Territorial Fish Life History Sample Inventory 2022

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Summary

Biological sampling of commercial, recreational, and subsistence-valued fish species for life history research is an important component of sustainable fisheries management. To achieve this, Pacific Islands Fisheries Science Center, Life History Program samples insular fish species in the U.S. Pacific territories via the Commercial Fisheries Biosampling Programs (CFBS) and NOAA Life History Program research surveys. The purpose of this document is to provide background information on the CFBS, including a shift in priorities, published life history research available in each territory, and territory- and species-specific summarizations of sample collections (otoliths and gonads) to guide future sample collection and life history research.

The federal bottomfish management unit species (BMUS) are currently prioritized for both 'field' sampling (trip-level information such as species composition and individual fish length and weights) and 'lab' sampling (collection of biological samples) for research to inform stock assessments and management. Non-BMUS species (typically shallow-water reef fish) were prioritized prior to 2019, and BMUS have been prioritized since 2020. Beginning in 2021, the CFBS switched from a haphazard otolith collection sampling design to a proportional otolith sampling (POS) based on a simulation study examining biases associated with improper sampling designs. The POS approach allows for efficient collection of samples and reduces sampling bias that can occur when selecting samples for age and growth.

Introduction

Appropriate collections of biological samples are crucial for understanding fish life history and population dynamics needed for sustainable fisheries management. These samples provide estimates of length at age, growth rates, longevity, aspects of reproduction (size and age at maturity, fecundity, spawning season), and mortality. This information is used to inform stock assessments, including those that use a data-poor approach. Life history information is also important to local management agencies when setting size limits and closed seasons to protect fish while they are spawning and ultimately increase fish population productivity. Finally, fish life history is expected to change in response to climate change; therefore, providing baseline information under current conditions is needed to document and understand future impacts.

Here we provide:

- Background of territorial biological sample objectives and collection methods,
- Sampling design approaches,
- Pacific Islands Fisheries Science Center (PIFSC)-species priorities,
- Territory- and species-specific completed research and sample inventories,
- Territory- and species-specific detailed sample collection information for species with more than 50 samples.

Territory Sampling Regions and Methods

The Commercial Fisheries Biosampling Programs (CFBS), PIFSC Life History Program (LHP) research surveys, and American Samoa Shore-based research efforts are the primary means of collecting biological samples for life history research. The CFBS currently operates in Guam (2009–present) and CNMI (2010–present) and previously operated in American Samoa (2010–2016). The American Samoa Shore-based research effort is proposed to replace the CFBS in this region but is currently delayed due to the global pandemic. LHP surveys are infrequent, typically occur during summer months, and often prioritize unfished areas of CNMI (Northern Mariana Islands). Research surveys in American Samoa are currently not feasible due to the small BMUS quota.

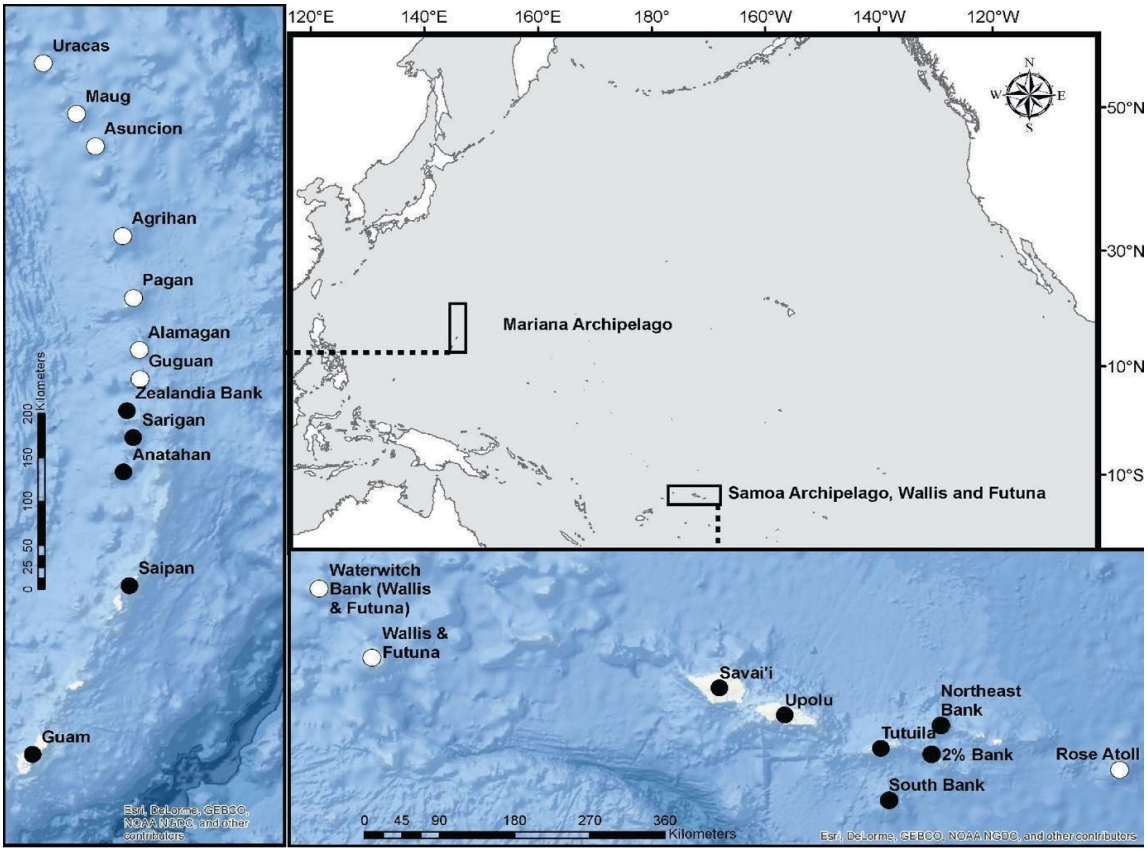

Figure 1. Territory life history sampling regions include Mariana Archipelago and American Samoa. Fished areas are labeled with a black circle and lightly or non-fished areas are labeled with a white circle. Territory life history sampling is summarized to Guam (Guam and surrounding areas such as Eleven-Mile Bank, Galvez Bank, and Santa Rosa Bank), CNMI fished regions (Rota, Tinian, Saipan, Anatahan, Sarigan, Zealandia Bank), CNMI unfished regions (CNMI northern islands north of Zealandia Bank), American Samoa fished regions (Tutuila, Manu'a Islands, Two Percent Bank, South Bank), and American Samoa unfished region (Rose Atoll). Independent Samoa and Wallis and Futuna are also shown but not included in life history summaries because the samples were collected during PIFSC LHP and the Pacific Communities (SPC) research surveys.

Commercial Fisheries Biosampling Program Objectives Program Objectives

2009–2019 Commercial Fisheries Biosampling Program Objectives (CFBS phase 1):

1. Obtain length-weight relationships for all species at select, presumed representative, markets.
2. Species identification of commonly landed species.
3. Obtain biological samples for life history information for species identified by PIFSC and local agencies as important commercial species. These species were typically non-BMUS.

2019 Updated Commercial Fisheries Biosampling Program Objectives (CFBS phase 2):

1. Obtain length frequency distributions and length-weight relationships for management unit species.
2. Sample otoliths and gonads from individuals across the population length distribution using a POS approach to provide life history information for priority species.
3. Provide local life history information for BMUS and support life history assessments for select non-BMUS species.
4. Standardized sampling and life history protocols across territories.

NOAA Life History Program Sampling Approach

Accuracy of fish growth estimates depends greatly on how otoliths are collected. Three common sampling strategies are random, fixed otolith sampling (FOS), and proportional otolith sampling (POS). Random sampling is rarely random and is not efficient due to the total number of samples needed in order for fish at both ends of the size distribution to be represented. LHP tested the FOS and POS approaches for bottomfish and found that POS consistently had less bias in the resulting growth parameter estimates than FOS, especially when the catch was representative of the population (Schemmel et al. 2022). Therefore, a POS approach is now applied for sample collection by the Guam and CNMI CFBS programs. Schemmel et al. (2022) also identified a POS sample size of 300 or more as the value where precision in growth parameters levels off with further increases in sample size resulting in diminished returns in precision. As of 2021, samples sizes for CFBS programs were set to a minimum of 300 for POS with increased sample sizes of 400+ for larger species where sexually explicit growth was identified. These species were identified from a review of the sex-specific otolith weight-to-fish length relationship using information collected to date.

For reproductive research, additional gonad and otolith samples need to be collected for the smaller size bins in which fish are assumed to be immature. To account for this, if otolith samples were less than 20 per length bin, we rounded the total sample size up to 20 individuals for length bins less than 60% of the fish's total length. If unusually large sized fish are

encountered (i.e., larger than maximum size listed on sampling table), up to three individuals per length bin are sampled. It is preferred that gonads and otoliths are collected from each fish sampled, but this is not always possible. Therefore, total sample sizes can differ for gonads and otoliths. To minimize over-representation of one fishing location or fishing event, the total samples collected from one sampling trip are limited to 10 individuals/species. These sampling approaches were initiated in 2021.

NOAA Life History Priority Species

The current focus of PIFSC LHP biological sampling and life history assessments is on federally managed BMUS for stock assessment and management purposes (Table 1, Table 2). The CFBS and American Samoa Shore-based research efforts are the primary means to collect these samples. Secondary focus is on BMUS and non-BMUS species collections from across the entire Mariana Archipelago (Table 3). LHP research surveys are the sole means to collect samples from the entire Marina Archipelago, sampling across latitudinal gradients in environmental conditions and in fishing pressure.

Table 1. List of bottomfish management unit species (BMUS) that are identified in the relevant Fishery Ecosystem Plan and that are used for the bottomfish assessments for Guam and the Commonwealth of the Northern Mariana Islands.

Species name	Common name	Common local name
Aphareus rutilans	Rusty jobfish	lehi/maroobw
Caranx ignobilis	Giant trevally	mamulan/etam
Caranx lugubris	Black trevally	tarakiton attelong/orong
Etelis carbunculus	Ruby snapper	buninas agaga'/falaghal moroobw
Etelis coruscans	Flame snapper	buninas/taighulupegh
Lethrinus rubrioperculatus	Redgill emperor	mafute'/atigh
Lutjanus kasmira	Bluestripe snapper	funai/saas
Pristipomoides flavipinnis	Yelloweye snapper	buninas/falaghal-maroobw
Pristipomoides sieboldii	Von Siebold's snapper	buninas/-
Pristipomoides zonatus	Oblique-banded snapper	buninas rayao amiriyu /falaghal-maroobw
Pristipomoides auricilla	Goldflag snapper	buninas/falaghal-maroobw
Pristipomoides filamentosus	Pink snapper	buninas/falaghal-maroobw
Variola louti	Lyretail grouper	gadau matingon/bwele

Table 2. List of bottomfish management unit species (BMUS) that are identified in the relevant Fishery Ecosystem Plan and that are used for the bottomfish assessment for American Samoa.

Species name	Common name	Samoan name
Aphareus rutilans	Rusty jobfish	palu-gutusiliva
Aprion virescens	Green jobfish	asoama
Caranx lugubris	Black trevally	tafauli
Etelis carbunculus[1]	Ruby snapper	palu malau
Etelis coruscans	Flame snapper	palu-loa
Lethrinus rubrioperculatus	Redgill emperor	filoa-paomumu
Lutjanus kasmira	Bluestripe snapper	savane
Pristipomoides flavipinnis	Yelloweye snapper	palu-sina
Pristipomoides zonatus	Oblique-banded snapper	palu-ula, palu-sega
Pristipomoides filamentosus	Pink snapper	palu-‘ena‘ena
Variola louti	Lyretail grouper	papa, velo

[1] *E. carbunculus* is now known to be comprised of two distinct, non-interbreeding lineages (Andrews et al. 2016). Both species occur in the Samoa Archipelago and were likely both captured by fishermen in the 1980s but reported as one species.

PIFSC LHP is currently conducting research examining variability in fish life history parameters as a consequence of fishing pressure and climate change (Table 3). This research utilizes the spatial extent of the Mariana Archipelago as it spans 7° of latitude and offers a south-to-north gradient of fishing pressure and water temperatures. Biological samples collected in the southern portion of the chain are in the ‘fished area’ which includes Guam, Rota, Tinian, Saipan, and the surrounding offshore reefs and seamounts. Less fishing pressure occurs between Saipan and Zealandia and there is considerably less pressure between Zealandia and Uracas due to distance from port. Water temperature also varies latitudinally along this same spatial extent. The biological samples needed for this study complicate the following inventories as the areas between Saipan and Zealandia are considered part of the CNMI primary fishing grounds yet the fishing pressure and water temperature differences there occur on a gradient. Therefore, the number of samples required in the fished area for stock assessment purposes (required n = 300/species across the entire area) differs from those needed for the variability in life history parameters research (required n = 300/species/location). LHP survey samples will not be used in CNMI species life history assessments to avoid over representation from the lightly fished areas.

Table 3. List of BMUS and non-BMUS species that are being collected and assessed from the Northern Mariana Islands for archipelago-wide climate change and fisheries research.

