Pseudopleuronectes americanus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

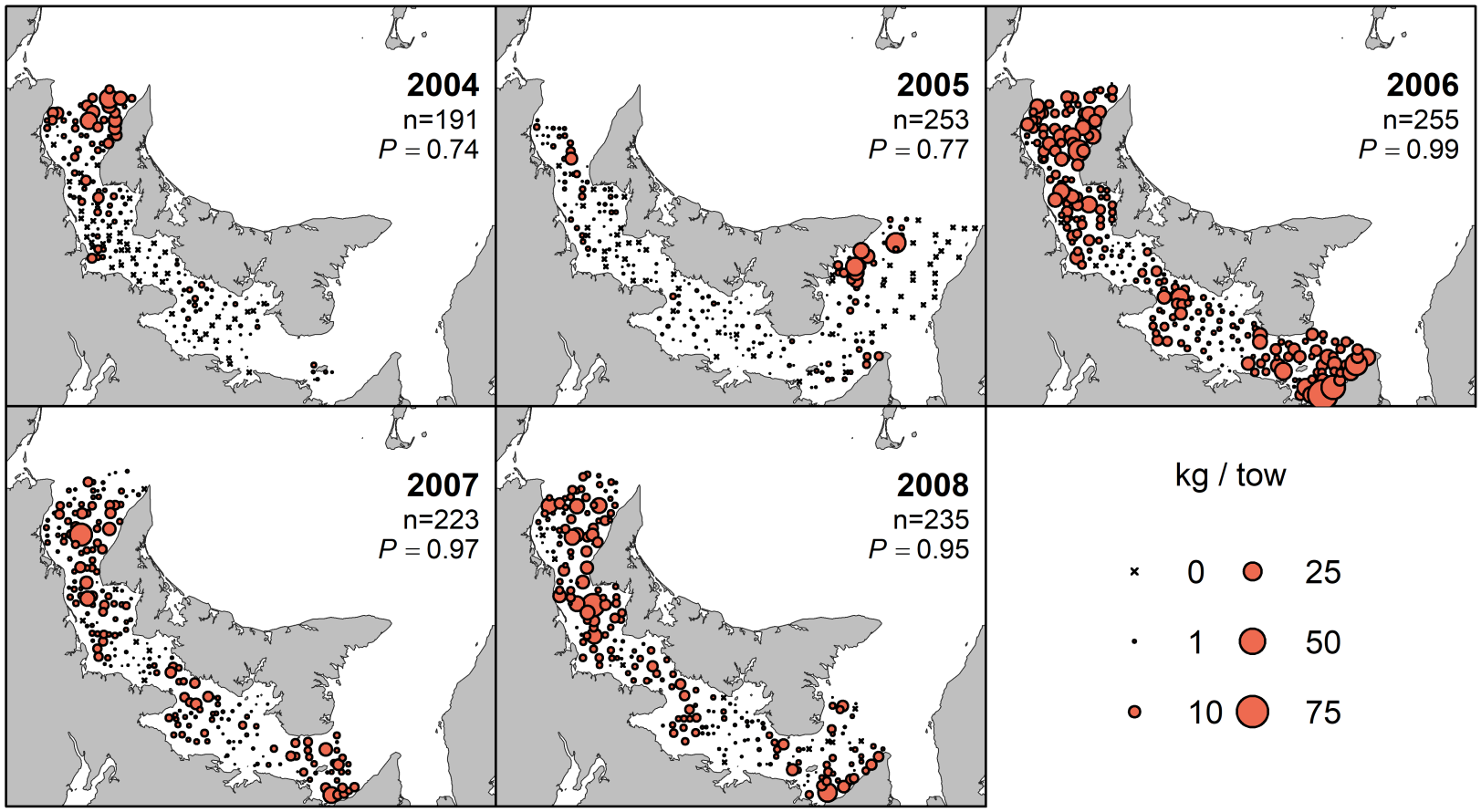

Figure 69. Relative density (kg/tow) of winter flounder (*Pseudopleuronectes americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

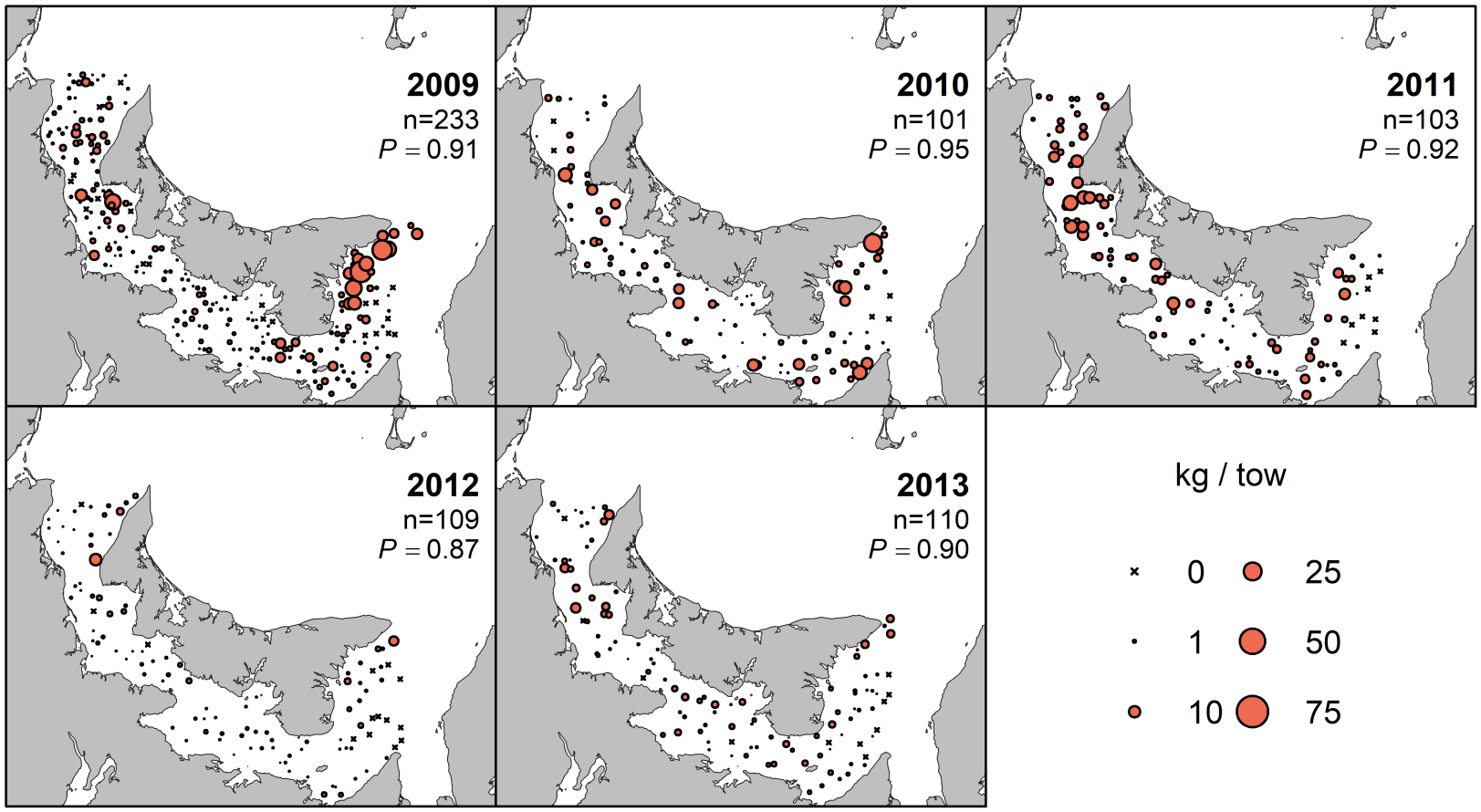

Figure 70. Relative density (kg/tow) of winter flounder (*Pseudopleuronectes americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

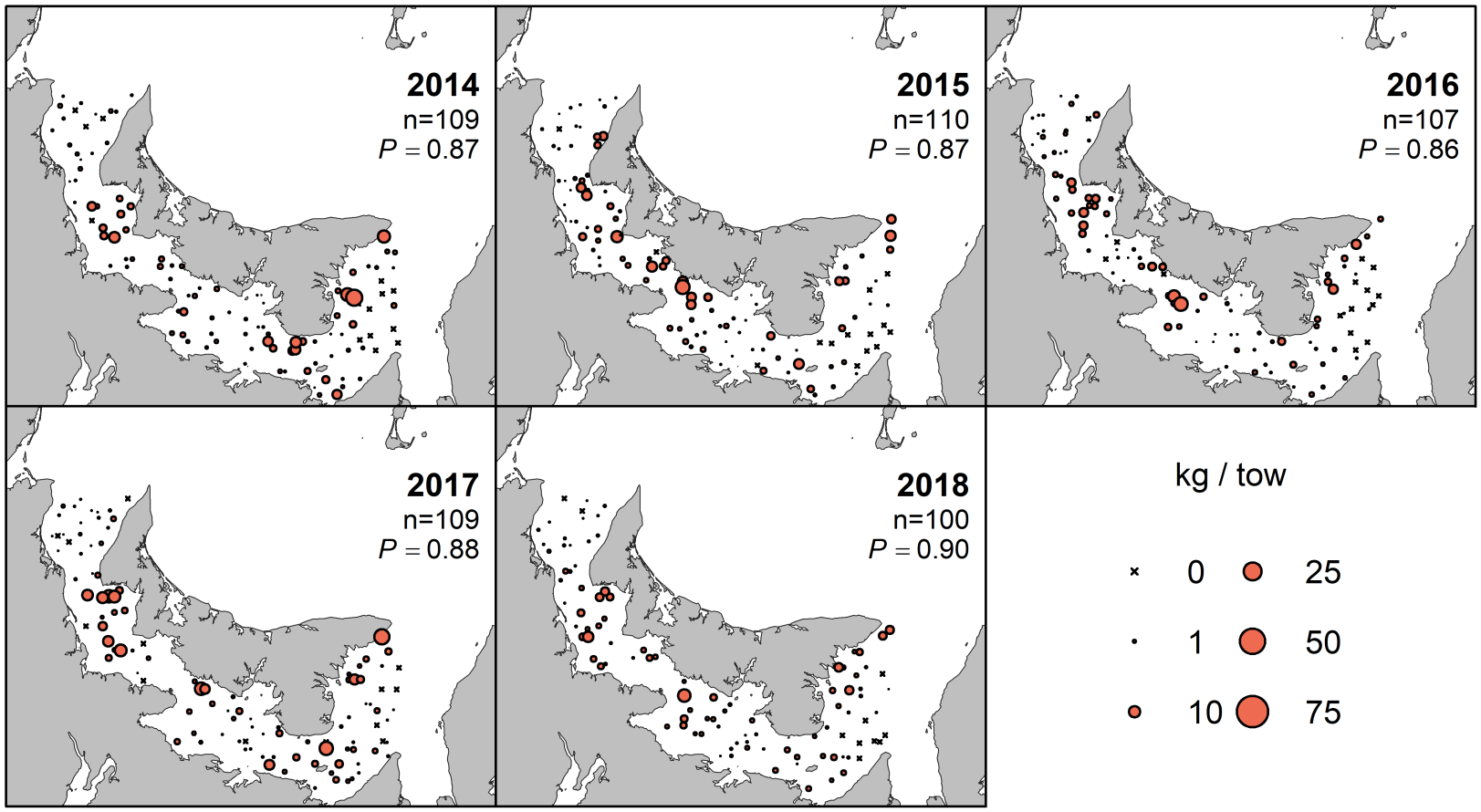

Figure 71. Relative density (kg/tow) of winter flounder (*Pseudopleuronectes americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

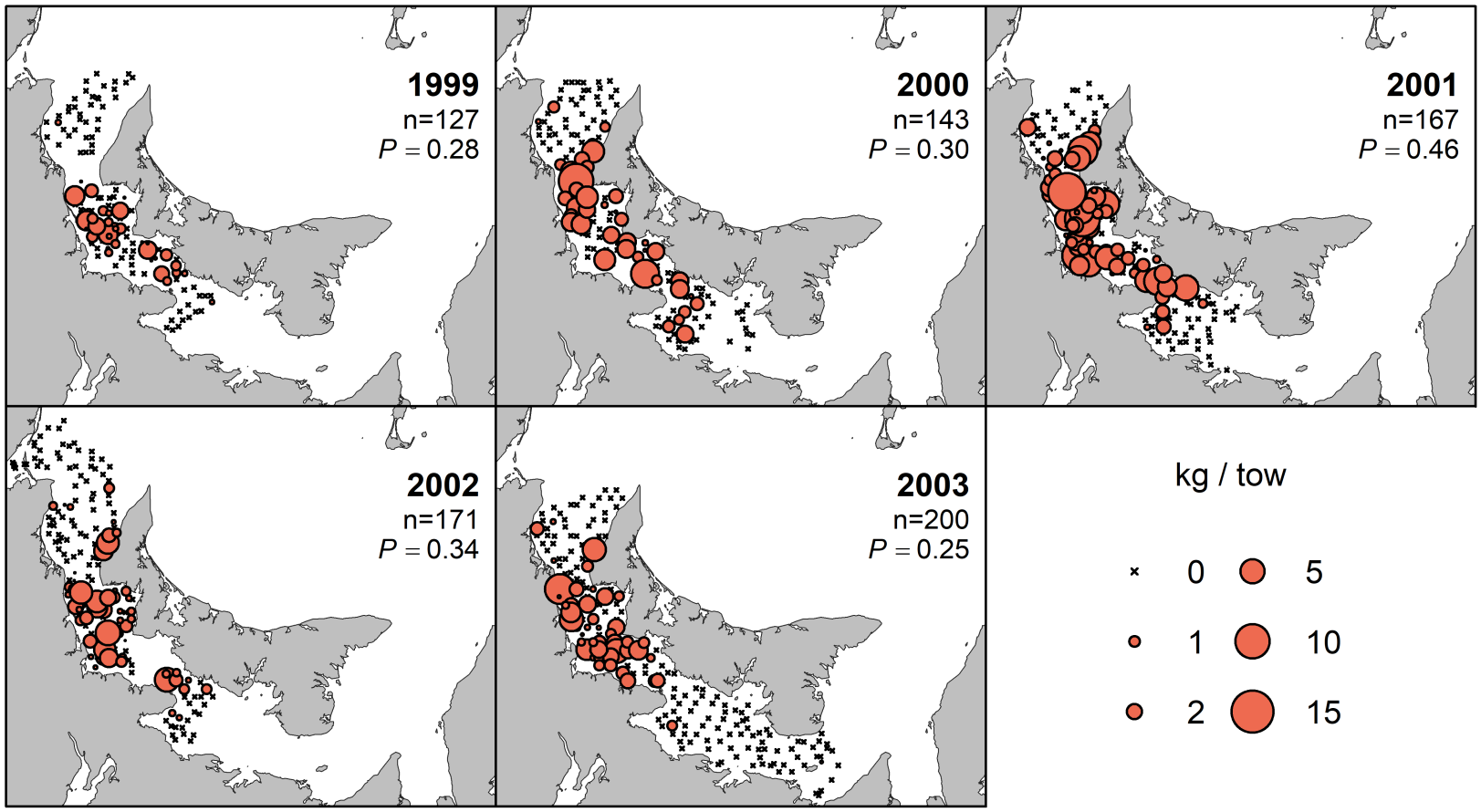

Figure 72. Relative density (kg/tow) of winter skate (*Leucoraja ocellata*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