Scientific name	Common name	BMSU or non-BMUS
Acanthurus lineatus	Lined surgeonfish; blue-lined surgeonfish; blue banded surgeonfish	non-BMUS
Caranx melampygus	Bluefin trevally	non-BMUS
Cephalopholis argus	Peacock grouper	non-BMUS
Etelis carbunculus	Ruby snapper	BMUS
Etelis coruscans	Flame snapper	BMUS
Monotaxis grandoculis	Bigeye emperor	non-BMUS
Naso lituratus	Orangespine unicornfish	non-BMUS
Naso unicornis	Bluespine unicornfish	non-BMUS
Pristipomoides auricilla	Goldflag snapper	BMUS
Pristipomoides filamentosus	Pink snapper	BMUS
Pristipomoides flavipinnis	Yelloweye snapper	BMUS
Pristipomoides zonatus	Oblique-banded snapper	BMUS
Scarus rubroviolaceus	Ember parrotfish	non-BMUS
Zanclus cornutus	Moorish idol	non-BMUS

NOAA Territorial Sampling Inventories

A review of the samples collected for each of the territories (2008–2021) is presented in Table 4 (BMUS species) and Table 5 (non-BMUS species). Additional sample information (fish size distribution, monthly sample distribution, relationship between gonadosomatic index (GSI) and fish length, and mean female GSI by month) is available for all BMUS species and non-BMUS species that had a total sample size of 50 or greater in the appendix.

Guam Territory Species Summary

Four BMUS are completed for Guam:

- *Pristipomoides auricilla*—age, growth, mortality (O'Malley et al. 2019)
- *Pristipomoides filamentosus*—age, growth, mortality, reproduction (Villagomez 2019)
- *Pristipomoides zonatus*—age, growth, mortality, reproduction (Schemmel et al. 2021)
- *Variola louti*—age, growth, mortality, reproduction (Schemmel in review)

The remaining nine BMUS species are prioritized for continued sample collection using a POS approach. *P. auricilla* samples are currently being collected and processed to determine size at maturity and spawning season for this species.

Twelve non-BMUS life history assessments are completed for Guam:

- *Calatomus carolinus* (Taylor & Choat 2014)
- *Chlorurus frontalis* (Taylor & Choat 2014)
- *Chlorurus microrhinos* (Taylor & Choat 2014)
- *Chlorurus spilurus* (Taylor & Choat 2014)
- *Hipposcarus longiceps* (Taylor & Cruz 2017)
- *Naso lituratus* (Taylor et al. 2014)
- *Naso unicornis* (Taylor et al. 2014)
- *Scarus altipinnis* (Taylor et al. 2014)
- *Scarus forsteni* (Taylor et al. 2014)
- *Scarus psittacus* (Taylor et al. 2014)
- *Scarus rubroviolaceus* (Taylor et al. 2014)
- *Scarus schlegeli* (Taylor et al. 2014).

Three non-BMUS species life history assessments using CFBS samples are currently in progress:

- *Caranx melampygus* (Erin Reed, LHP)
- *Cheilinus undulatus* (Andrew Kang, UoG)
- *Monotaxis grandoculis* (Eric Cruz, PIFSC, UoG)

CNMI Territory Species Summary

Three BMUS are completed for CNMI:

- *Lethrinus rubrioperculatus*—age, growth, mortality, reproduction (Trianni 2011)
- *Pristipomoides filamentosus*—age, growth, mortality, reproduction (Villagomez 2019)
- *Pristipomoides auricilla*—age, growth, mortality (O'Malley et al. 2019)

The remaining ten BMUS species are prioritized for continued sample collection using a POS approach. *P. auricilla* samples are currently being collected and processed to determine size at maturity and spawning season for this species.

Five non-BMUS life history assessments are completed for CNMI:

- *Lethrinus harak* (Trianni 2016)
- *Lethrinus obsoletus* (Taylor et al. 2017)
- *Mulloidichthys flavolineatus* (Reed et al. 2020)

- *Parupeneus barberinus* (Reed et al. 2020)
- *Siganus argenteus* (Taylor et al. 2016)

Eleven non-BMUS life history assessments using CFBS samples are currently in progress:

- *Acanthurus lineatus* (Saipan—Keena Leon Guerrero, UH)
- *Acanthurus nigricauda* (John Gourley, MES)
- *Acanthurus triostegus* (John Gourley, MES))
- *Kyphosus cinerascens* (LHP In progress)
- *Sargocentron spiniferum* (John Gourley, MES)
- *Sargocentron tiere* (John Gourley, MES)
- *Caranx melampygus* (Erin Reed, LHP)

American Samoa Territory Species Summary

American Samoa CFBS was operational from 2010 to 2016. During that time, the focus was on non-BMUS, primarily emperors and squirrelfish.

One BMUS is partially completed for American Samoa:

- *Pristipomoides auricilla*—age, growth, mortality (O'Malley et al. 2019)
    - Survey data only (i.e., no samples from CFBS)

All of the BMUS species are prioritized for continued sampling in American Samoa. The only method for sampling BMUS is from fishermen's catch (e.g., American Samoa shore-based research).

Four non-BMUS life history assessments have been completed for A. Samoa:

- *Lethrinus xanthochilus* (Taylor et al. 2018)
- *Lutjanus gibbus* (Taylor et al. 2018)
- *L. rufolineatus* (Taylor et al. 2018)
- *S. rubroviolaceus* (Taylor and Pardee 2017)

Non-BMUS *Myripristis amaena, M. berndti, M. murdjan, N. unicornis, Sargocentron spiniferum,* and *S. tiere* were extensively sampled by the CFBS. However, concerns over the quality of the samples have been raised, with the widespread mislabeling of samples. Further, PIFSC received hundreds of samples that were not entered into the biosampling database by the contractor so species and other needed metrics cannot be assigned. See appendix for additional species sampling information.

Table 4. BMUS species summarized by region. Sample collection status is marked complete if the sample size and distribution are adequate, and a reference is listed under study status if life history information is available for that species. If that information is not available, the lab and researcher working on the species are listed. This includes samples that were collected during life history surveys and CFBS through December 2021. CNMI fished (CNMI CFBS) are samples collected via the CFBS and include samples collected south of Zealandia. CNMI unfished are samples collected during LHP surveys north of Zealandia. CNMI LHP survey are samples collected during LHP surveys south of Zealandia. Please refer to Figure 1 for fished and unfished area designation.

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Completed)	Research status (Reference, Lab (name))
Aphareus rutilans	A. Samoa	103	30.9–95.9	Ongoing	
Aprion virescens	A. Samoa	4	57.1–61.3	Ongoing	
Etelis carbunculus	A. Samoa	129	23.7–85.8	Ongoing	
Etelis coruscans	A. Samoa	129	45.6–88.7	Ongoing	
Lethrinus rubrioperculatus	A. Samoa	1	32.4–32.4	Ongoing	
Lutjanus kasmira	A. Samoa	5	20.5–23.4	Ongoing	DMWR (Ochavillo)
Pristipomoides auricilla	A. Samoa	129	22.8–48.4	Ongoing	
Pristipomoides filamentosus	A. Samoa	66	34.1–54.4	Ongoing	
Pristipomoides flavipinnis	A. Samoa	267	32.5-47.4	Age & Growth Completed	O'Malley et al. 2019
Pristipomoides zonatus	A. Samoa	74	23–40.2	Ongoing	
Variola louti	A. Samoa	0		Ongoing	
Aphareus rutilans	A. Samoa unfished	1	50.1–50.1		
Etelis carbunculus	A. Samoa unfished	55	27.2–47.2		
Etelis coruscans	A. Samoa unfished	26	46.1–87.6		
Pristipomoides auricilla	A. Samoa unfished	13	29.5–34.8		
Pristipomoides filamentosus	A. Samoa unfished	1	46.2–46.2		
Pristipomoides flavipinnis	A. Samoa unfished	8	39–42.5		
Pristipomoides zonatus	A. Samoa unfished	9	30.2–43.7		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Completed)	Research status (Reference, Lab (name))
Aphareus rutilans	CNMI CFBS	24	25.5–92.8	Ongoing	
Caranx lugubris	CNMI CFBS	18	30.3–68.1	Ongoing	
Caranx lugubris	CNMI CFBS	0		Ongoing	
Etelis carbunculus	CNMI CFBS	289	15.7–53.4	Ongoing	
Etelis coruscans	CNMI CFBS	133	34.3–95.3	Ongoing	
Lethrinus rubrioperculatus	CNMI CFBS	2	27.5–27.6	Completed	Trianni 2011
Lutjanus kasmira	CNMI CFBS	12	21.9–29.7	Ongoing	
Pristipomoides auricilla	CNMI CFBS	106	23.7–38.9	Age & Growth—Complete; Reproduction-Ongoing	O'Malley et al. 2019; LHP (Schemmel reproduction in progress)
Pristipomoides filamentosus	CNMI CFBS	10	31.7–57.2	Completed	Villagomez 2019
Pristipomoides flavipinnis	CNMI CFBS	50	26.8–43.3	Ongoing; Reproduction-Processing	LHP (Schemmel in progress)
Pristipomoides sieboldii	CNMI CFBS	57	21.5–34.7	Ongoing	
Pristipomoides zonatus	CNMI CFBS	184	18.6–41.3	Ongoing	LHP (Schemmel in progress)
Variola louti	CNMI CFBS	0		Ongoing	
Caranx ignobilis	CNMI LHP survey	1	94.6–94.6		
Caranx lugubris	CNMI LHP survey	3	30.7–56.8		
Etelis carbunculus	CNMI LHP survey	73	21.7–44.8	Ongoing	LHP (Table 3)

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Completed)	Research status (Reference, Lab (name))
Etelis coruscans	CNMI LHP survey	27	64.6–91.7	Ongoing	LHP (Table 3)
Pristipomoides auricilla	CNMI LHP survey	56	23.3–34.7	Ongoing	LHP (Table 3)
Pristipomoides filamentosus	CNMI LHP survey	10	40.2–60.0	Ongoing	LHP (Table 3)
Pristipomoides flavipinnis	CNMI LHP survey	10	37.4–44.1	Ongoing	LHP (Table 3)
Pristipomoides zonatus	CNMI LHP survey	126	24.4–40.5	Ongoing	LHP (Schemmel)
Variola louti	CNMI LHP survey	0			
Aphareus rutilans	CNMI unfished	25	38.4–96.1		
Caranx lugubris	CNMI unfished	6	29.2–56.9		
Etelis carbunculus	CNMI unfished	156	20.8–51.2	Ongoing	LHP (Table 3)
Etelis coruscans	CNMI unfished	217	47.8–92	Ongoing	LHP (Table 3)
Pristipomoides auricilla	CNMI unfished	213	22.5–89.4	Age & Growth—Complete; Reproduction—ongoing	O'Malley et al. 2019
Pristipomoides filamentosus	CNMI unfished	133	15.06–65.3	Ongoing	LHP (Table 3)
Pristipomoides flavipinnis	CNMI unfished	65	30.4–53.2	Ongoing	LHP (Table 3)
Pristipomoides sieboldii	CNMI unfished	6	32.2–35.2	Ongoing	LHP (Table 3)
Pristipomoides zonatus	CNMI unfished	488	23.3–68	Ongoing	LHP (Schemmel)

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Completed)	Research status (Reference, Lab (name))
Variola louti	CNMI unfished	6	25.9–41.1		
Aphareus rutilans	Guam	143	15.8–96.7	Ongoing	
Aprion virescens	Guam	22	22.8–78.9	Ongoing	
Caranx ignobilis	Guam	53	15–99.7	Ongoing	
Caranx lugubris	Guam	39	23–76.2	Ongoing	
Etelis carbunculus	Guam	130	18.1–84.0	Ongoing	
Etelis coruscans	Guam	531	29.2–99.0	Complete	LHP (Nichols & Reed)
Lethrinus rubrioperculatus	Guam	12	18.1–44.7	Ongoing	
Lutjanus kasmira	Guam	37	14.9–23.7	Ongoing	
Pristipomoides auricilla	Guam	272	16.2–34.8	Age & Growth Complete; Reproduction—Ongoing	O'Malley et al. 2019
Pristipomoides filamentosus	Guam	90	22.6–65.5	Ongoing	Villagomez et al. 2019
Pristipomoides flavipinnis	Guam	71	17.0–62.5	Sample Collection; Reproductive—Ongoing	LHP (Schemmel)
Pristipomoides sieboldii	Guam	29	21.1–59.8	Ongoing	
Pristipomoides zonatus	Guam	382	11.4–40.5	Complete	Schemmel et al. 2021
Variola louti	Guam	324	19.4–49.7	Complete	Schemmel et al. *in review*

Table 5. Non-BMUS summarized by region. Sample collection status is marked complete if the sample size and distribution are adequate and a reference is listed under study status if life history information is available for that species. If that information is not available, the lab and researcher working on the species are listed. This includes samples that were collected during life history surveys and CFBS through December 2021. CNMI fished (CNMI CFBS) are samples collected via the CFBS and include samples collected south of Zealandia. CNMI unfished are samples collected during LHP surveys north of Zealandia. CNMI LHP survey are samples collected during LHP surveys south of Zealandia. *CNMI LHP survey samples do not reflect the number of samples available at NOAA PIFSC as survey SE-14-04 reef fish samples were given to CNMI DFW as part of a permitting agreement between PIFSC and DFW.