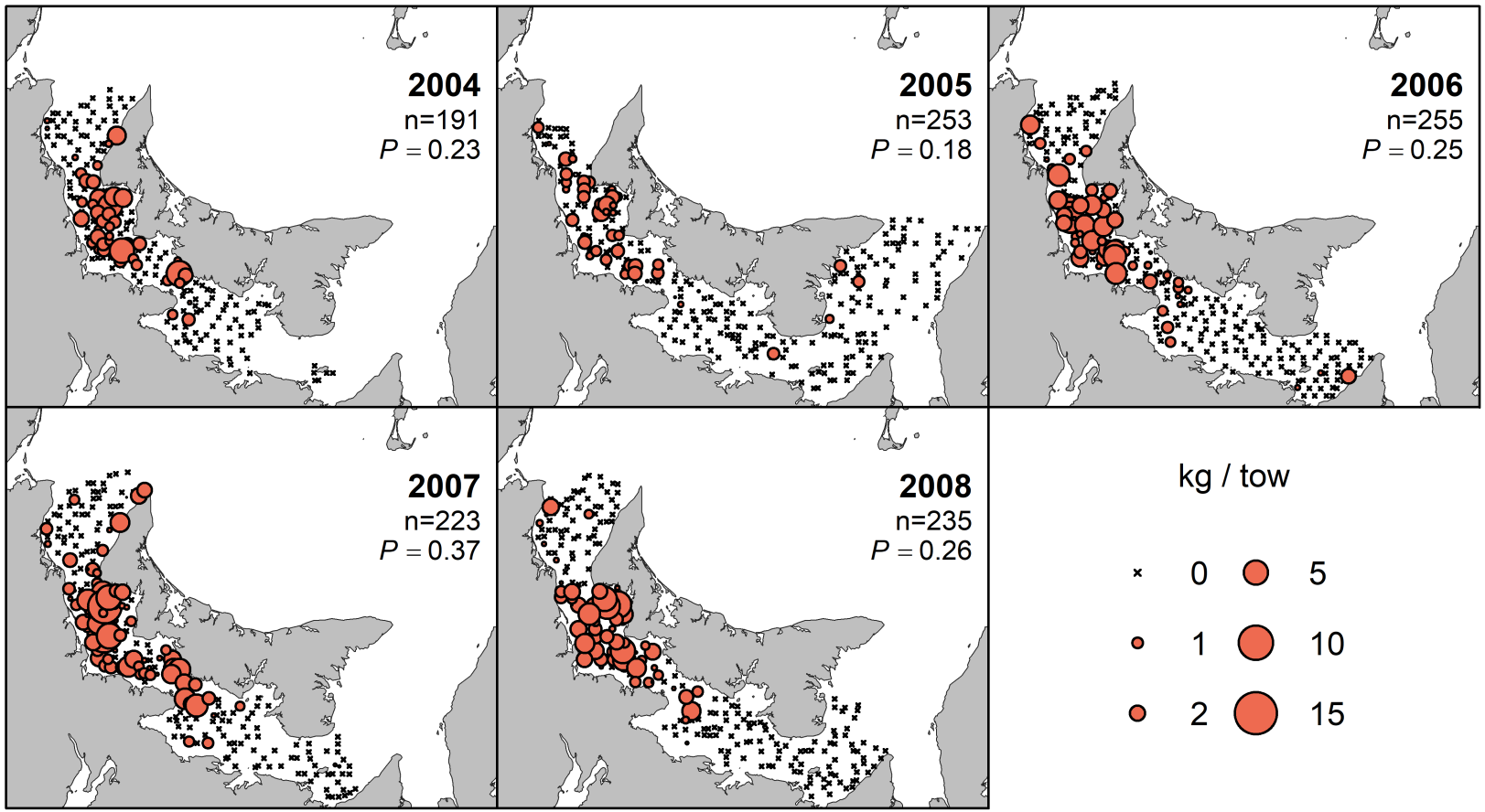

Figure 73. Relative density (kg/tow) of winter skate (*Leucoraja ocellata*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

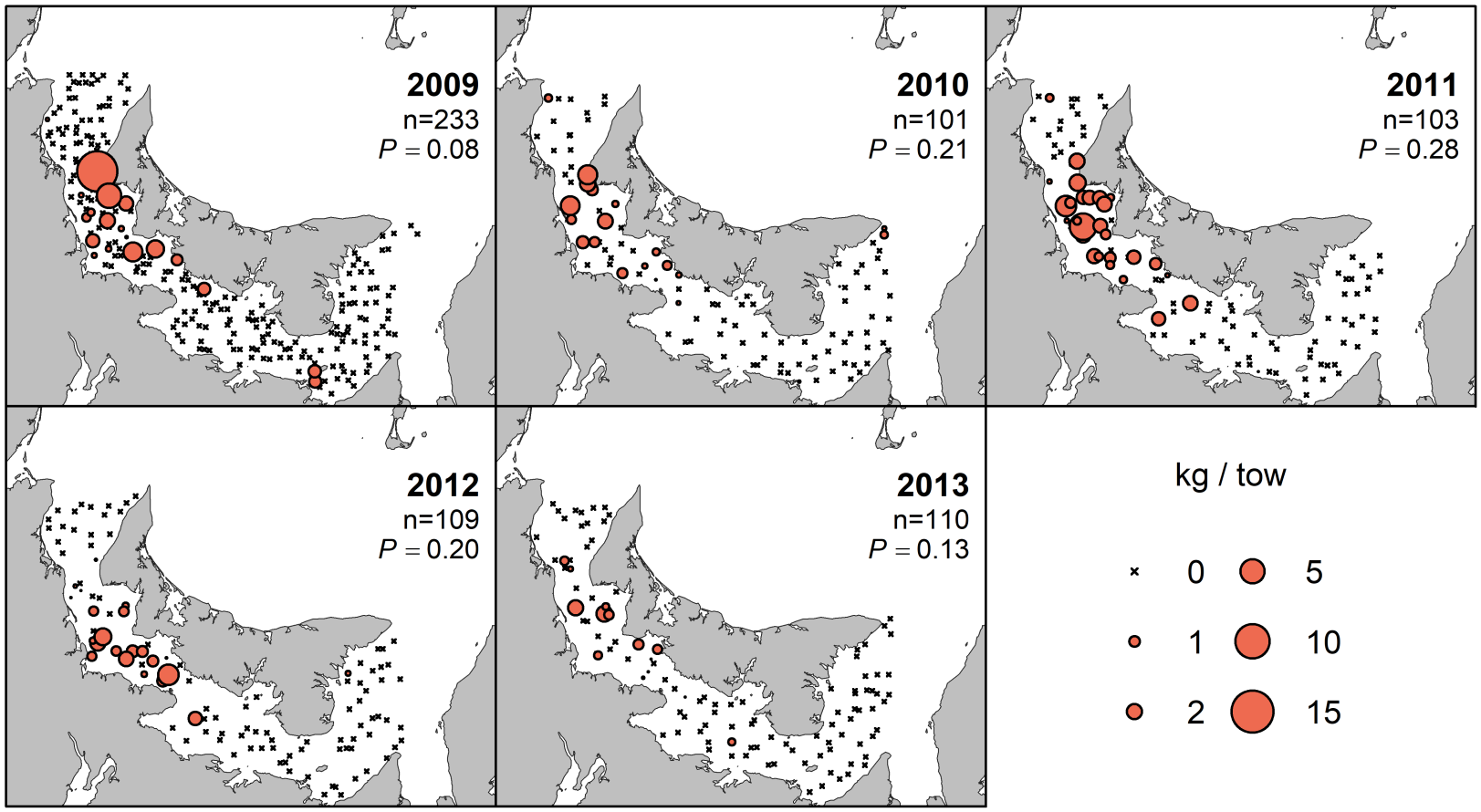

Figure 74. Relative density (kg/tow) of winter skate (*Leucoraja ocellata*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

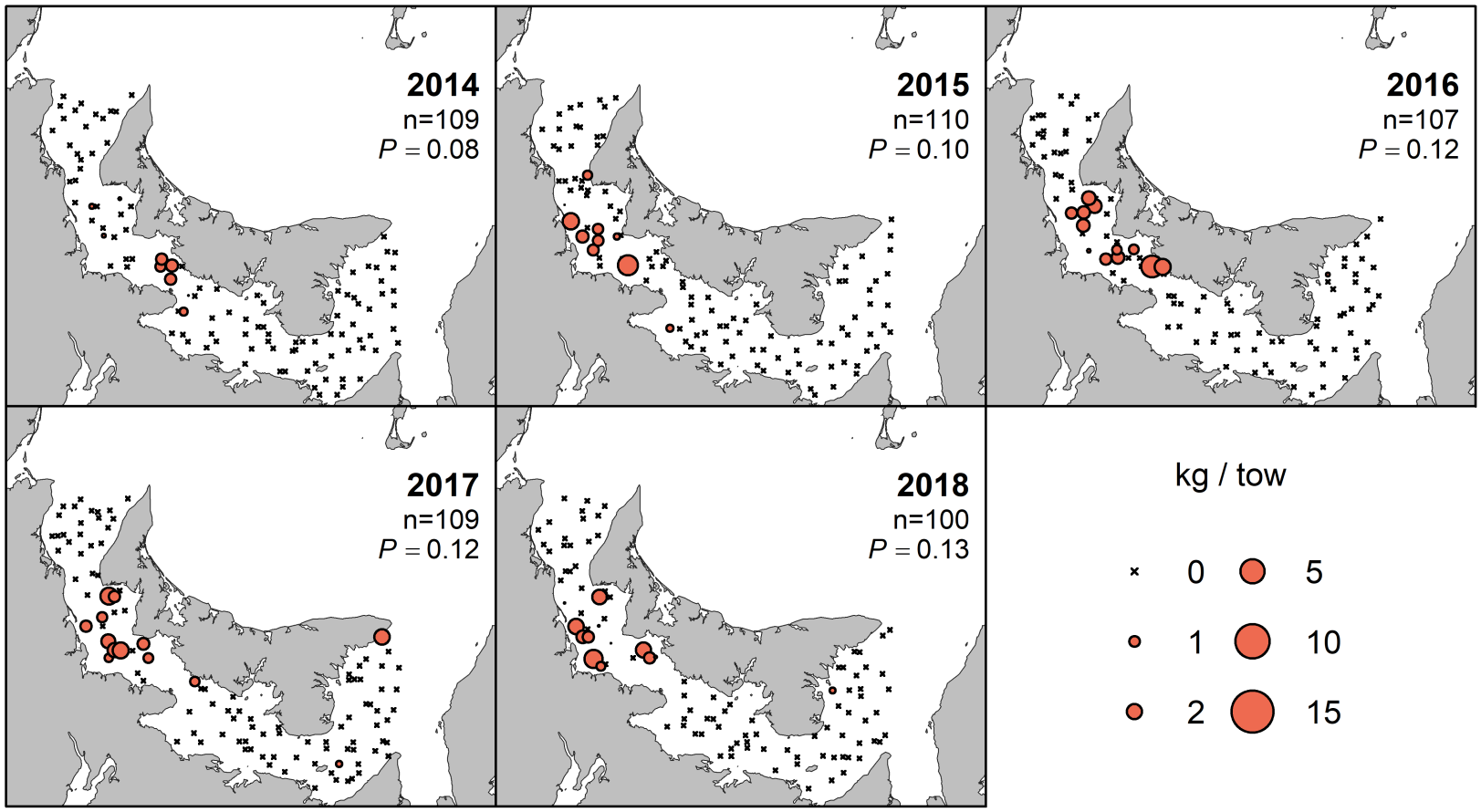

Figure 75. Relative density (kg/tow) of winter skate (*Leucoraja ocellata*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

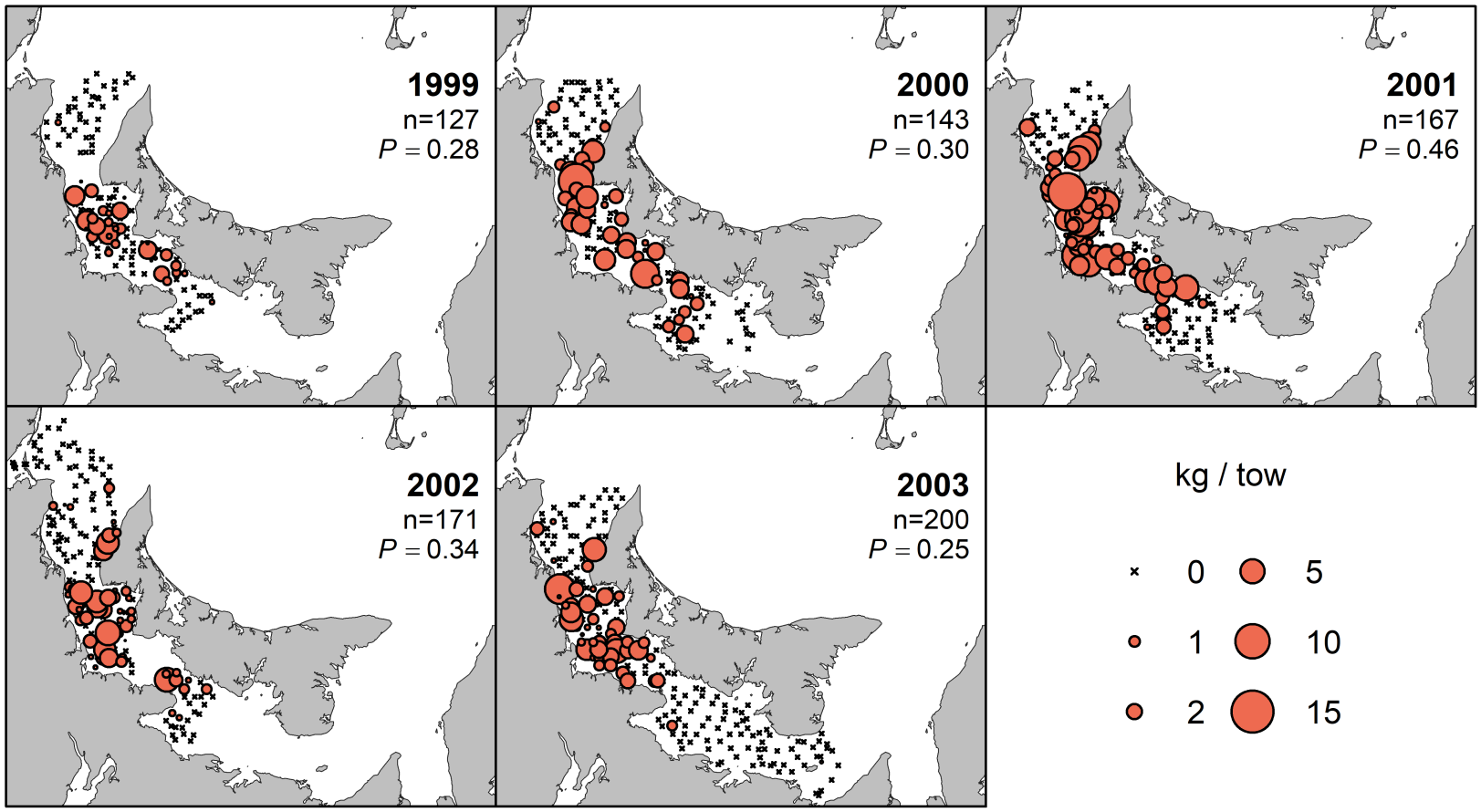

Figure 76. Relative density (kg/tow) of yellowtail flounder (*Limanda ferruginea*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2003. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

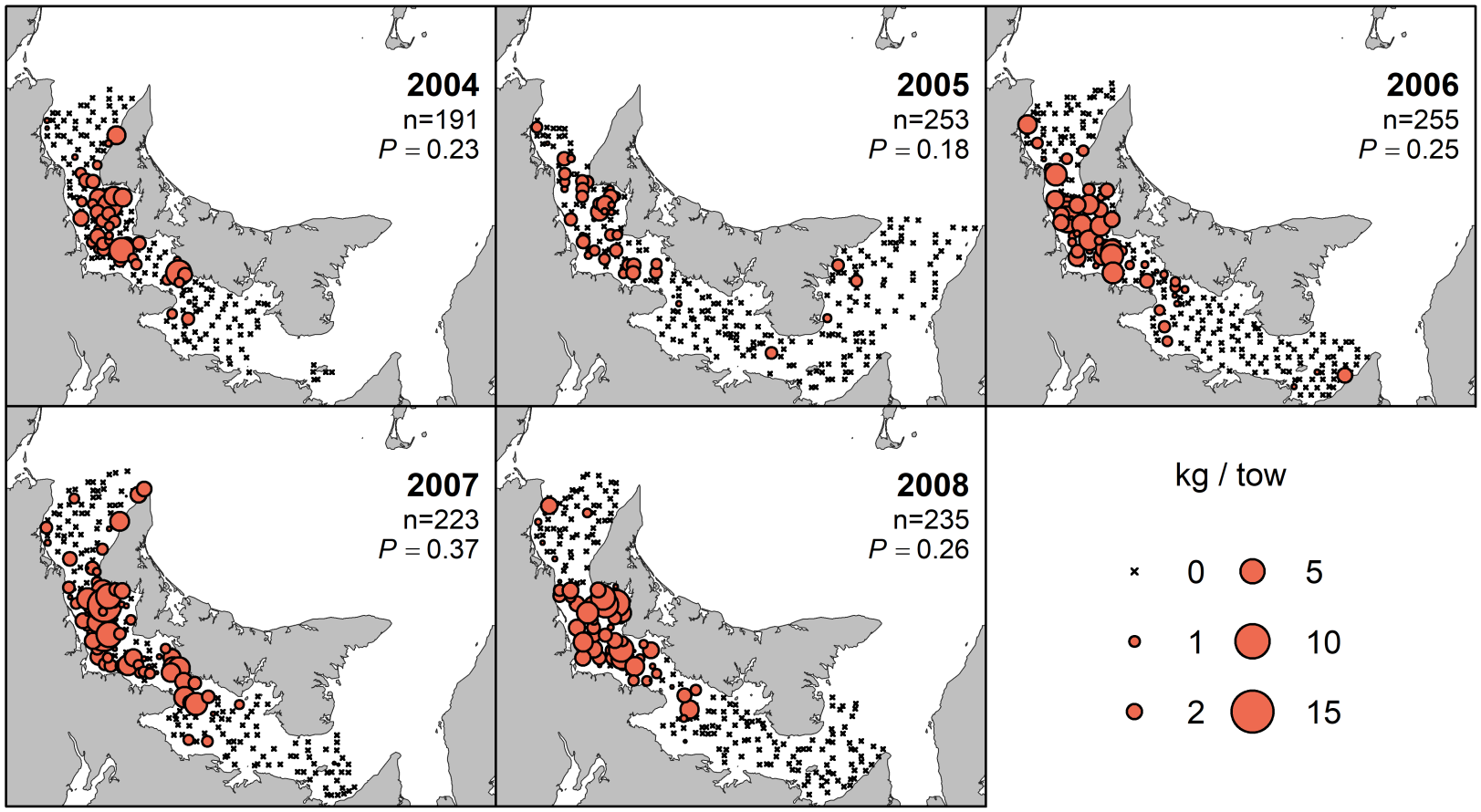

Figure 77. Relative density (kg/tow) of yellowtail flounder (*Limanda ferruginea*) from the Northumberland Strait multi-species bottom trawl survey, 2004 to 2008. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

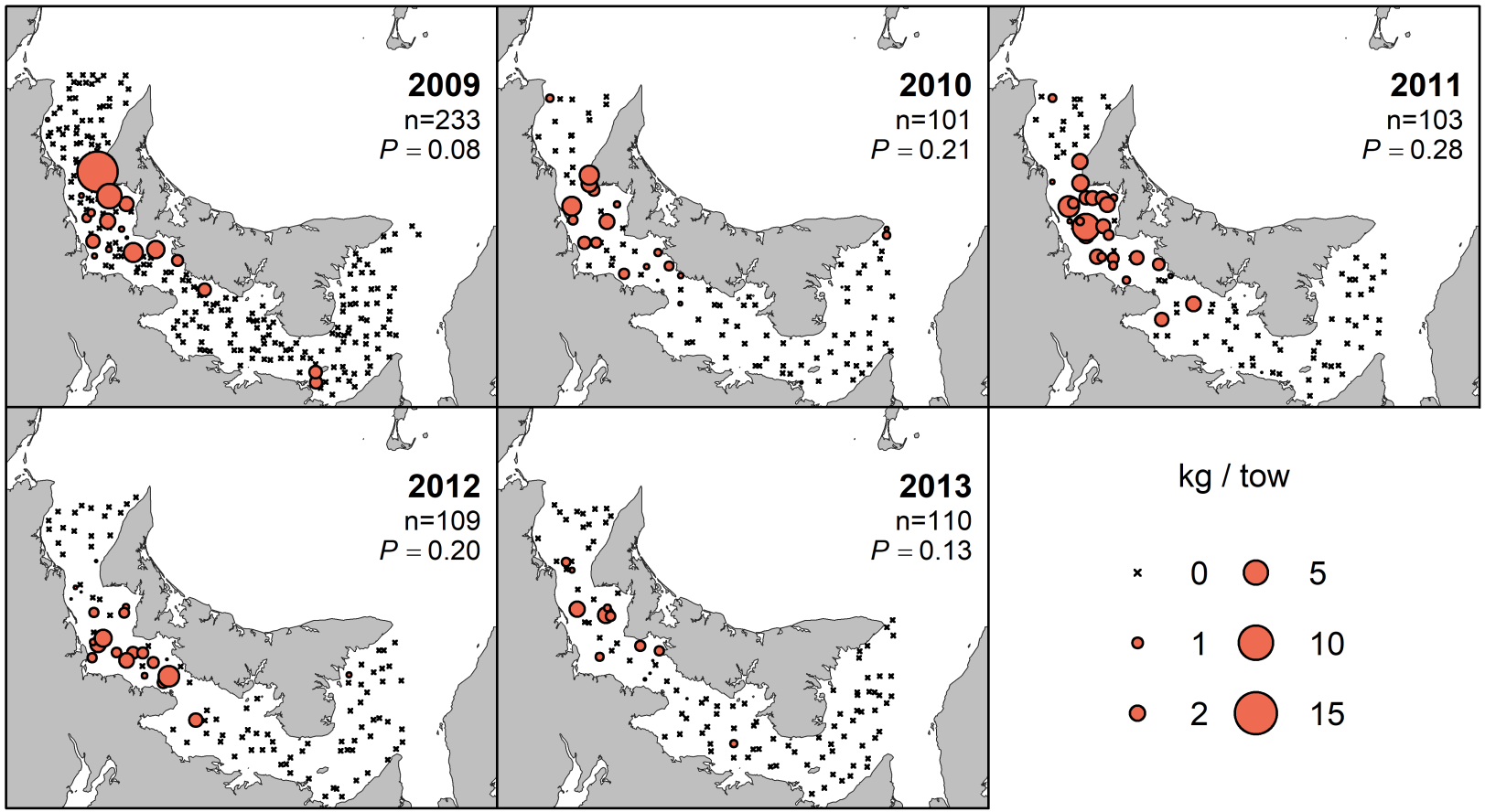

Figure 78. Relative density (kg/tow) of yellowtail flounder (*Limanda ferruginea*) from the Northumberland Strait multi-species bottom trawl survey, 2009 to 2013. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

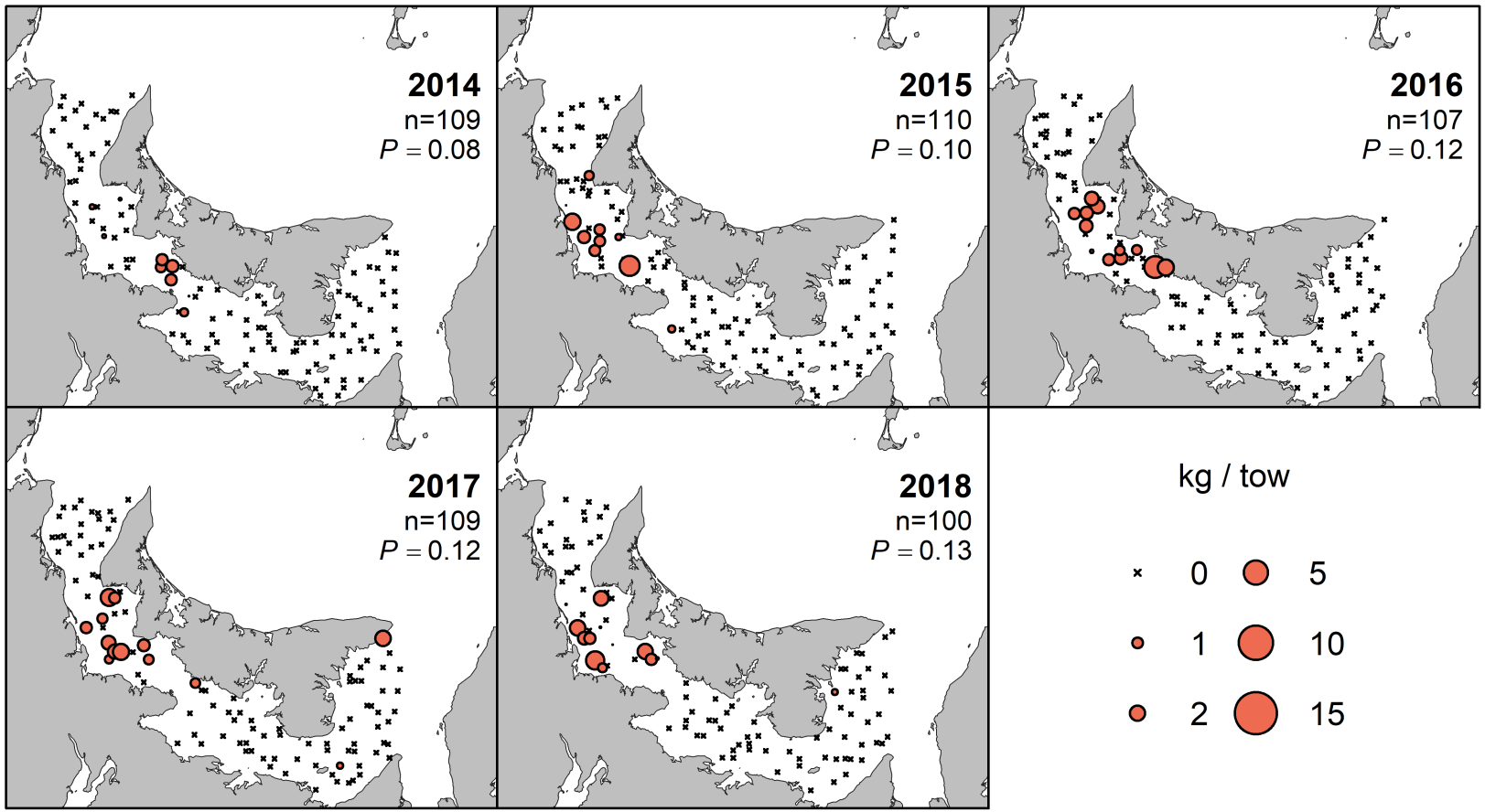

Figure 79. Relative density (kg/tow) of yellowtail flounder (*Limanda ferruginea*) from the Northumberland Strait multi-species bottom trawl survey, 2014 to 2018. The number of valid sets completed (n) and the probability of occurence (*P*) are shown below the year label in each panel. See Table 1 for details regarding changes to trawl gear and set duration.