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Aphareus furca	A. Samoa	4	44.3–47.6		
Cephalopholis igarashiensis	A. Samoa	5	25.5–39.1		
Chlorurus microrhinos	A. Samoa	3	41.3–59.2		
Epinephelus miliaris	A. Samoa	2	47.4–59.4		
Epinephelus morrhua	A. Samoa	1	62.4–62.4		
Epinephelus retouti	A. Samoa	1	46.4–46.4		
Epinephelus timorensis	A. Samoa	11	23.1–35.5		
Etelis radiosus	A. Samoa	1	74.9–74.9		
Etisus spendidus	A. Samoa	31	23.2–105.2		
Heoniphon opercularis	A. Samoa	2	18.6–23		
Hyporthodus octofasciatus	A. Samoa	2	123.5–136.6		
Lethrinus amboinensis	A. Samoa	4	34.9–43.4		
Lethrinus xanthochilus	A. Samoa	397	19–54	Complete	Taylor et al. (2018)
Lutjanus fulvus	A. Samoa	26	18.2–26.6		
Lutjanus gibbus	A. Samoa	489	14.6–49	Complete	Taylor et al. (2018)
Lutjanus rufolineatus	A. Samoa	260	14.9–43.3	Complete	Taylor et al. (2018)
Myripristis amaena	A. Samoa	344	12.5–21	Complete	Species ID issues

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Myripristis berndti	A. Samoa	703	12.5–32.5	Complete	Species ID issues
Myripristis murdjan	A. Samoa	296	9.3–20.5	Complete	Species ID issues
Naso unicornis	A. Samoa	558	12.4–53.5	Complete	Taylor et al. 2019
Paracaesio kusakarii	A. Samoa	30	46.5–61.5		
Paracaesio stonei	A. Samoa	8	45.2–53.9		
Paracaesio xanthura	A. Samoa	2	25.1–26		
Paracaesio xanthurus	A. Samoa	2	25.1–26		
Priacanthus blochii	A. Samoa	4	14.1–16.1		
Pristipomoides argyrogrammicus	A. Samoa	6	22.1–26.7		
Saloptia powelli	A. Samoa	11	30-38.2		
Sargocentron spiniferum	A. Samoa	268	10.2–70.5	Complete	Species ID issues
Sargocentron tiere	A. Samoa	699	10.3–31.6	Complete	Species ID issues
Scarus globiceps	A. Samoa	1	26.6–26.6		
Scarus rubroviolaceus	A. Samoa	447	17.9–91.6	Complete	Taylor and Pardee (2017)
Variola albimarginata	A. Samoa	3	28.6–33.5		
Etisus spendidus	A. Samoa unfished	9	69.1–111.1		
Saloptia powelli	A. Samoa unfished	2	36.7–39.4		
Acanthurus lineatus	CNMI CFBS	899	12–22.3	Complete	UoG (K. Leon Guerrero)
Acanthurus nigricauda	CNMI CFBS	588	12.5–25.3	Complete	MES (Gourley)

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Acanthurus triostegus	CNMI CFBS	372	11.7–18.7	Complete	MES (Gourley)
Calotomus carolinus	CNMI CFBS	427	17–32.2	Complete	
Cheilinus trilobatus	CNMI CFBS	408	17.2–34.1	Complete	LHP
Cheilinus undulatus	CNMI CFBS	305	15.5–126.2		MES (Gourley)
Chlorurus sordidus	CNMI CFBS	723	14.5–27.1		
Epinephelus octofasciatus	CNMI CFBS	1	115.8–115.8		
Etelis radiosus	CNMI CFBS	1	52.1–52.1		
Kyphosus cinerascens	CNMI CFBS	297	17.5–40.1	Complete	LHP (in progress)
Lethrinus atkinsoni	CNMI CFBS	930	12.4–34	Complete	Trianni et al. (in prep)
Lethrinus obsoletus	CNMI CFBS	1011	14.1–29.7	Complete	Taylor et al. 2017
Monotaxis grandoculis	CNMI CFBS	169	16–46.2		PIFSC (Cruz)
Mulloidichthys flavolineatus	CNMI CFBS	1226	8.5–31	Complete	Reed et al. 2020
Mulloidichthys vanicolensis	CNMI CFBS	985	8.9–28.5	Complete	
Naso lituratus	CNMI CFBS	1296	14.5–29.8	Complete	LHP
Naso unicornis	CNMI CFBS	2457	10.8–53.2	Complete	LHP
Parupeneus barberinus	CNMI CFBS	1243	6.7–62.7	Complete	Reed et al. 2020

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Plectropomus leopardus	CNMI CFBS	1	62.7–62.7		Trianni et al. (in prep)
Pristipomoides argyrogrammicus	CNMI CFBS	6	22–30.9		
Randallichthys filamentosus	CNMI CFBS	1	68.5–68.5		
Sargocentron spiniferum	CNMI CFBS	951	11.5–34.2	Complete	MES (Gourley)
Sargocentron tiere	CNMI CFBS	722	12.9–23.2	Complete	MES (Gourley)
Scarus ghobban	CNMI CFBS	12	16.5–41.3		
Siganus argenteus	CNMI CFBS	1194	12.4–33.3	Complete	Taylor et al. (2016)
Siganus spinus	CNMI CFBS	2026	10.2–25.6	Complete	
Tarachtichthys steindachneri	CNMI CFBS	18	54.4–69		
Acanthurus lineatus	CNMI LHP surveys	111	4.8–30	Ongoing	LHP (Table 3)
Caranx melampygus	CNMI LHP surveys	109	2.5–68.9	Ongoing	LHP (Table 3)
Cephalopholis argus	CNMI LHP surveys	117	16.5–41.1	Ongoing	LHP (Table 3)
Cephalopholis igarashiensis	CNMI LHP surveys	6	26.5–33		
Cephalopholis sonnerati	CNMI LHP surveys	1	26.2–26.2		
Cephalopholis urodeta	CNMI LHP surveys	3	16.8–22.5		
Cheilinus trilobatus	*CNMI LHP surveys	3	16.2–29.5		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Cheilinus undulatus	*CNMI LHP surveys	1	103–103		
Epinephelus hexagonatus	*CNMI LHP surveys	13	12.6–23.6		
Epinephelus socialis	*CNMI LHP surveys	1	36.6–36.6		
Gymnocranius euanus	*CNMI LHP surveys	2	45.4–48.4		
Gymnocranius euanus	*CNMI LHP surveys	2	45.4–48.4		
Lethrinus erythracanthus	*CNMI LHP surveys	1	56.2–56.2		
Lethrinus erythropterus	*CNMI LHP surveys	1	56.2–56.2		
Lethrinus harak	*CNMI LHP surveys	1	33.3–33.3		
Monotaxis grandoculis	*CNMI LHP surveys	80	15.8–41.4	Ongoing	LHP (Table 3)
Mulloidichthys pfluegeri	*CNMI LHP surveys	1	39.6–39.6		
Myripristis amaena	*CNMI LHP surveys	1	17.5–17.5		
Myripristis berndti	*CNMI LHP surveys	5	14.4–21.5		
Naso lituratus	*CNMI LHP surveys	112	7.9–28	Ongoing	LHP (Table 3)
Naso unicornis	*CNMI LHP surveys	101	10.4–50.7	Ongoing	LHP (Table 3)
Parupeneus barberinus	*CNMI LHP surveys	3	27.3–30.9		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Pristipomoides argyrogrammicus	*CNMI LHP surveys	8	24.8–30.2		
Saloptia powelli	*CNMI LHP surveys	1	39.1–39.1		
Scarus rubroviolaceus	*CNMI LHP surveys	102	17–43.5	Ongoing	LHP (Table 3)
Scorpaenidae spp.	*CNMI LHP surveys	1	26–26		
Zanclus cornutus	*CNMI LHP surveys	118	7.4–24.8	Ongoing	LHP (Table 3)
Acanthurus dussumieri	*CNMI unfished	1	35.8–35.8		
Acanthurus lineatus	*CNMI unfished	272	6.9–23.9	Ongoing	LHP (Table 3)
Aphareus furca	*CNMI unfished	12	22–29.7		
Carangoides orthogrammus	*CNMI unfished	3	25.9–26.8		
Caranx melampygus	*CNMI unfished	224	24.1–79	Ongoing	LHP (Table 3)
Cephalopholis argus	*CNMI unfished	223	6.5–44.9	Ongoing	LHP (Table 3)
Cephalopholis aurantia	*CNMI unfished	1	22.4–22.4		
Cephalopholis igarashiensis	*CNMI unfished	6	33.2–41.5		
Cephalopholis sexmaculata	*CNMI unfished	1	31.1–31.1		
Cephalopholis urodeta	*CNMI unfished	15	13–38.5		
Cheilinus trilobatus	*CNMI unfished	4	23–30.5		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Chlorurus sordidus	*CNMI unfished	1	24.7–24.7		
Coris aygula	*CNMI unfished	2	35.6–38.2		
Epinephelus coioides	*CNMI unfished	4	54–73.2		
Epinephelus corallicola	*CNMI unfished	4	54–73.2		
Epinephelus fasciatus	*CNMI unfished	1	28–28		
Epinephelus hexagonatus	*CNMI unfished	5	14.8–23.8		
Epinephelus howlandi	*CNMI unfished	1	31.5–31.5		
Epinephelus morrhua	*CNMI unfished	4	54–73.2		
Epinephelus retouti	*CNMI unfished	1	39.3–39.3		
Epinephelus socialis	*CNMI unfished	1	41.5–41.5		
Epinephelus tauvina	*CNMI unfished	1	44.4–44.4		
Erythrocles scintillans	*CNMI unfished	2	31.2–31.4		
Gymnocranius euanus	*CNMI unfished	1	39.7–39.7		
Hyporthodus octofasciatus	*CNMI unfished	33	81.4–152.2		
Monotaxis grandoculis	*CNMI unfished	171	8.6–40	Ongoing	LHP (Table 3)
Mulloidichthys flavolineatus	*CNMI unfished	2	18–28.5		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Mulloidichthys vanicolensis	*CNMI unfished	1	27.3–27.3		
Myripristis amaena	*CNMI unfished	1	19.5–19.5		
Myripristis berndti	*CNMI unfished	11	19.3–23.2		
Myripristis murdjan	*CNMI unfished	4	18.3–22.3		
Naso lituratus	*CNMI unfished	274	10.5–30.4	Ongoing	LHP (Table 3)
Naso unicornis	*CNMI unfished	178	16.5–52	Ongoing	LHP (Table 3)
Oplegnathus punctatus	*CNMI unfished	1	30–30		
Ostichthys kaianus	*CNMI unfished	1	21.5–21.5		
Parupeneus barberinus	*CNMI unfished	1	36.7–36.7		
Parupeneus multifasciatus	*CNMI unfished	1	16.5–16.5		
Pirstipomoides sieboldii	*CNMI unfished	6	32.2–35.2		
Polymixia spp.	*CNMI unfished	2	32.9–40.2		
Pontinus macrocephalus	*CNMI unfished	1	32.3–32.3		
Pontinus sp	*CNMI unfished	2	32.9–40.2		
Pristipomoides argyrogrammicus	*CNMI unfished	33	10-36.0		
Randallichthys filamentosus	*CNMI unfished	1	74–74		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Saloptia powelli	*CNMI unfished	16	29.9–45		
Scarus forsteni	*CNMI unfished	1	24.3–24.3		
Scarus rubroviolaceus	*CNMI unfished	259	17.2–51.8	Ongoing	LHP (Table 3)
Scarus forsteni	*CNMI unfished	1	24.3–24.3		
Seriola dumerili	*CNMI unfished	1	90.5–90.5		
Thyrisitoides marleyi	*CNMI unfished	1	151.5–151.5		
Zanclus cornutus	*CNMI unfished	202	13–20.8		
Acanthurus guttatus	Guam	8	14.5–16.6		
Acanthurus lineatus	Guam	13	15.1–19.7		
Acanthurus nigricauda	Guam	2	13.3–18		
Aphareus furca	Guam	5	22.8–35		
Aprion virescens	Guam	22	22.8–78.9		
Carangoides fulvoguttatus	Guam	1	43.9–43.9		
Carangoides orthogrammus	Guam	2	20.5–23		
Caranx melampygus	Guam	133	9.5–66.5	Complete	LHP (Table 3)
Caranx sexfasciatus	Guam	1	67.5–67.5		
Cephalopholis argus	Guam	2	27.7–37		
Cephalopholis igarashiensis	Guam	1	19.8–19.8		
Cephalopholis sonnerati	Guam	3	25.5–33.6		
Cephalopholis spiloparaea	Guam	1	17.3–17.3		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Cephalopholis urodeta	Guam	4	14.7–17.8		
Cetoscarus bicolor	Guam	2	42.2–48.1		
Chaetodon auriga	Guam	6	12.7–15.6		
Chaetodon lunula	Guam	11	10.6–14.2		
Cheilinus trilobatus	Guam	6	12.2–23.8		
Cheilinus undulatus	Guam	127	9.8–135	Complete	UoG (Kang)
Cheilopogon unicolor	Guam	6	9.8–22.6		
Chlorurus frontalis	Guam	1	24–24		
Chlorurus microrhinos	Guam	16	9–46.7		
Chlorurus spilurus	Guam	9	11.4–27.1		
Emmelichtyidae	Guam	1	50.6–50.6		
Epibulus insidiator	Guam	3	19.4–22.8		
Epinephelus fasciatus	Guam	60	14.1–30.6		
Epinephelus lanceolatus	Guam	3	139.5–175.2		
Epinephelus maculatus	Guam	1	41.4–41.4		
Epinephelus melanostigma	Guam	1	20.7–20.7		
Epinephelus merra	Guam	2	20.7–26.6		
Epinephelus octofasciatus	Guam	6	81.9–157.5		
Epinephelus polyphekadion	Guam	1	55.2–55.2		
Epinephelus spilotoceps	Guam	1	26.6–26.6		
Etelis marshi	Guam	3	18.5–23.8		
Etelis radiosus	Guam	6	66.3–107.8		
Gnathodentex aureolineatus	Guam	6	15.6–19.6		
Gnathodentex aurolineatus	Guam	6	15.6–19.6		
Hemigymnus fasciatus	Guam	1	18.9–18.9		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Heteropriacanthus cruentatus	Guam	1	18.7–18.7		
Hipposcarus longiceps	Guam	354	14.2–51.4	Complete	Taylor and Cruz (2017)
Kyphosus cinerascens	Guam	4	20.6–31.5		
Kyphosus vaigiensis	Guam	3	29.1–48.2		
Leptoscarus vaigiensis	Guam	1	33.1–33.1		
Lethrinus atkinsoni	Guam	33	16.2–35		
Lethrinus erythracanthus	Guam	7	23.7–68.6		
Lethrinus harak	Guam	11	19.8–26.2		
Lethrinus obsoletus	Guam	57	16–32.2		
Lethrinus olivaceus	Guam	20	22-72.2		
Lethrinus xanthochilus	Guam	7	32.3–57.8		
Lutjanus argentimaculatus	Guam	3	39–52.5		
Lutjanus fulvus	Guam	1	18.3–18.3		
Lutjanus gibbus	Guam	33	13.1–40.5		
Lutjanus monostigma	Guam	1	28–28		
Macolor macularis	Guam	3	17.6–23.1		
Macolor niger	Guam	1	33.5–33.5		
Melichthys niger	Guam	5	14.8–21.8		
Melichthys vidua	Guam	6	17.5–23.9		
Monotaxis grandoculis	Guam	422	8.7–48.6	Complete	PIFSC/UoG (Cruz)
Mulloidichthys vanicolensis	Guam	2	18.8–20.8		
Myripristis adusta	Guam	4	24–25.6		
Myripristis berndti	Guam	10	12.2–23.9		
Myripristis violacea	Guam	1	16.2–16.2		
Naso lituratus	Guam	27	11.9–28.1	Complete	Taylor et al. (2014)

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Naso unicornis	Guam	52	13.9–55.3	Complete	Taylor et al. (2014)
Neoniphon argenteus	Guam	1	25.5–25.5		
Neoniphon aurolineatus	Guam	1	5.4–5.4		
Paracirrhites hemistictus	Guam	2	21.7–21.9		
Parupeneus barberinus	Guam	1	31.8–31.8		
Parupeneus cyclostomus	Guam	1	33.1–33.1		
Parupeneus heptacanthus	Guam	2	21.7–21.9		
Parupeneus multifasciatus	Guam	3	15.1–44.3		
Pempheris oualensis	Guam	1	16.8–16.8		
Pirstipomoides sieboldii	Guam	8	31.5–35.8		
Plectorhinchus albovittatus	Guam	4	52.6–86.4		
Plectorhinchus picus	Guam	1	32.8–32.8		
Plectropomus laevis	Guam	9	25.3–91.6		
Plectropomus leopardus	Guam	4	40–58		
Pomacanthus imperator	Guam	7	9.2–19.9		
Pontinus macrocephalus	Guam	1	19.5–19.5		
Pristipomoides argyrogrammicus	Guam	26	16.1–27.5		
Saloptia powelli	Guam	1	21.8–21.8		
Sargocentron spiniferum	Guam	5	17.6–29.3		
Sargocentron tiere	Guam	4	6.8–23.6		
Scarus festivus	Guam	1	39.5–39.5		
Scarus ghobban	Guam	2	44.9–52.6		
Scarus rubroviolaceus	Guam	2	42.7–42.8		
Scarus schlegeli	Guam	2	29.3–29.9		

Scientific name	Region	n	Length distribution (cm; min-max)	Sample collection status (Ongoing, Complete)	Research status (Reference, Lab (name))
Scolopsis lineatus	Guam	6	13.5–16.1		
Scomberoides lysan	Guam	1	39.1–39.1		
Seriola dumerili	Guam	3	29.8–76.8		
Siganus argenteus	Guam	7	26.2–29.7		
Siganus punctatus	Guam	88	15.8–30.1		
Sufflamen bursa	Guam	5	12.2–17.1		
Tarachtichthys steindachneri	Guam	1	59.1–59.1		
Triodon macropterus	Guam	6	41–46.4		
Variola albimarginata	Guam	3	24.7–30.8		
Zanclus cornutus	Guam	6	7.7–15		
Zebrasoma veliferum	Guam	1	15.8–15.8		

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Appendices

Appendix A: Guam Species Summaries

Updated April 2022 (current through 2021)

The following species were sampled through the Territory Commercial Fisheries Biosampling Program and NOAA life history surveys and are reviewed in this appendix for completeness of sampling to assess regional life history parameters for age, growth, and reproduction.

Bottomfish Management Unit Species (BMUS):

Aphareus rutilans
Caranx ignobilis
Caranx lugubris
Etelis carbunculus
Etelis coruscans
Lethrinus rubrioperculatus
Lutjanus kasmira
Pristipomoides auricilla
Pristipomoides filamentosus
Pristipomoides flavipinnis
Pristipomoides sieboldii
Pristipomoides zonatus
Variola louti

Non-BMUS:
Caranx melampygus
Cheilinus undulatus
Epinephelus fasciatus
Lethrinus obsoletus
Siganus punctatus

This species summary is a guide to inform future sampling collection efforts and life history assessments. Species with completed life history assessments for the territory are excluded unless continued sample collection is recommended for additional research to meet fisheries science and management needs. All BMUS and non-BMUS with a sample size greater or equal to 50 are included in this appendix. Sample sizes should be considered as approximate as there is not always an otolith and gonad for every entry in the database due to missing samples, otoliths breaking, or gonads not collected.

Data for each species are reviewed across four categories: fish size distribution, monthly sample distribution, relationship between gonadosomatic index (GSI) and fish length, and mean female GSI by month. Each of these categories allows for a review of the sample collection progress to meet the needs of the life history assessments for age, growth, spawning season, and size/age at maturity.

Size distribution: The length frequency distribution is a proxy for looking at the sampling coverage to estimate age and growth. It also allows for a first look at the size distribution of females and males. This is a proxy, and histological assessment is recommended to confirm

gender and to identify unknowns.

Monthly sample distribution: The total number of samples per month are plotted. A sample size of 20 individuals per month is recommended (red dashed line).

GSI and fish length: Gonadosomatic index (gonad weight/fish weight *100) is plotted against fish size to visualize the sample distribution as a proxy for size at maturity.

Spawning season: Female Gonadosomatic Index (GSI) is plotted by month to visualize if sampling is adequate to determine spawning seasonality.

Bottomfish Management Unit Species

Aphareus rutilans

A total of 143 *Aphareus rutilans* samples (females=51, males=43, unknown/na=49) have been collected to date (2022-12-02). Median fork length is 64 cm (min=15.8 cm, max=96.7 cm).

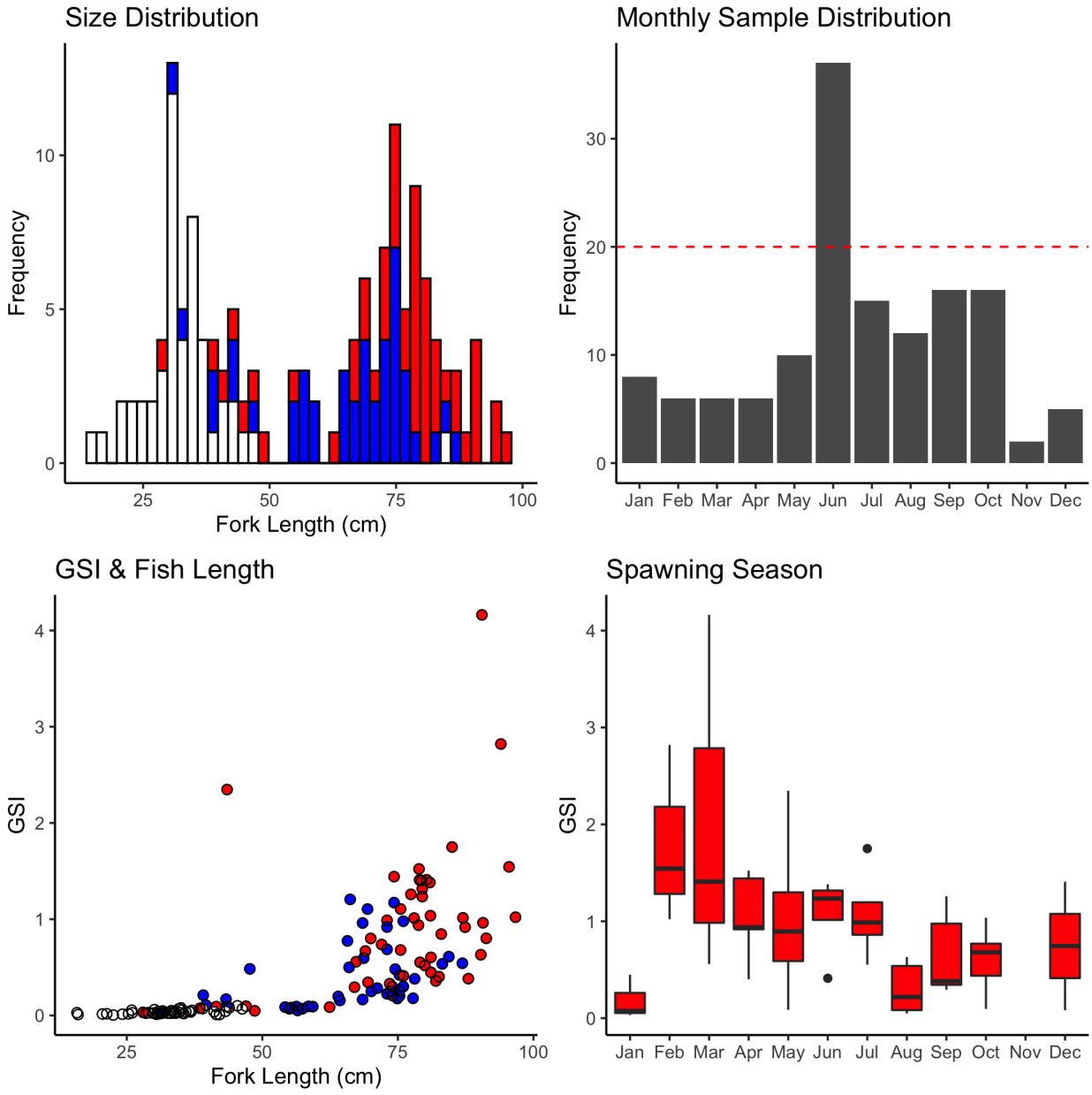

Figure A-1. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx ignobilis

A total of 51 *Caranx ignobilis* samples (females=17, males=10, unknown/na=24) have been collected to date (2022-12-02). Median fork length is 48.5 cm (min=15 cm, max=99.7 cm).

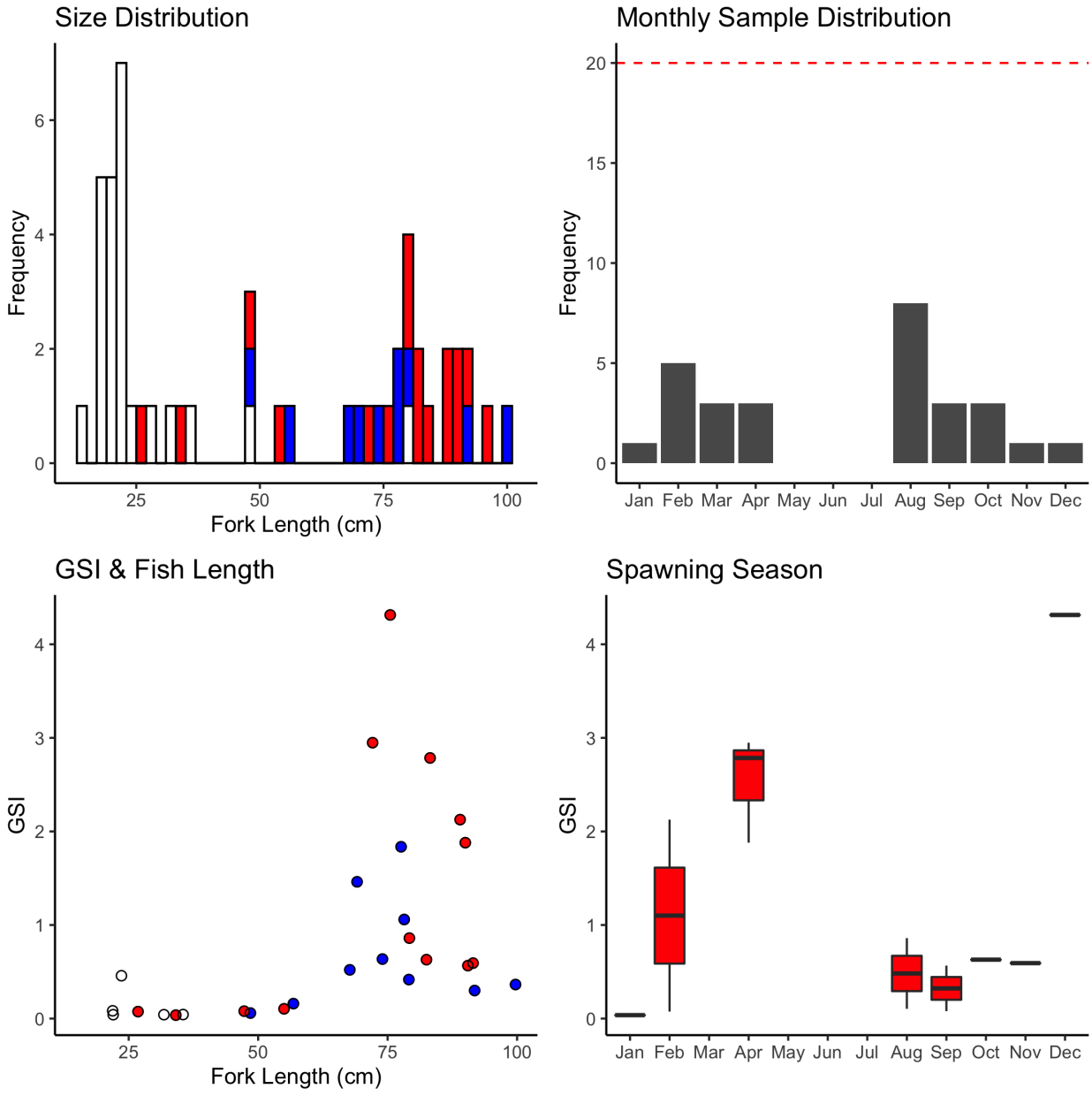

Figure A-2. *C. ignobilis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx lugubris

A total of 39 *Caranx lugubris* samples (females=18, males=14, unknown/na=7) have been collected to date (2022-12-02). Median fork length is 38.6 cm (min=23 cm, max=76.2 cm).