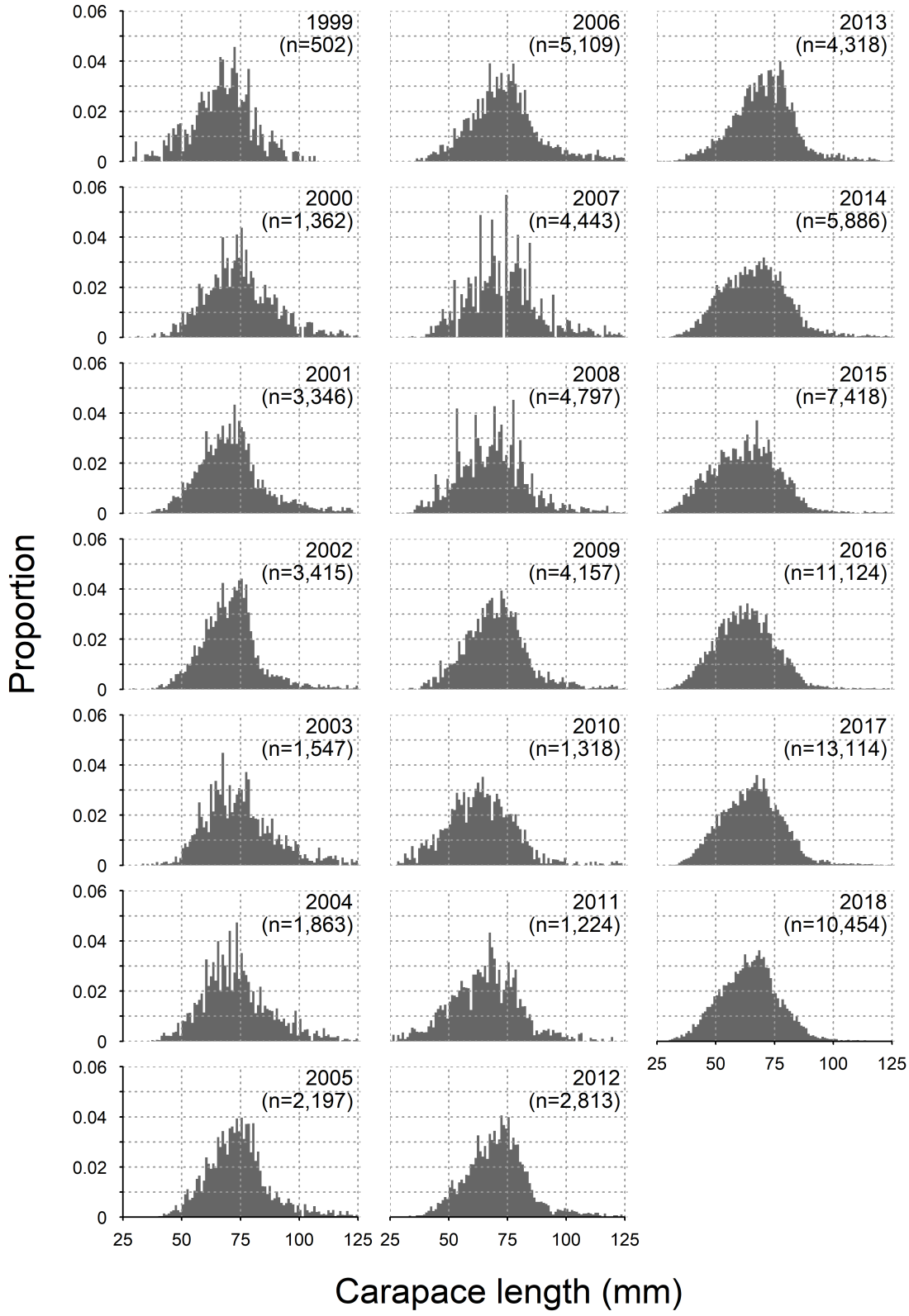

Figure 80. Length frequencies of American lobster (*Homarus americanus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. The total number of individuals is shown below the year label in each panel.

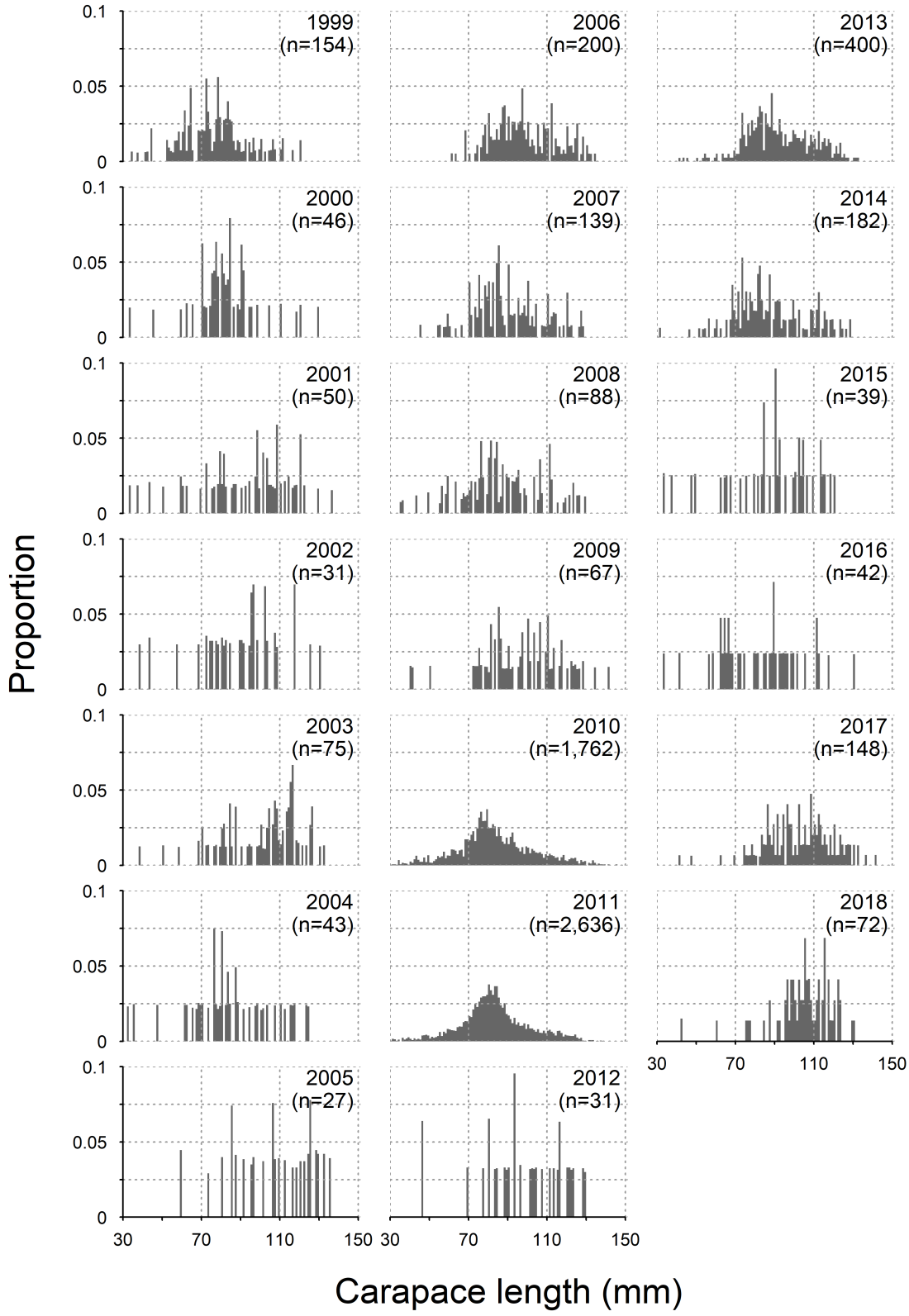

Figure 81. Length frequencies of Atlantic rock crab (*Cancer irroratus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. The total number of individuals is shown below the year label in each panel.

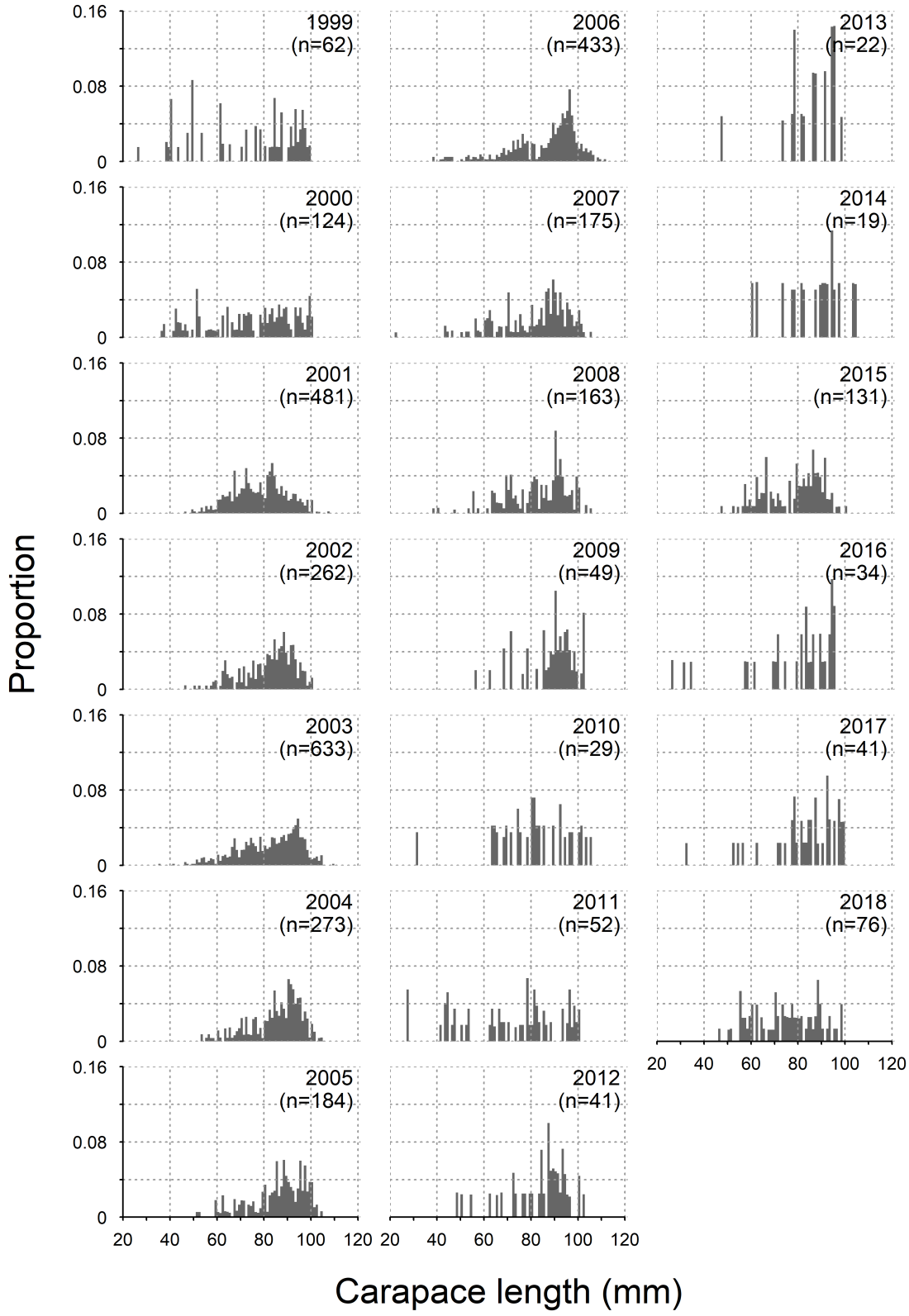

Figure 82. Length frequencies of lady crab (*Ovalipes ocellatus*) from the Northumberland Strait multi-species bottom trawl survey, 1999 to 2018. The total number of individuals is shown below the year label in each panel.