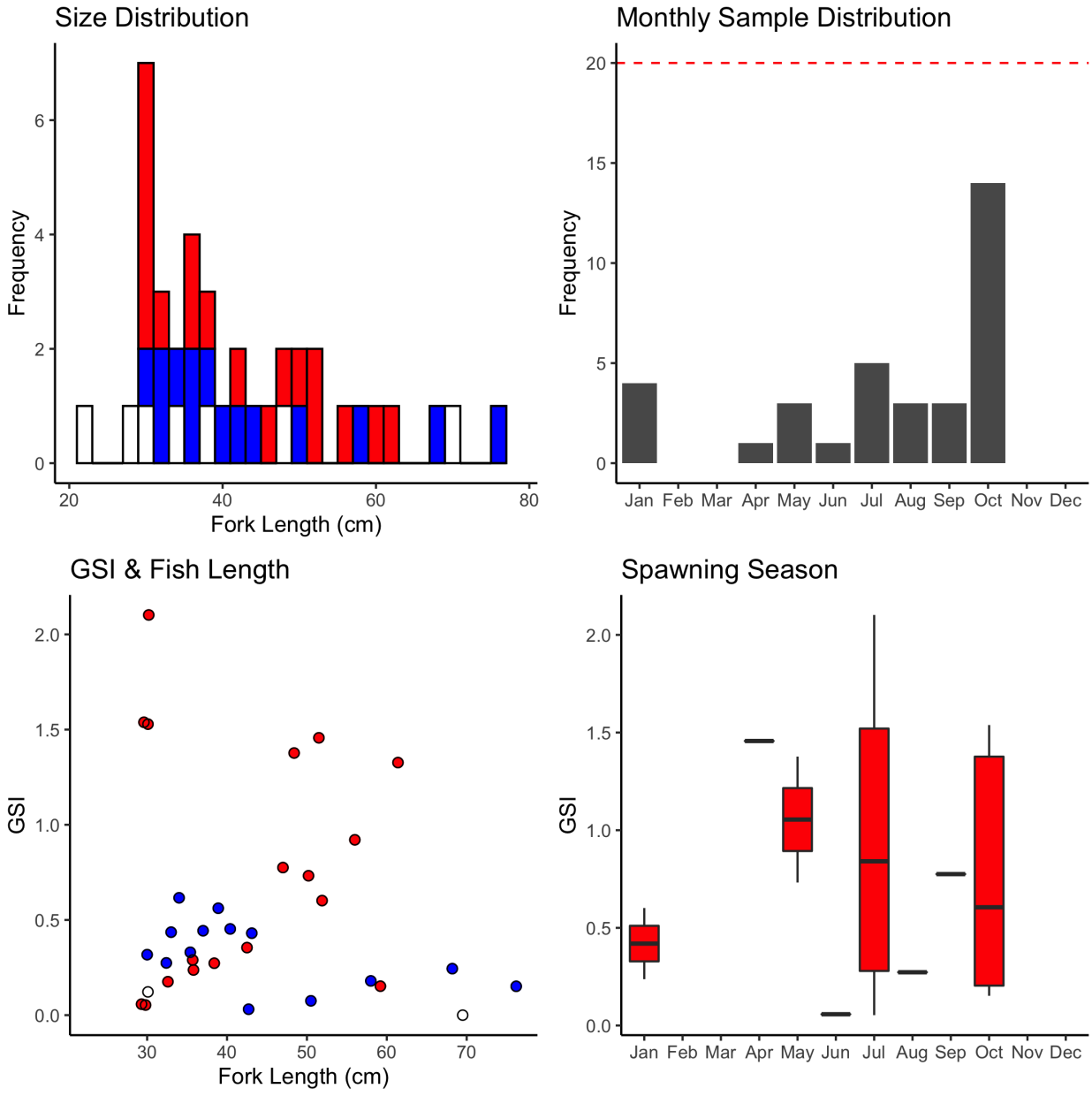

Figure A-3. *C. lugubris* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis carbunculus

A total of 130 *Etelis carbunculus* samples (females=80, males=21, unknown/na=29) have been collected to date (2022-12-02). Median fork length is 32.5 cm (min=18.1 cm, max=84 cm).

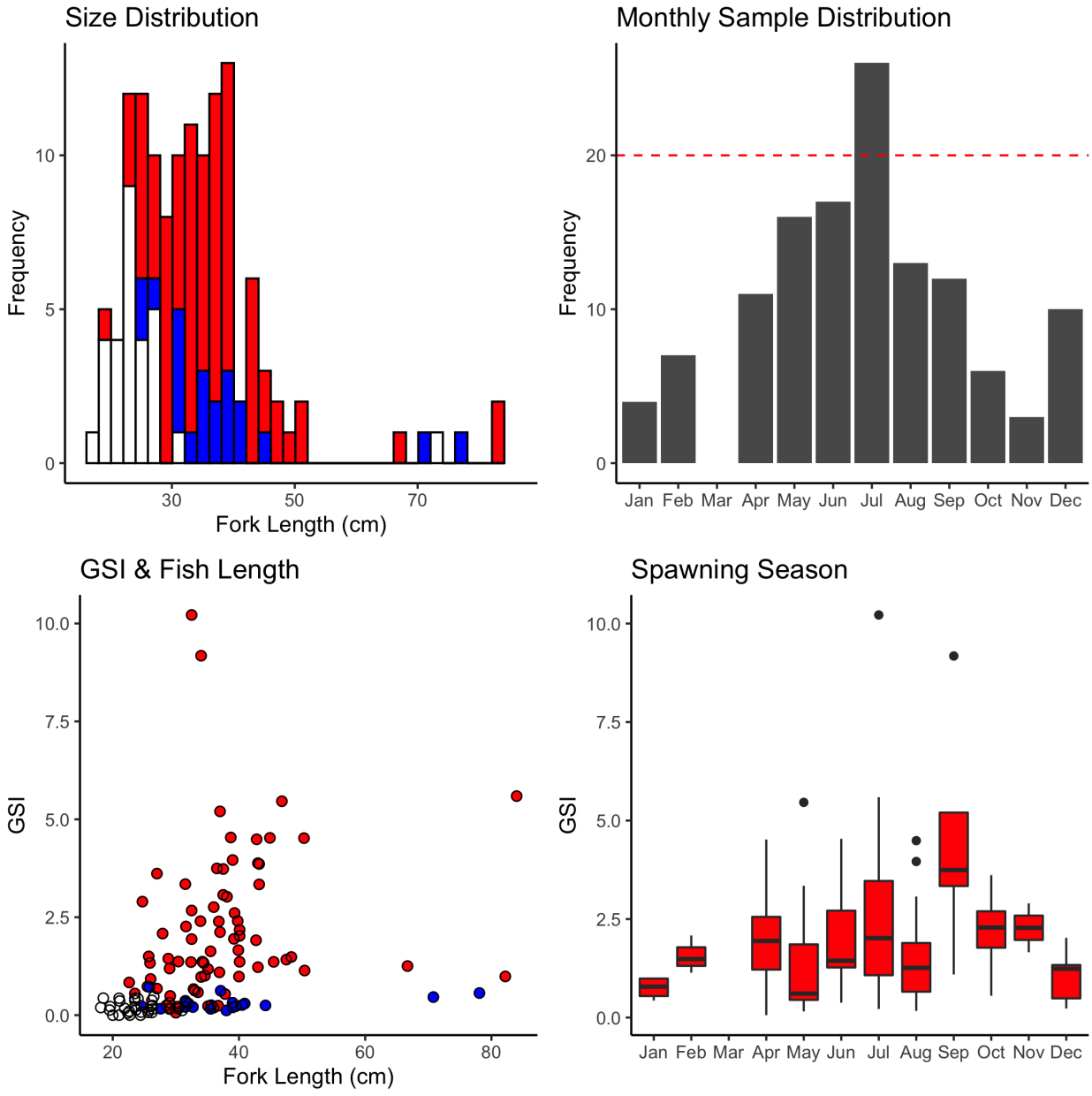

Figure A-4. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 528 *Etelis coruscans* samples (females=254, males=232, unknown/na=42) have been collected to date (2022-12-02). Median fork length is 71.6 cm (min=29.2 cm, max=99 cm).

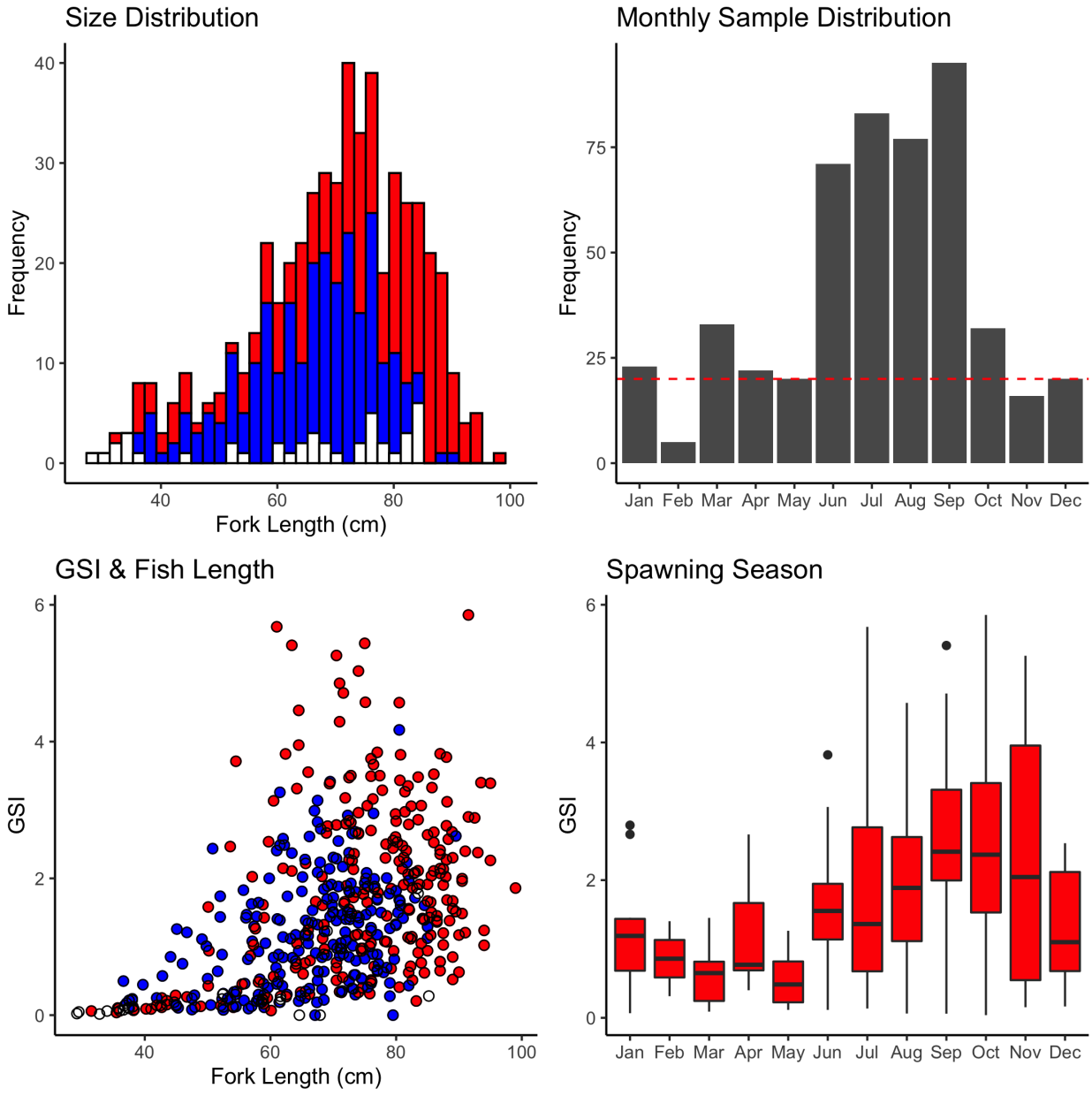

Figure A-5. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus rubrioperculatus

A total of 12 *Lethrinus rubrioperculatus* samples (females=7, males=3, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 25.1 cm (min=18.1 cm, max=44.7 cm).

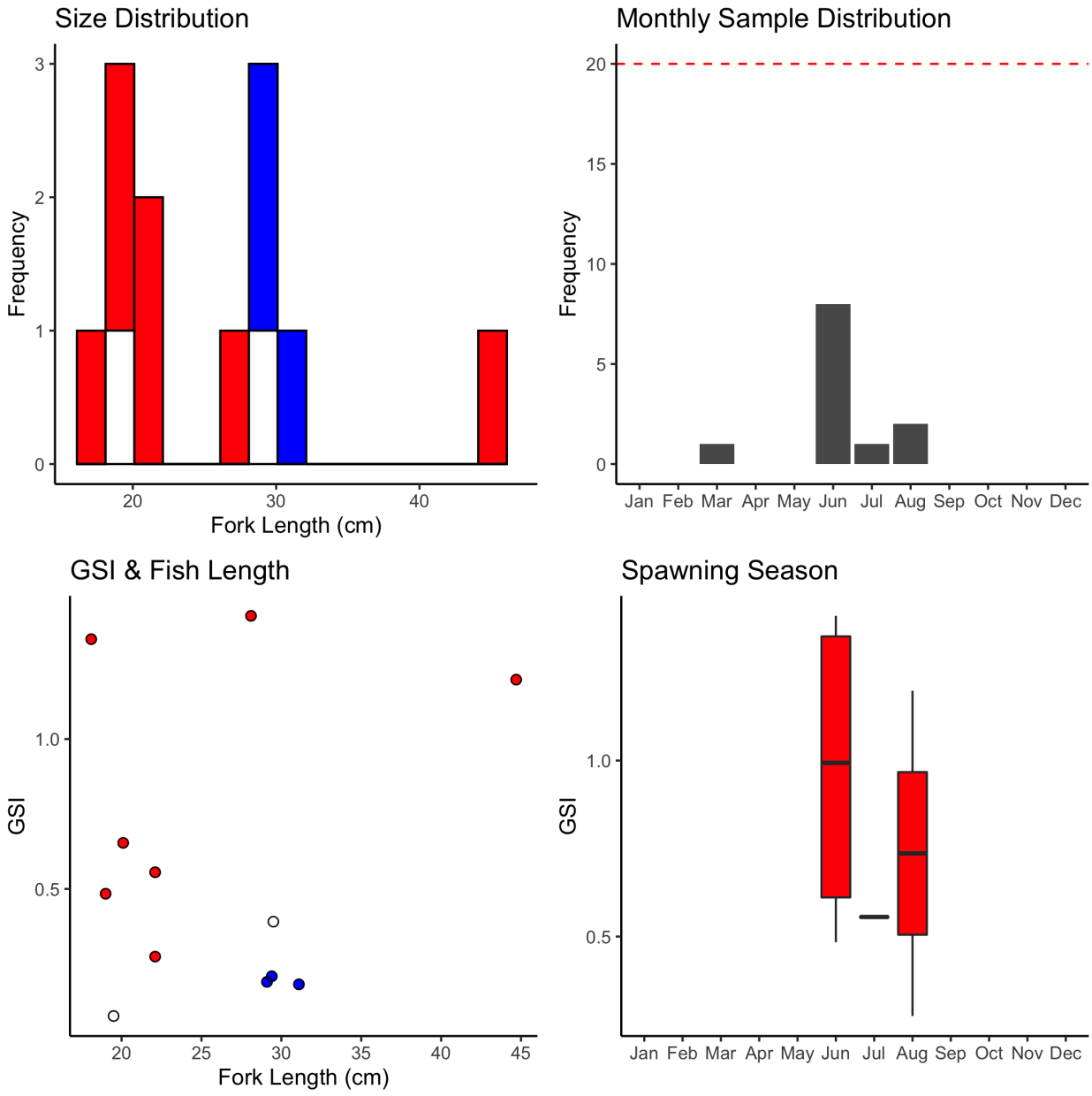

Figure A- 6. *L rubrioperculatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lutjanus kasmira

A total of 37 *Lutjanus kasmira* samples (females=1, males=11, unknown/na=25) have been collected to date (2022-12-02). Median fork length is 18.8 cm (min=14.9 cm, max=23.7 cm).

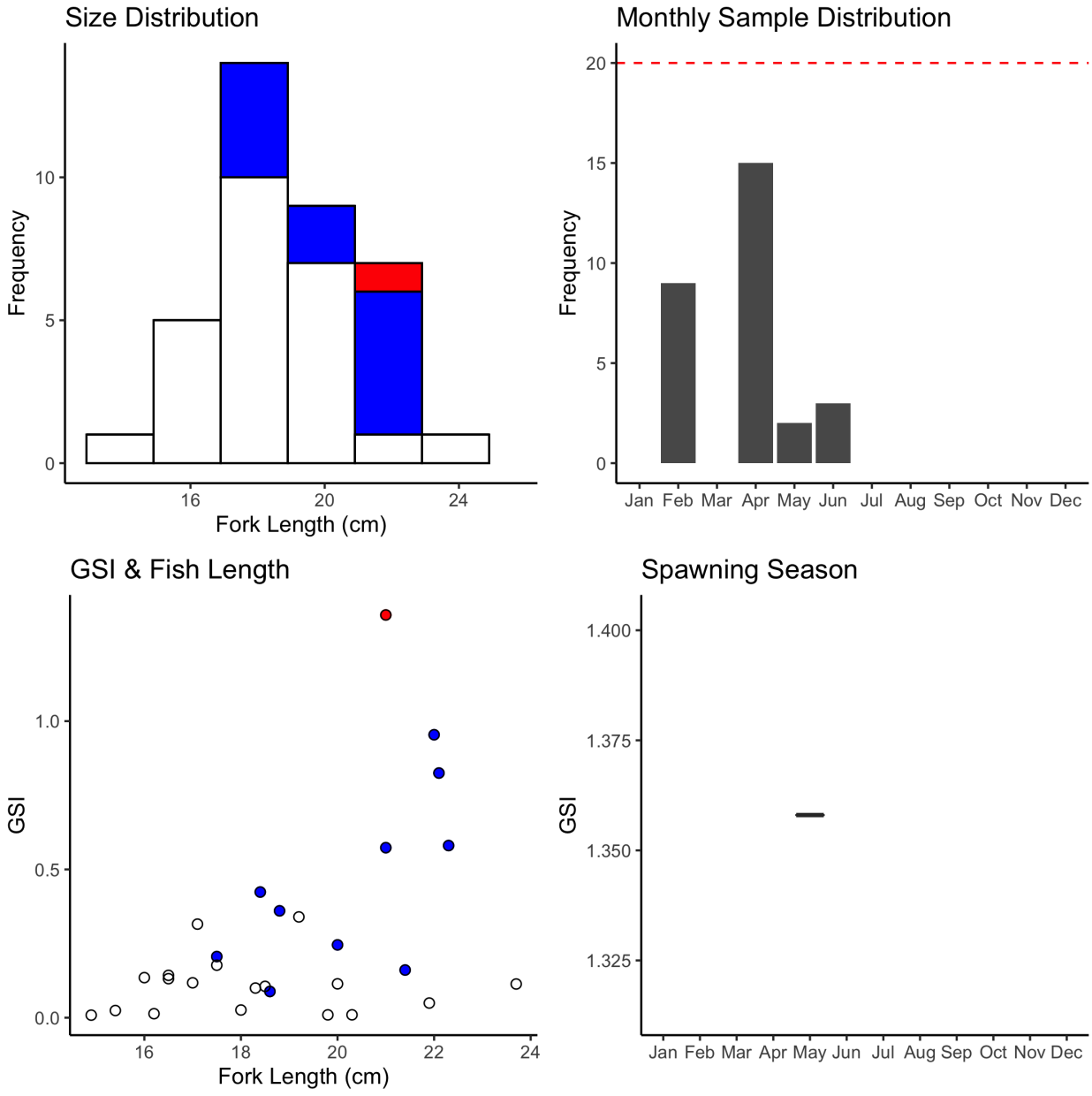

Figure A-7. *L. kasmira* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides auricilla

A total of 272 *Pristipomoides auricilla* samples (females=96, males=66, unknown/na=110) have been collected to date (2022-12-02). Median fork length is 25.7 cm (min=16.2 cm, max=34.8 cm).

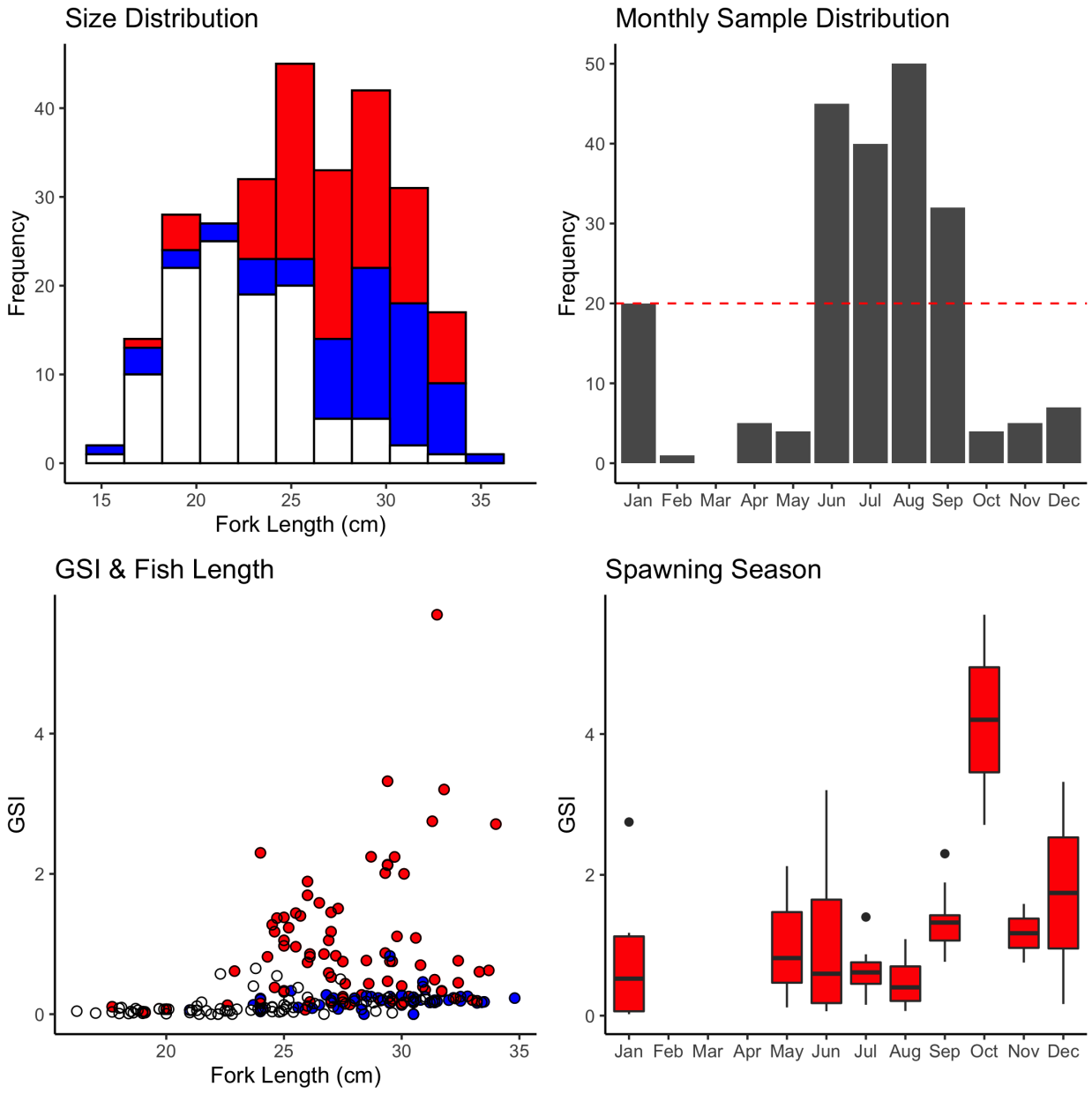

Figure A-8. *P. auricilla* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides filamentosus

A total of 90 *Pristipomoides filamentosus* samples (females=34, males=21, unknown/na=35) have been collected to date (2022-12-02). Median fork length is 33.05 cm (min=22.6 cm, max=65.5 cm).