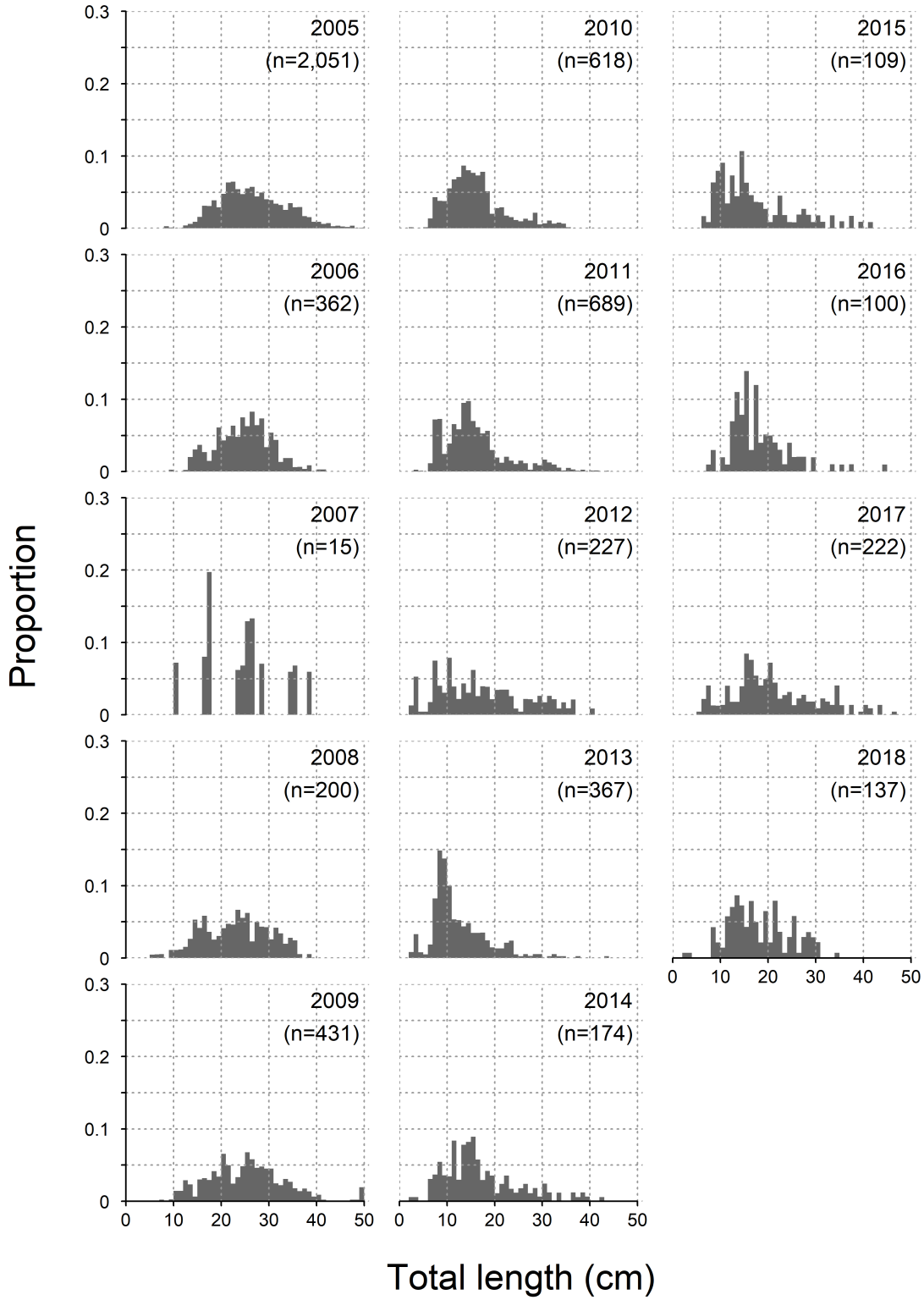

Figure 83. Length frequencies of American plaice (*Hippoglossoides platessoides*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

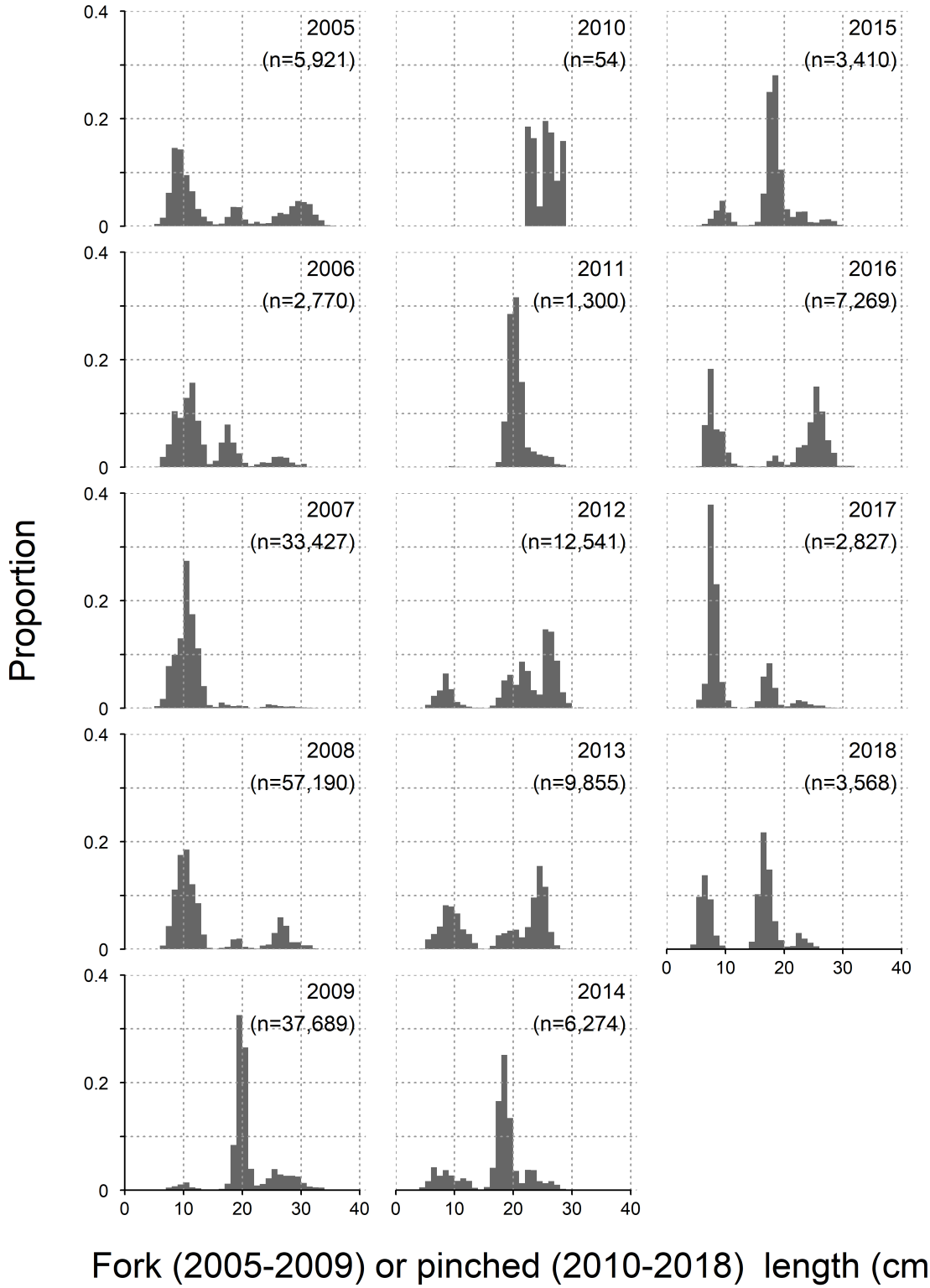

Figure 84. Length frequencies of Atlantic herring (*Clupea harengus*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

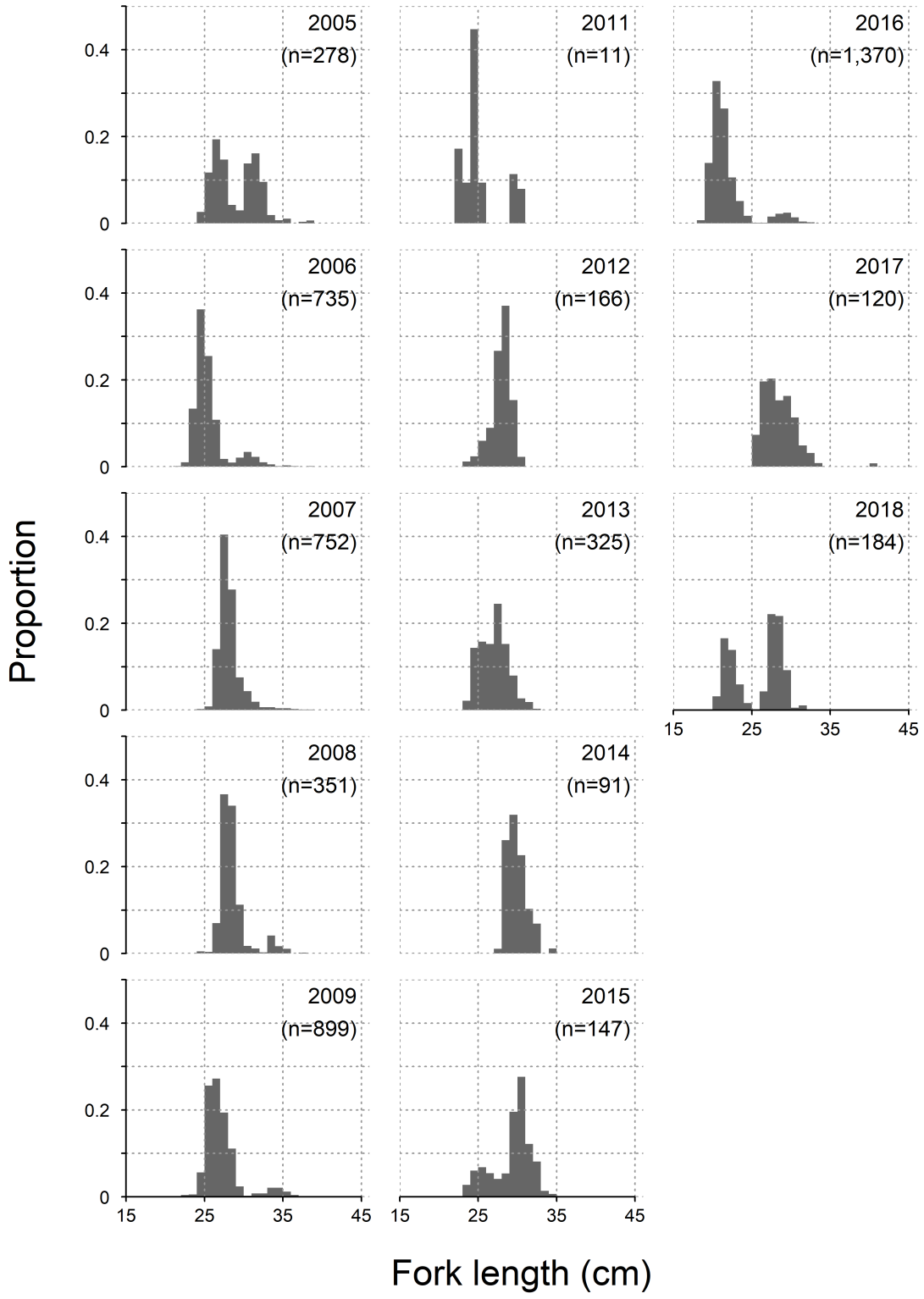

Figure 85. Length frequencies of Atlantic mackerel (*Scomber scombrus*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2009 and 2011 to 2018. The total number of individuals is shown below the year label in each panel. (Note: Atlantic mackerel was not captured in 2010)