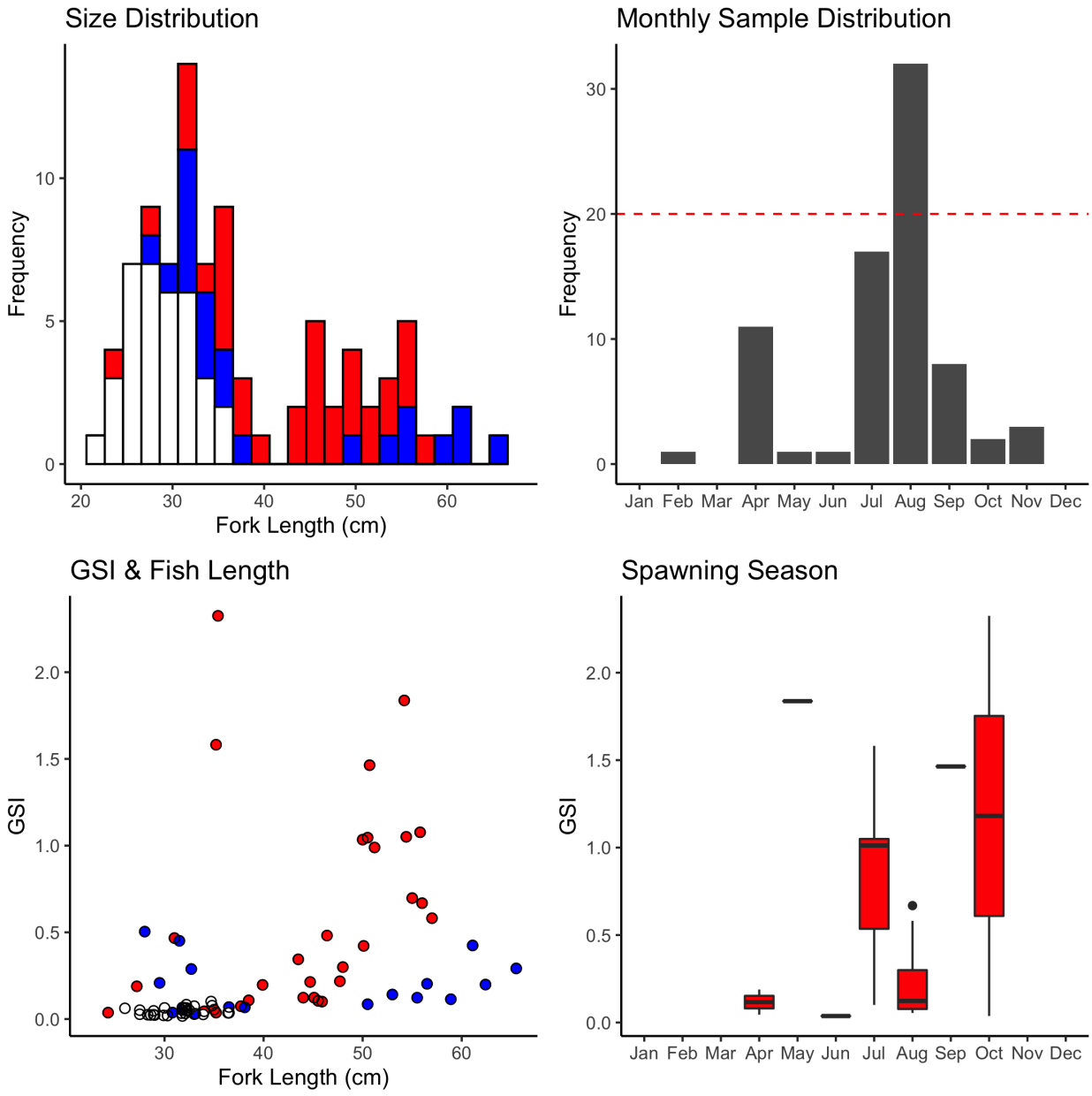

Figure A-9. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides flavipinnis

A total of 71 *Pristipomoides flavipinnis* samples (females=28, males=19, unknown/na=24) have been collected to date (2022-12-02). Median fork length is 33.3 cm (min=17 cm, max=62.5 cm).

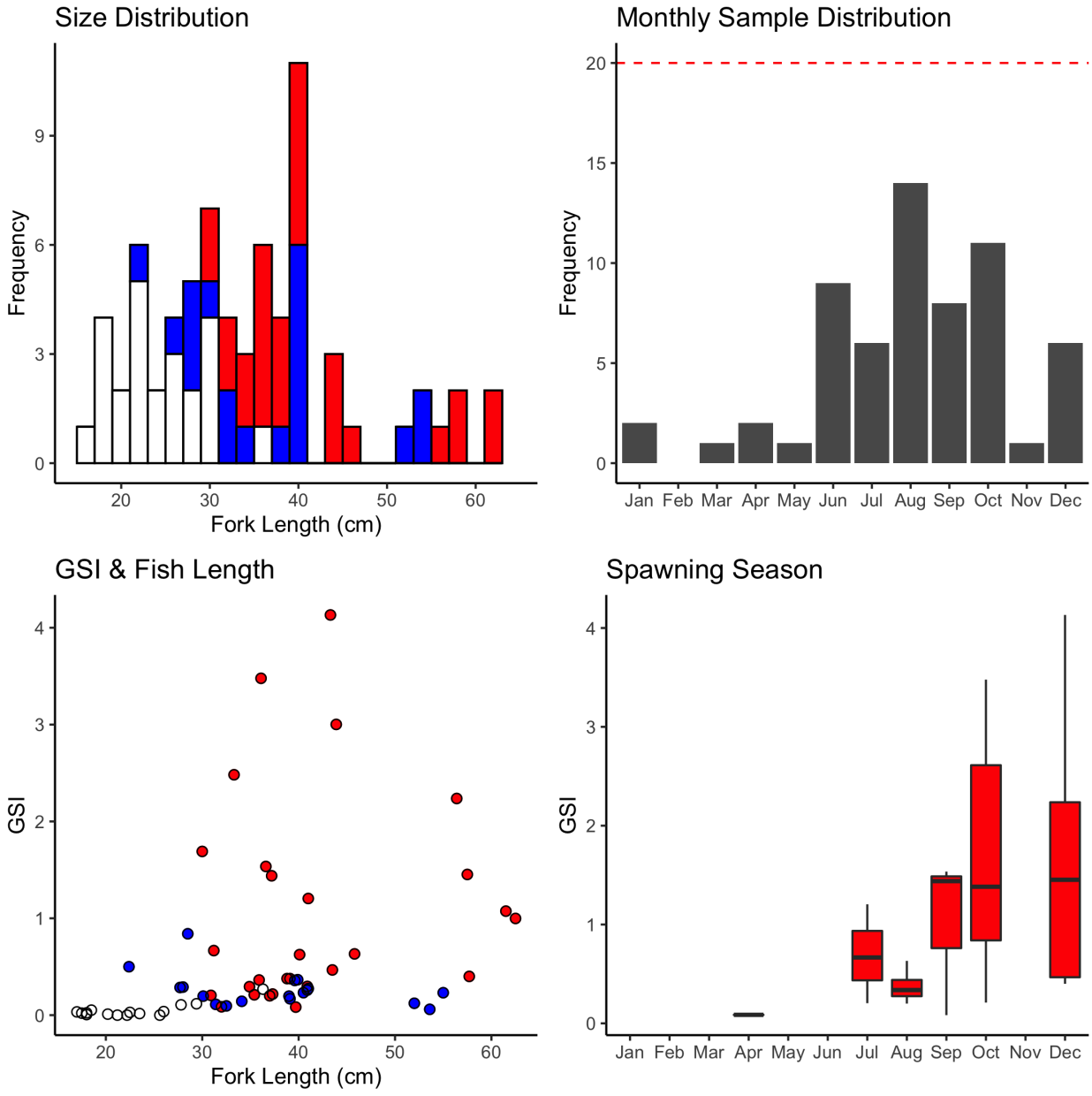

Figure A-10. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides sieboldii

A total of 29 *Pristipomoides sieboldii* samples (females=14, males=9, unknown/na=6) have been collected to date (2022-12-02). Median fork length is 33 cm (min=21.1 cm, max=59.8 cm).

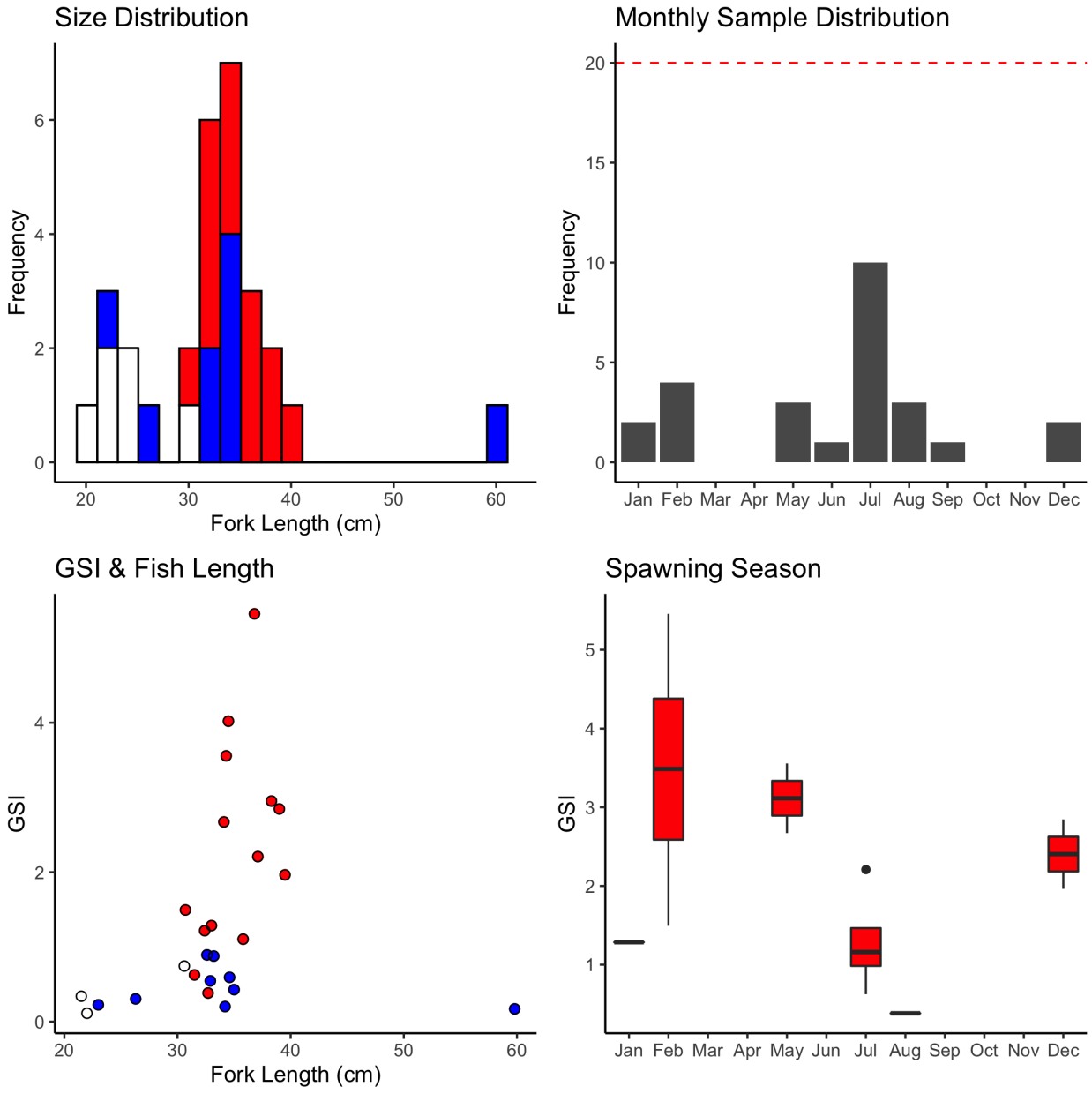

Figure A-11. *P. sieboldii* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides zonatus

A total of 382 *Pristipomoides zonatus* samples (females=169, males=24, unknown/na=189) have been collected to date (2022-12-02). Median fork length is 27 cm (min=11.4 cm, max=40.5 cm).

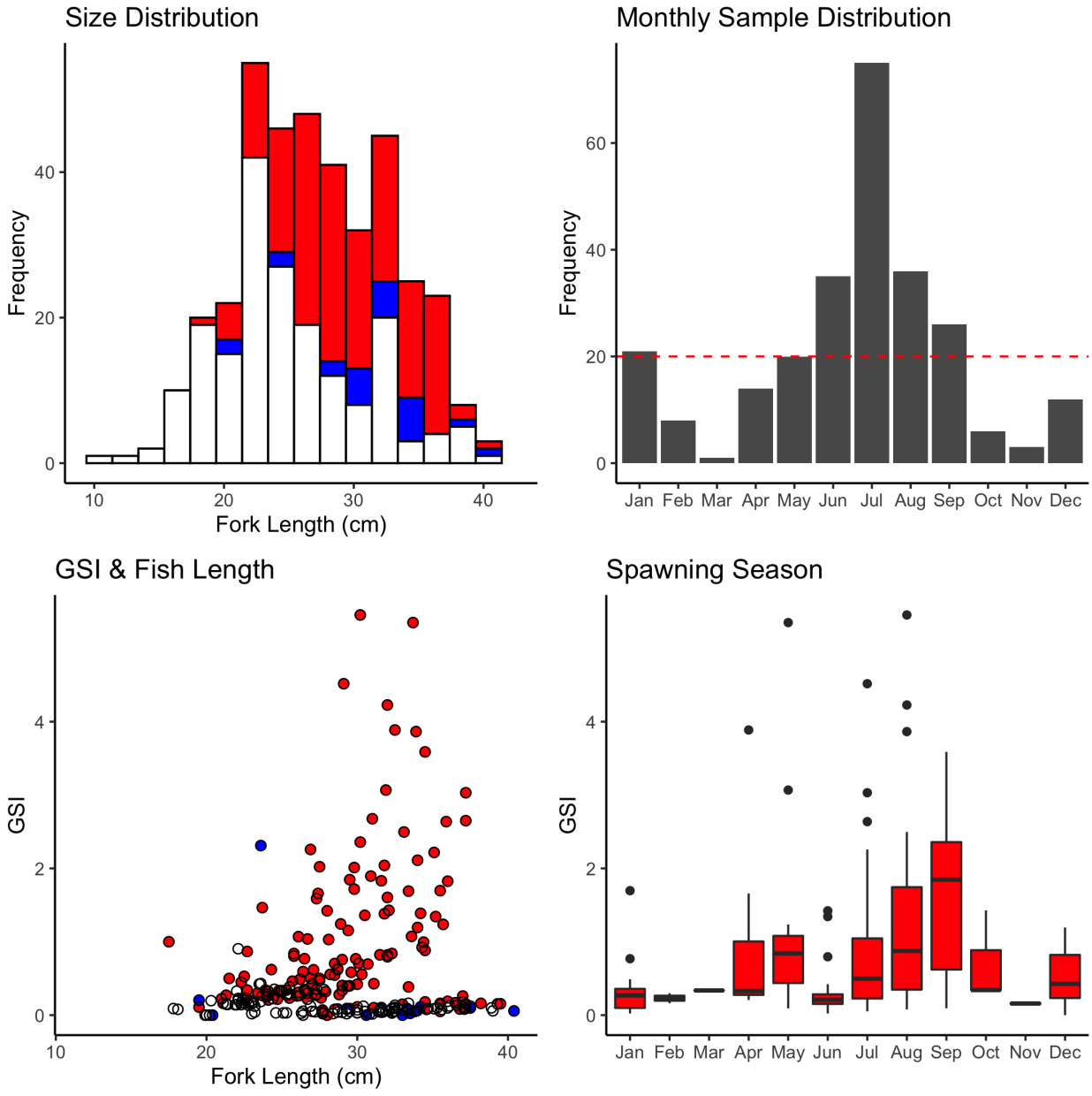

Figure A-12. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Variola louti

A total of 324 *Variola louti* samples (females=156, males=63, unknown/na=105) have been collected to date (2022-12-02). Median fork length is 33.7 cm (min=19.4 cm, max=49.7 cm).