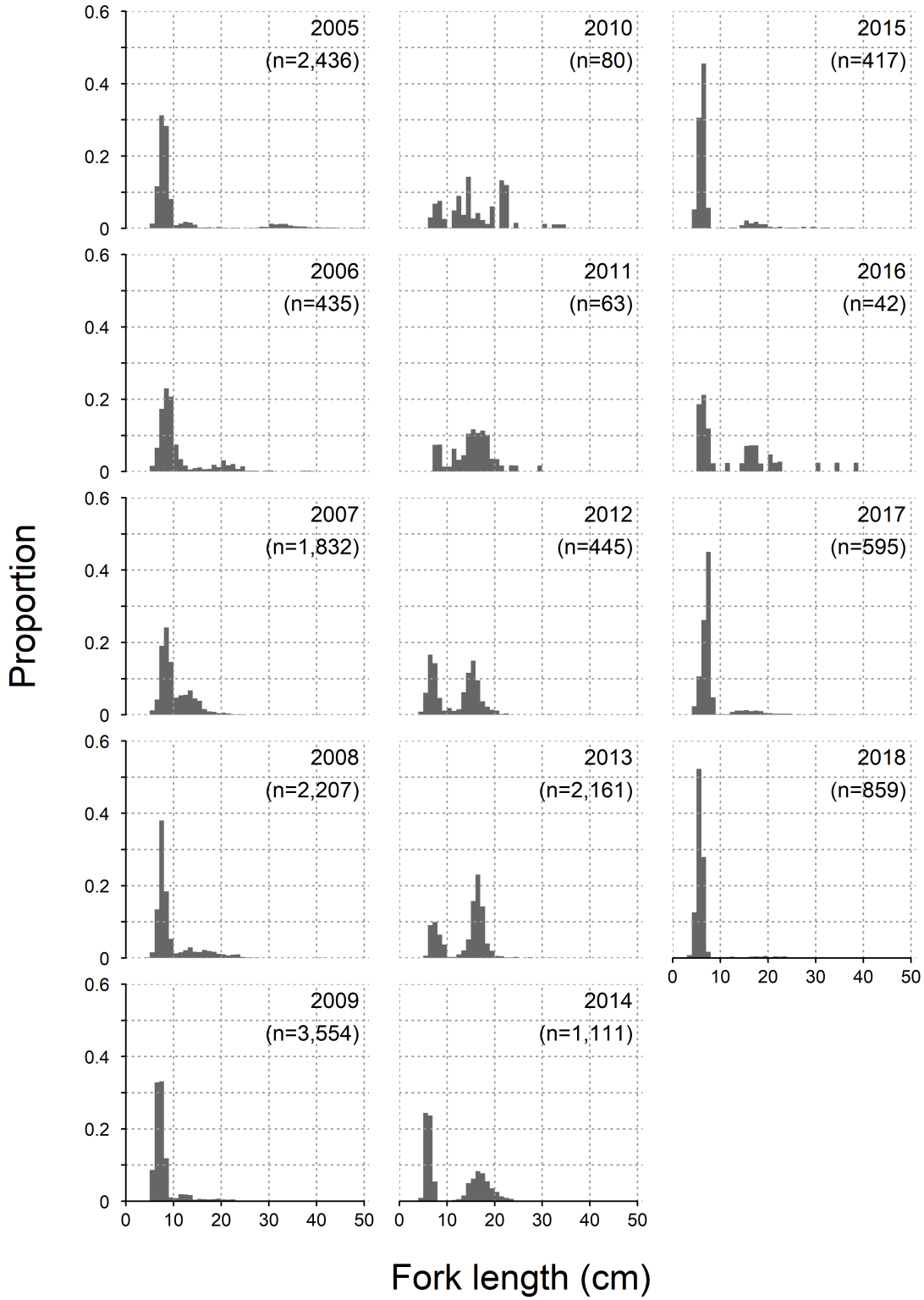

Figure 86. Length frequencies of cod (Gadidae) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

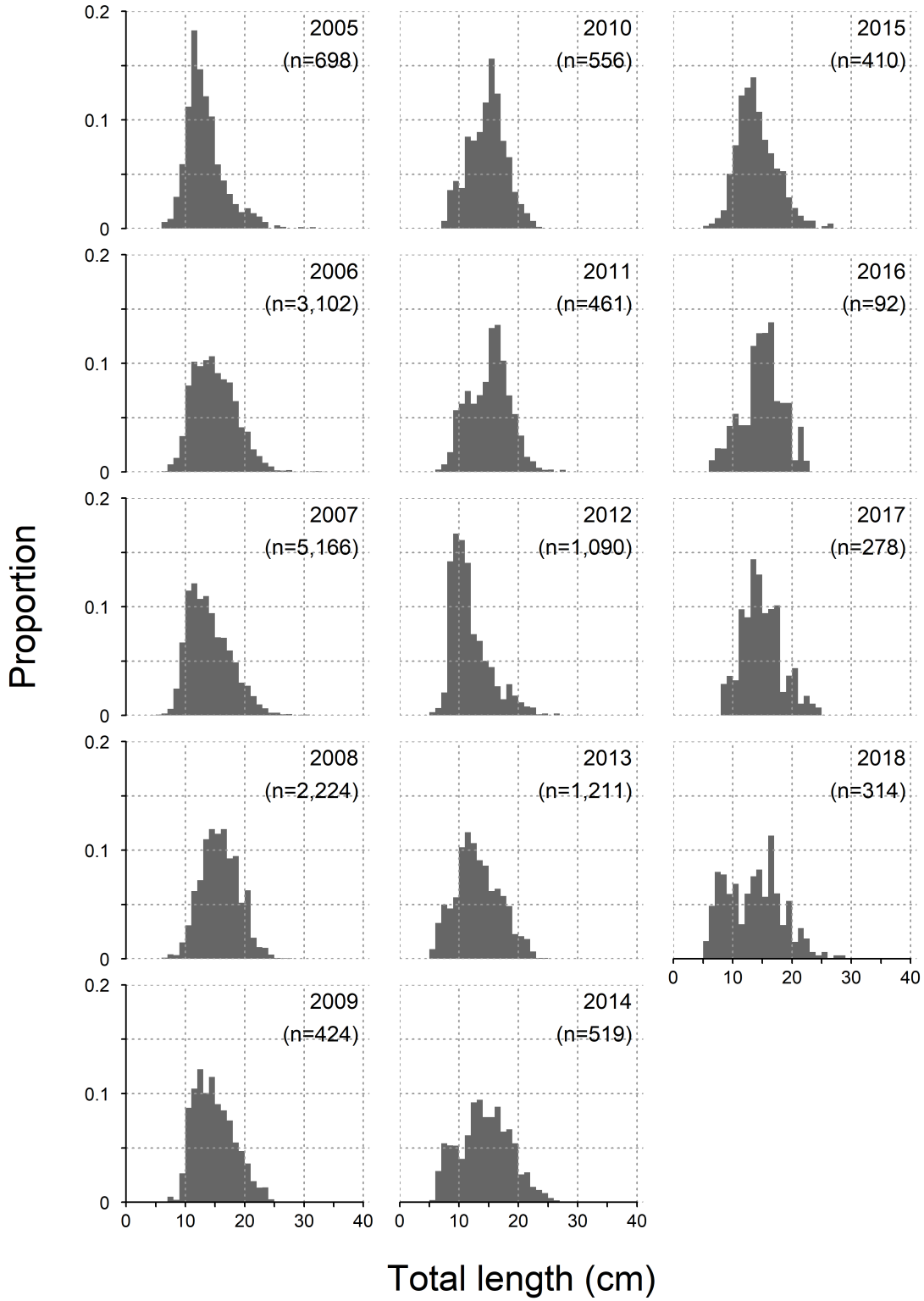

Figure 87. Length frequencies of cunner (*Tautogolabrus adspersus*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

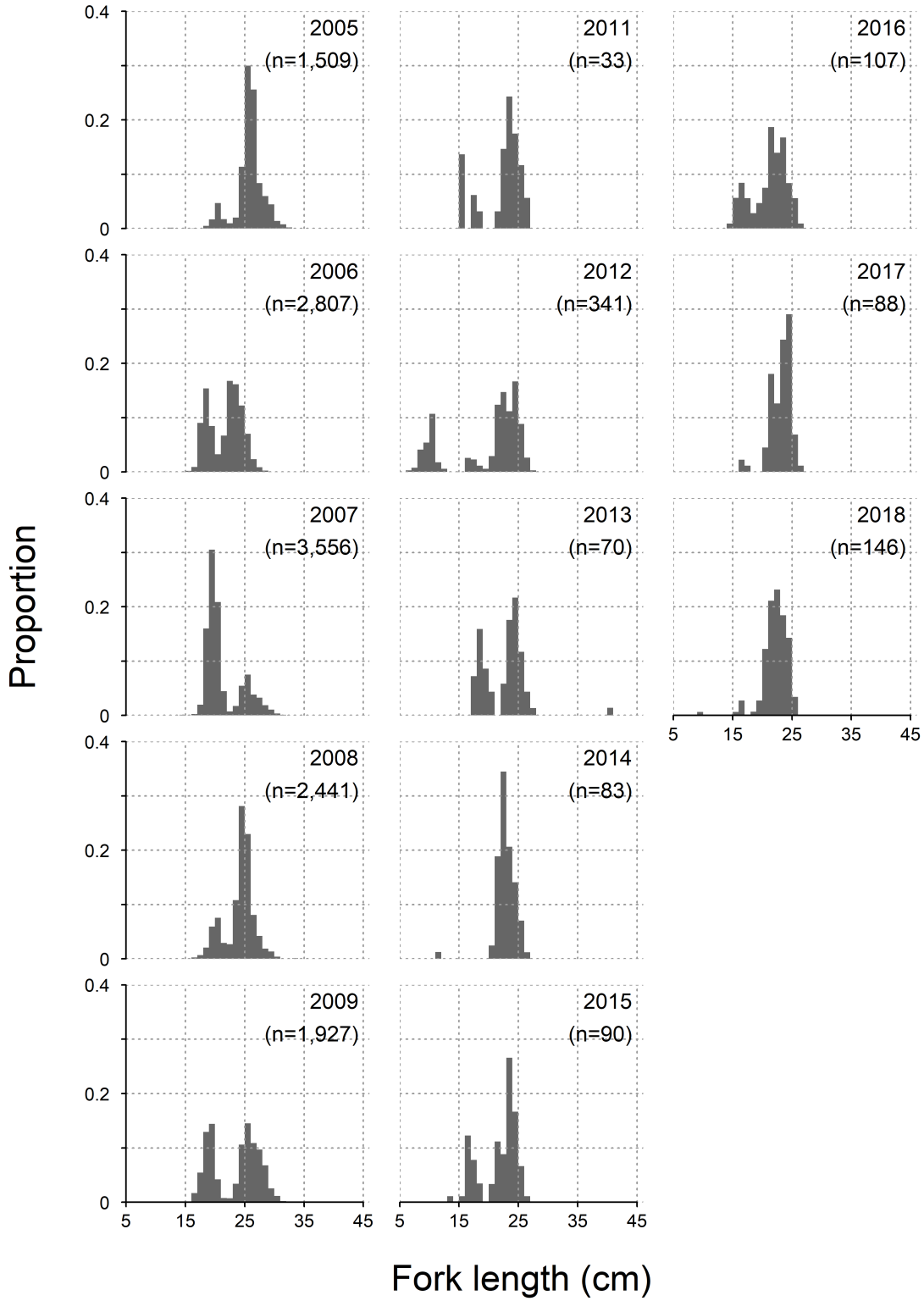

Figure 88. Length frequencies of gaspereau (*Alosa pseudoharengus* and *Alosa aestivalis*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2009 and 2011 to 2018. The total number of individuals is shown below the year label in each panel. (Note: gaspereau was not captured in 2010)

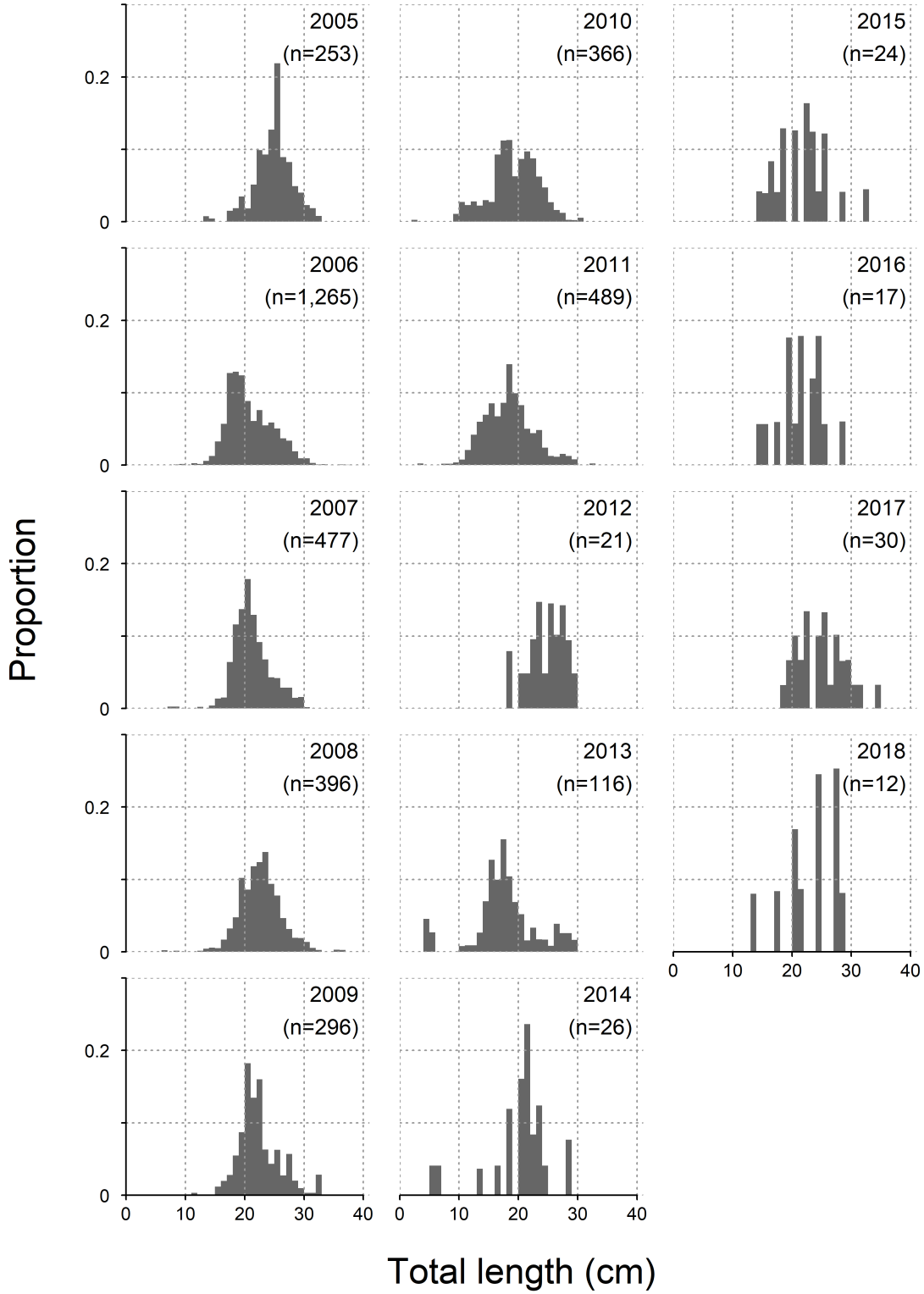

Figure 89. Length frequencies of longhorn sculpin (*Myoxocephalus octodecemspinosus*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

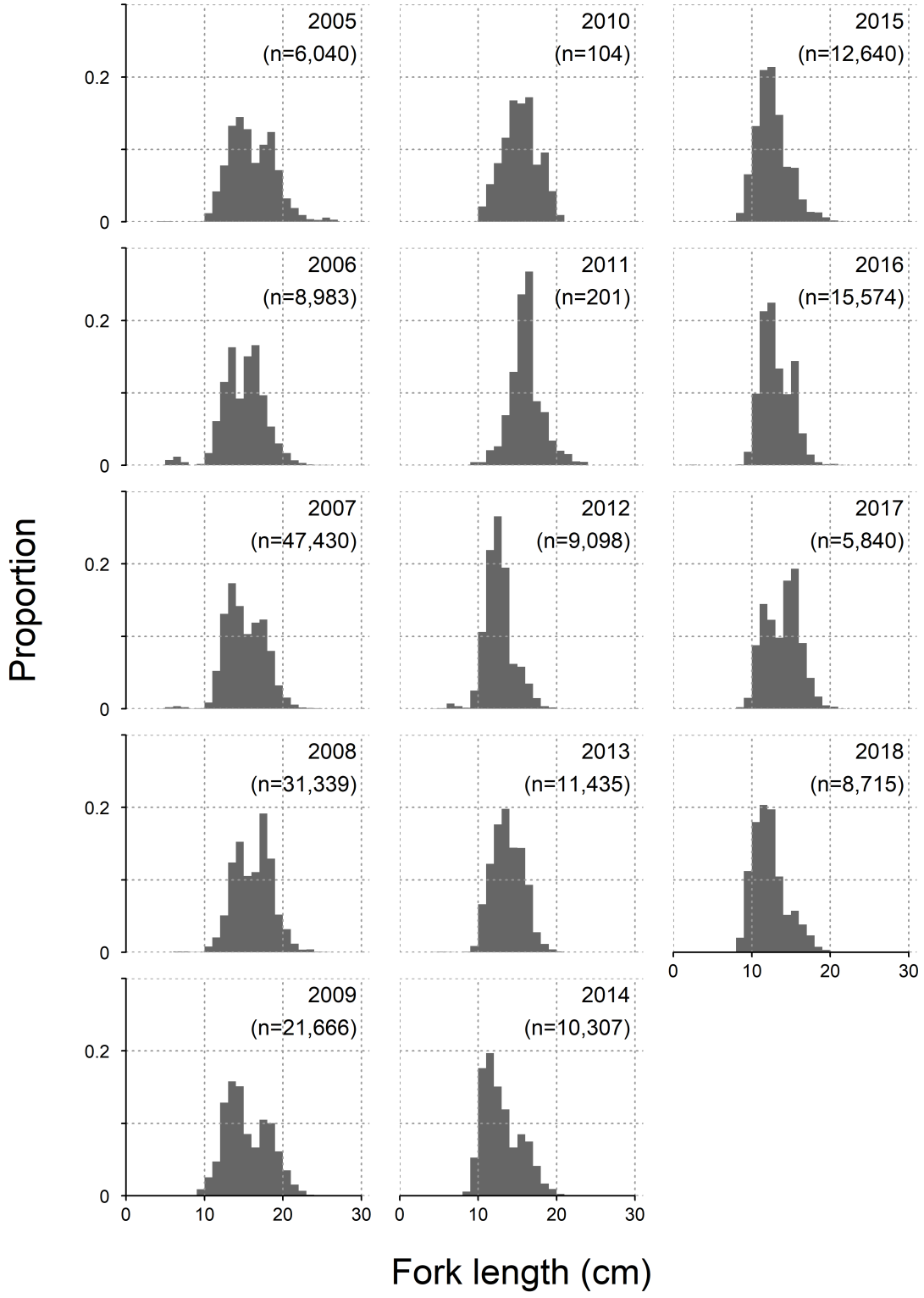

Figure 90. Length frequencies of rainbow smelt (*Osmerus mordax*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

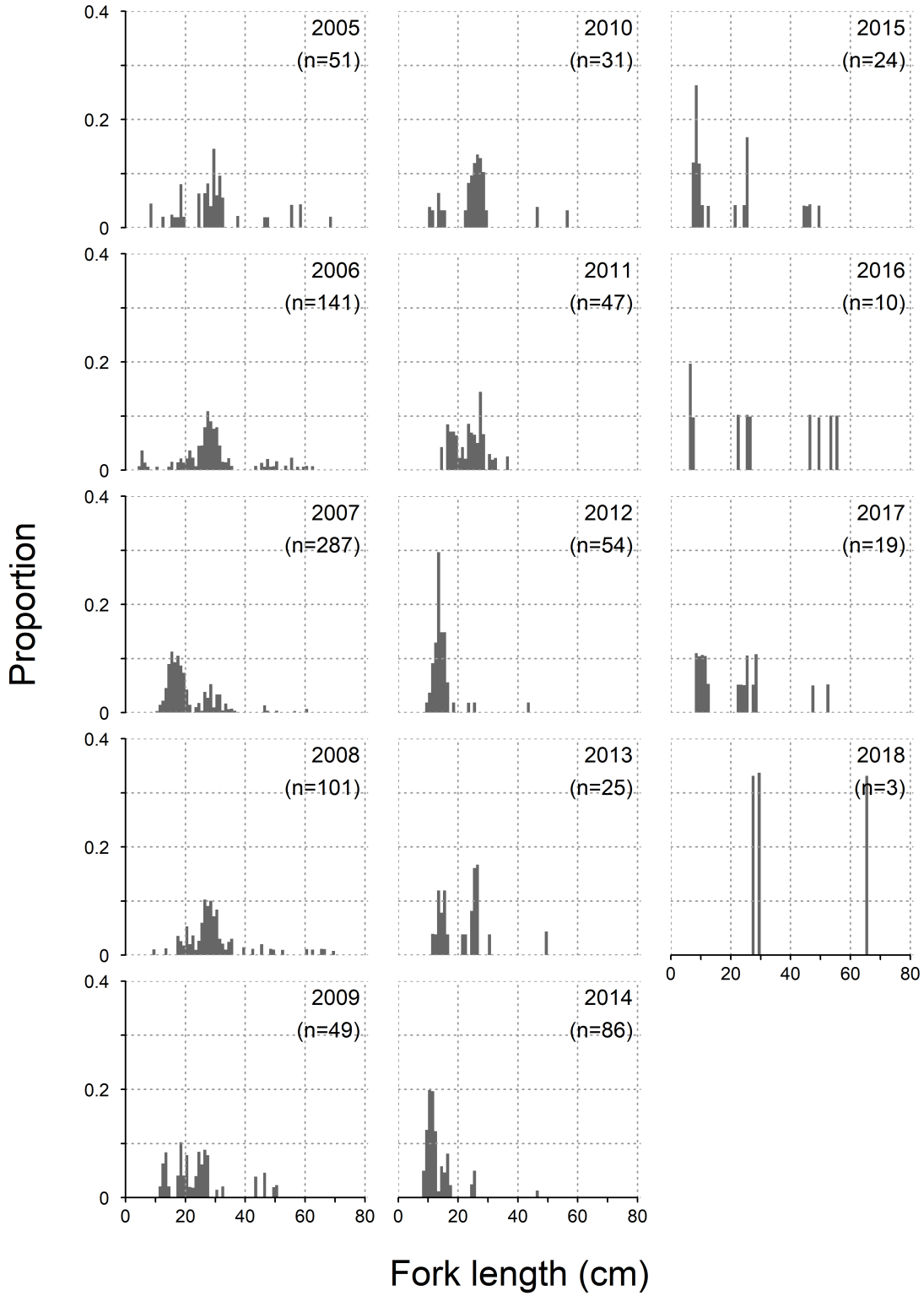

Figure 91. Length frequencies of white hake (*Urophycis tenuis*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

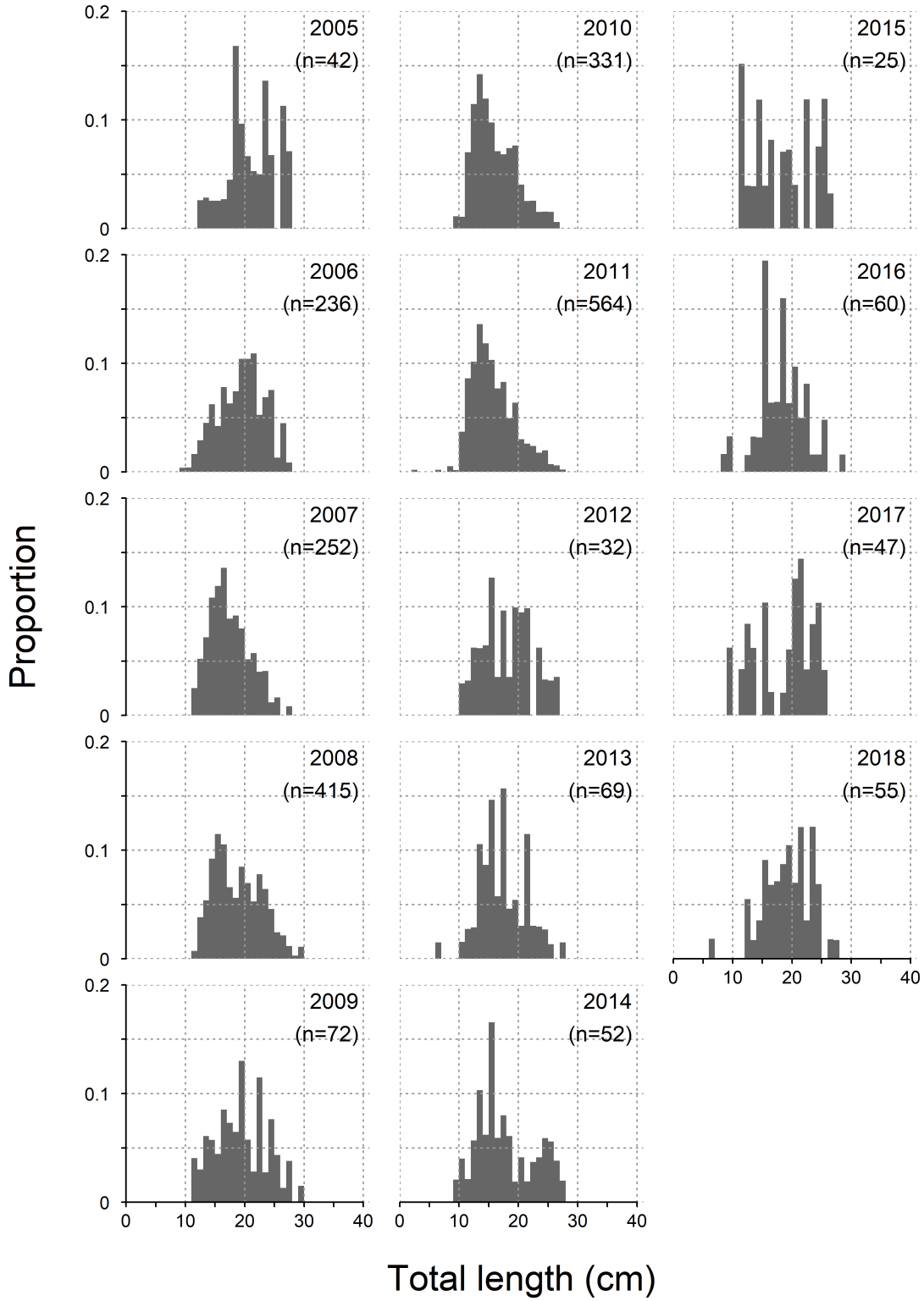

Figure 92. Length frequencies of windowpane flounder (*Scophthalmus aquosus*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

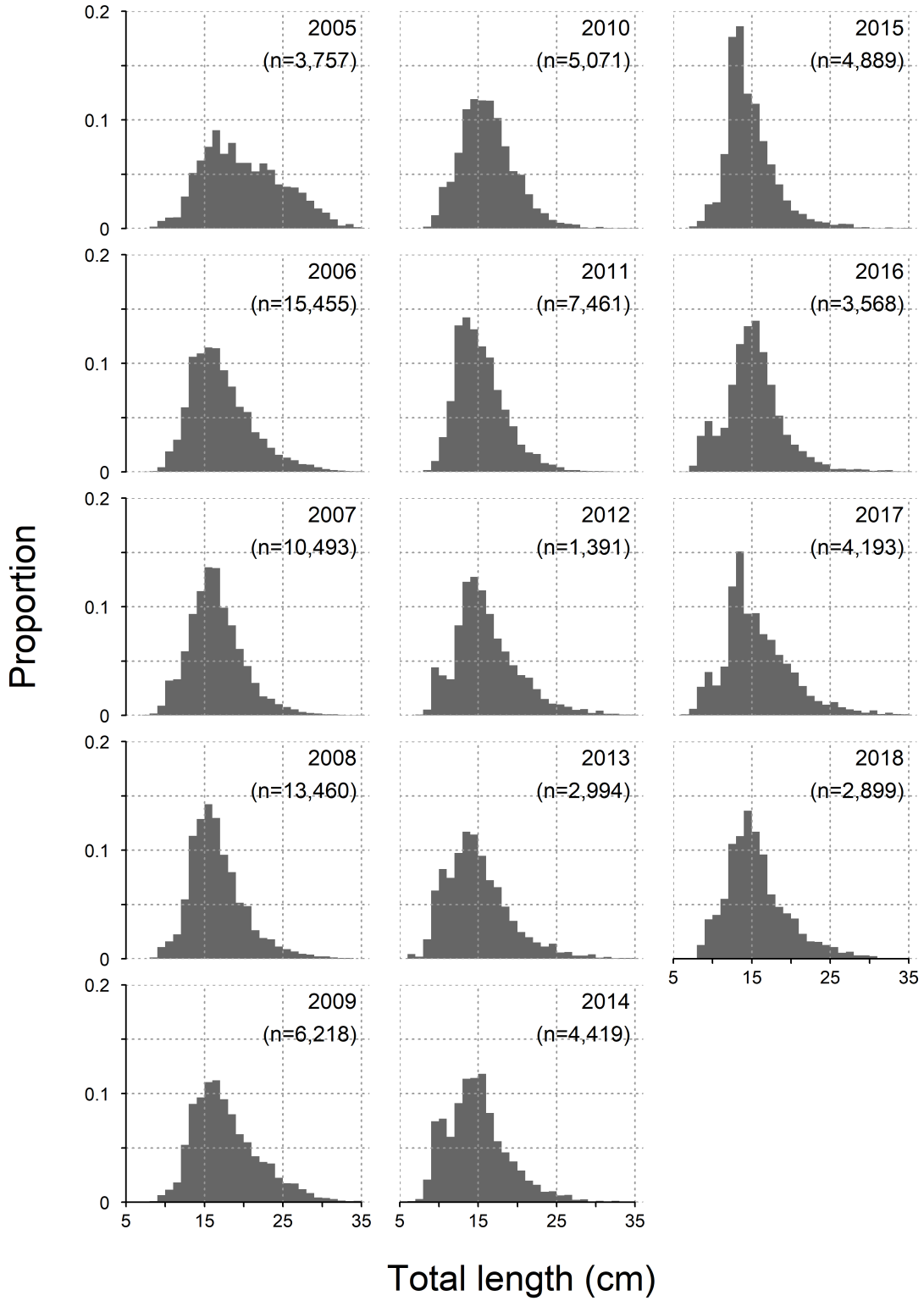

Figure 93. Length frequencies of winter flounder (*Pseudopleuronectes americanus*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

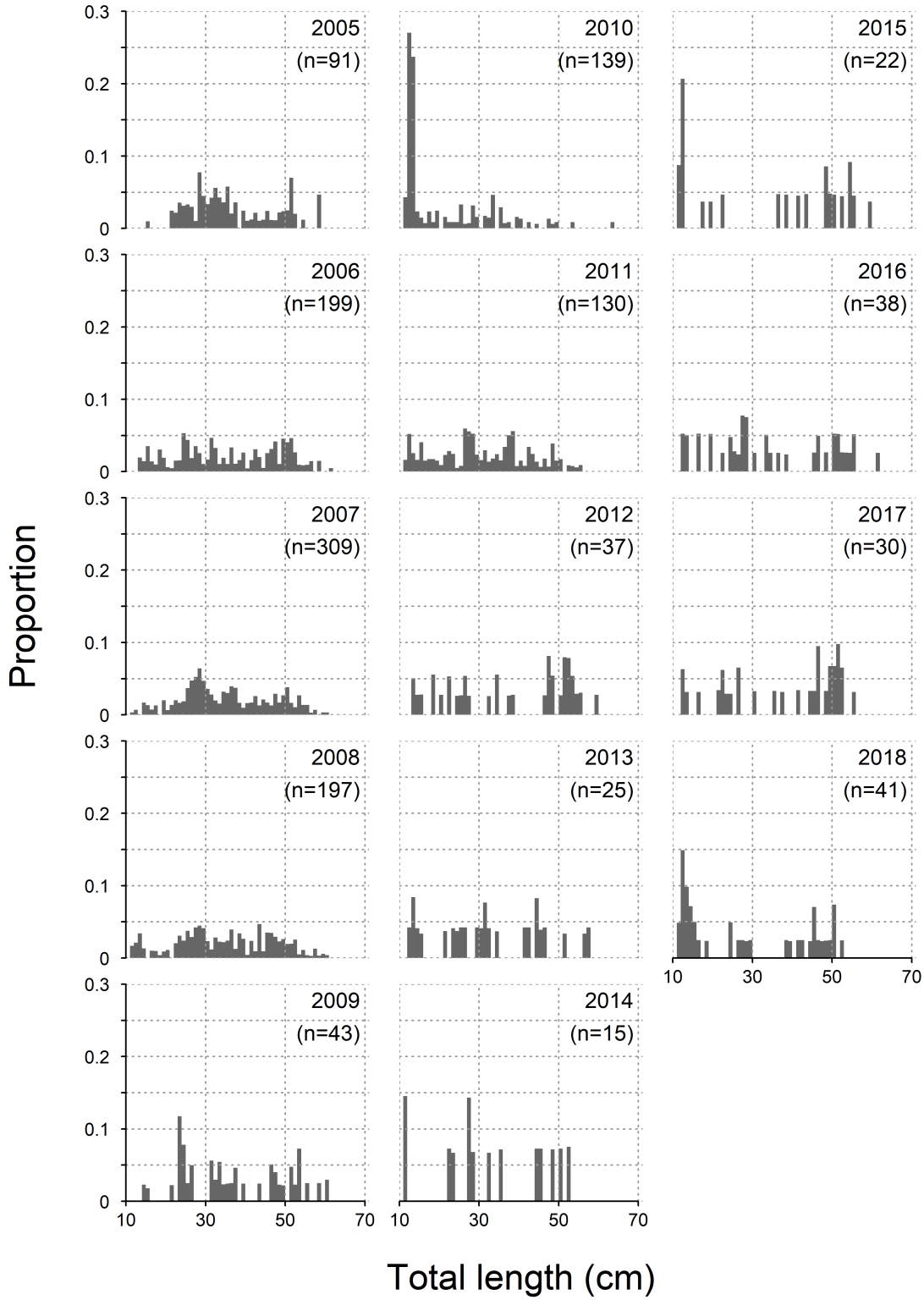

Figure 94. Length frequencies of winter skate (*Leucoraja ocellata*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

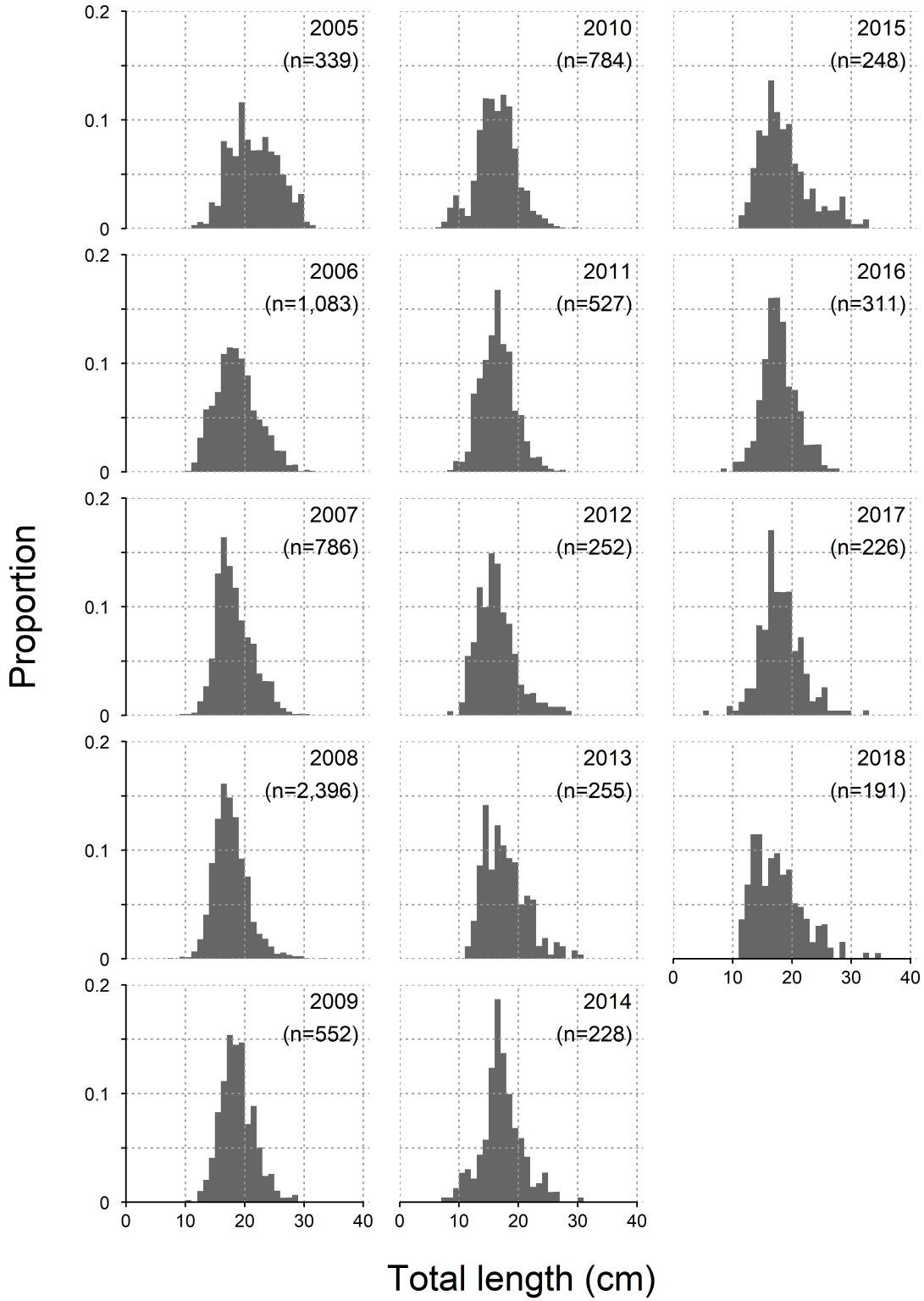

Figure 95. Length frequencies of yellowtail flounder (*Limanda ferruginea*) from the Northumberland Strait multi-species bottom trawl survey, 2005 to 2018. The total number of individuals is shown below the year label in each panel.

4 Discussion

The Northumberland Strait multi-species bottom trawl survey provides valuable data on fish and crustacean populations, particularly within the central portion of Northumberland Strait, which is excluded from the larger September multi-species bottom trawl survey in the southern Gulf of St. Lawrence (Savoie 2016). In addition to their use in stock assessments (e.g Comeau et al. 2004, 2008; Morin et al. 2002, 2012; Rondeau et al. 2014a, 2014b; Surette and Rolland 2019), data from this survey are particularly useful in assessments of the endangered winter skate (*Leucoraja ocellata*) whose range has contracted in recent years (Swain and Benoît 2016) and for a disjunct population of lady crab (*Ovalipes ocellatus*) (Voutier and Hanson 2008). The Northumberland Strait multi-species bottom trawl survey also facilitates the collection of oceanographic data that are used annually in a series of reports on physical oceanographic conditions in the Gulf of St. Lawrence (e.g. Galbraith et al. 2019, 2018).

Graphing the data highlighted errors in length measurements (e.g. evidence of erroneous measurements in carapace length measurements for lobster in 2007). Analyses conducted with these data should include thorough data checking to minimize the impacts of such errors on the results. Post-survey data verification is needed annually to ensure errors in field methods are identified and rectified quickly. A specific caveat to using this dataset is the presence of unusual species detected very rarely (e.g. only in one year of survey) which may indicate errors in species identification or data entry errors. If these specific species are of interest, it is recommended to compare their locations to published information on range and habitat. Additionally, certain pelagic species show up in the catch in large amounts (e.g. Atlantic herring and rainbow smelt) but a bottom trawl, as was used in this survey, is not the preferred way to sample these species and the catch may not be representative of the population size, structure or distribution.

The interpretation of the length frequency plots is challenged by changes in commercial size over time (e.g. the minimum legal carapace size for lobster), changes in the extent of the study area and the timing of the commercial fisheries. Specific to lobster, the survey is completed ahead of the commercial lobster season in LFA 25 and after the commercial lobster season in LFA 26A and changes in length frequency distributions may be partially explained by changes to the study area. The minimum legal caparace size for commercial lobster across the study area varies within each year and has also increased over time, from 65.9 to 70 mm in 1999 (Rondeau et al. 2014a) to 73 to 77 mm in 2018 (DFO 2018).

With the exception of the beam trawl used in 1999, which has a fixed opening of 4.2 m, data on the size of the trawl opening (i.e. wing spread) were not available for the full time series. Previous authors have described the size of the trawl opening as approximately 5 m for the No. 286 otter trawl with Bigouden Nephrops doors in 2000 (Hanson 2001), as 9.0 ± 0.2 m ($\bar{x} \pm$ 95% CI) for the No. 286 otter trawl in 2002 and 2003 (Comeau et al. 2008) and 5.9 m for the Bigouden Nephrops trawl in 2010 and 2011 (Rondeau et al. 2014a). As the size of the opening of bottom trawls is impacted by various factors, notably depth (Godo and Engas 1989; Weinberg and Kotwicki 2008), a set specific estimation of wing spread is needed to calculate the swept area of each set and improve the accuracy of relative density estimates.

Changes in survey trawls can also impact the catchability of marine species. For example, in 2010 and 2011, lower lobster catches and higher Atlantic rock crab catches likely reflect the use

of the Bigouden Nephrops trawl, as opposed to changes in the densities of these two species. Conversely, the No. 286 otter trawl, used in 2000 to 2009 and 2012 to 2018, does not capture Atlantic rock crab efficiently and underestimates the size of the underlying population.

Future work includes developing an approach to estimate the swept area of the sets and determining the catchability of various species. This will allow for further quantification of the results (e.g. the calculation of lobster densities) to be used in stock assessments.

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