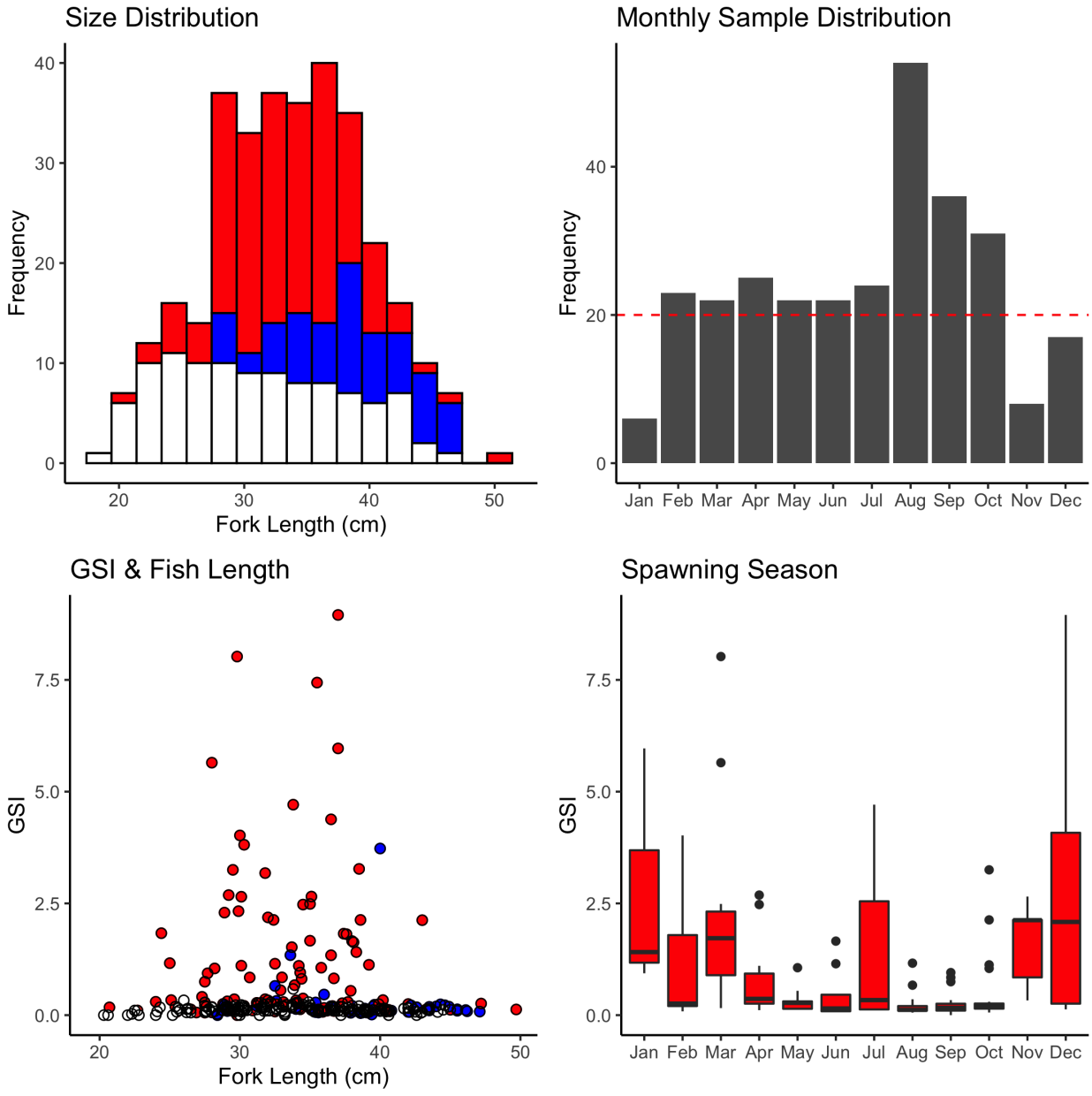

Figure A-13. *V. louti* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Non-BMUS

Caranx melampygus

A total of 133 *Caranx melampygus* samples (females=55, males=43, unknown/na=35) have been collected to date (2022-12-02). Median fork length is 34.4 cm (min=9.5 cm, max=66.5 cm).

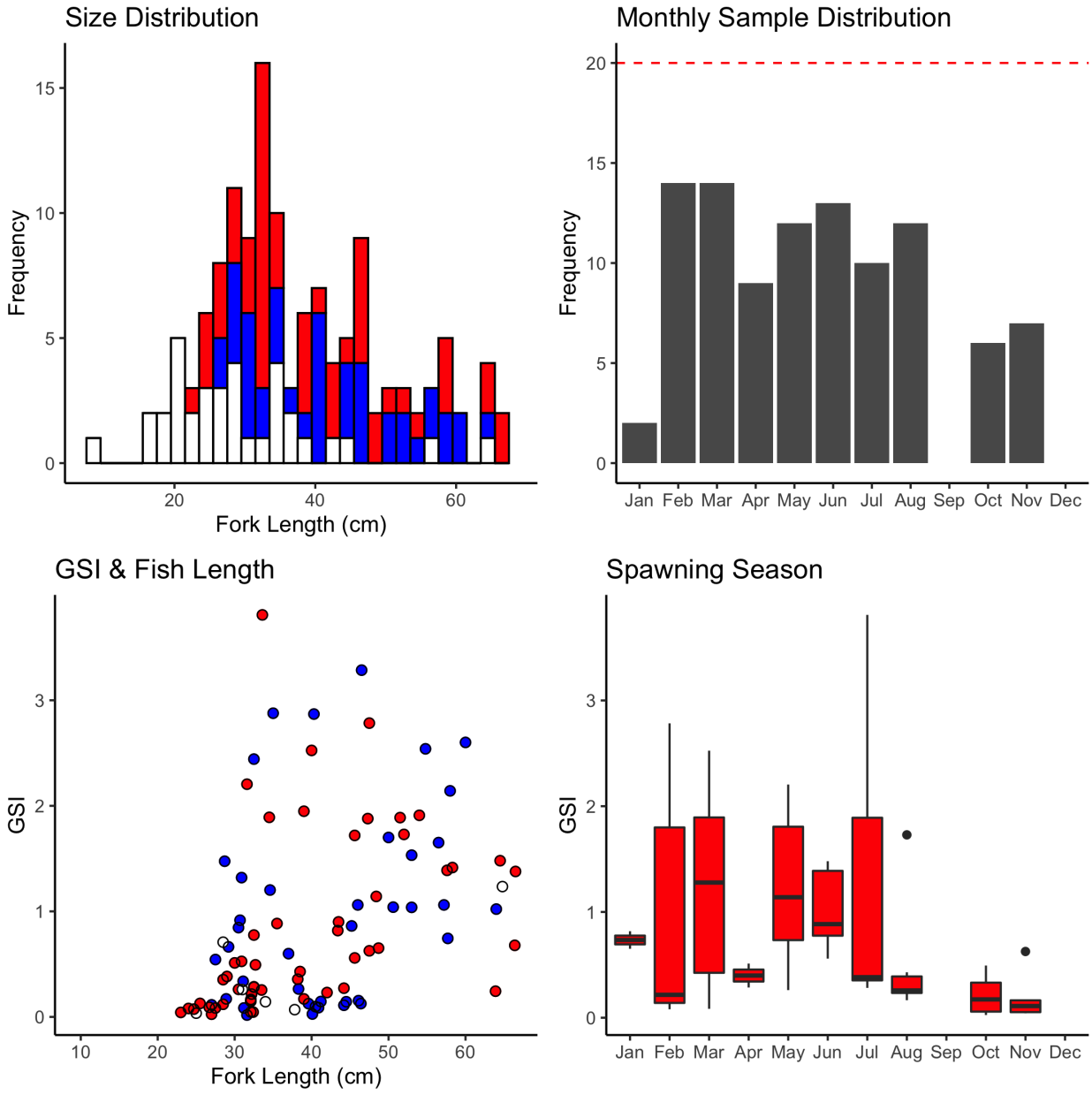

Figure A-14. *C. melampygus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cheilinus undulatus

A total of 127 *Cheilinus undulatus* samples (females=78, males=6, unknown/na=43) have been collected to date (2022-12-02). Median fork length is 67.6 cm (min=9.8 cm, max=135 cm).

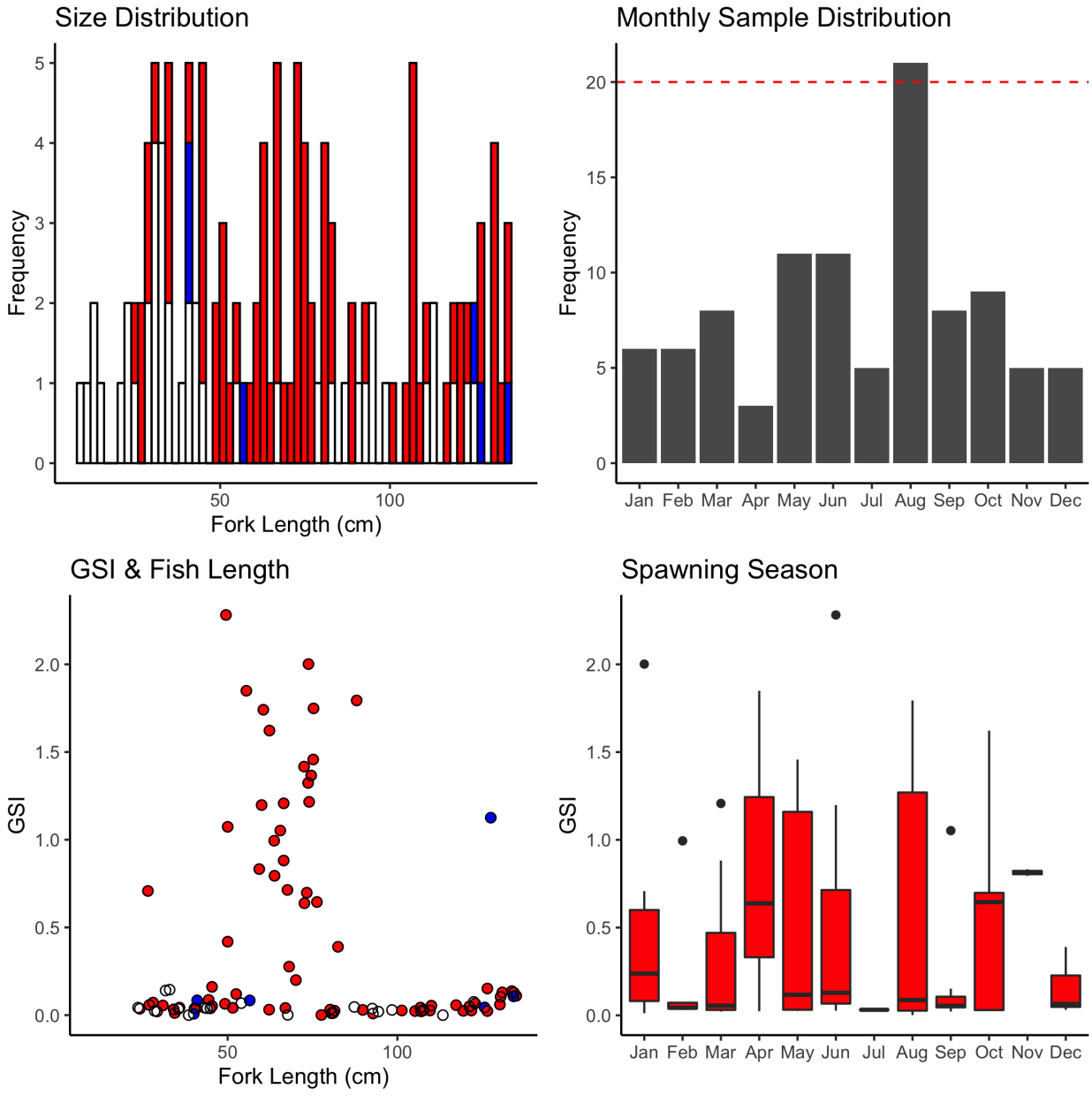

Figure A-15. *C undulatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Epinephelus fasciatus

A total of 60 *Epinephelus fasciatus* samples (females=24, males=4, unknown/na=32) have been collected to date (2022-12-02). Median fork length is 21.3 cm (min=14.1 cm, max=30.6 cm).

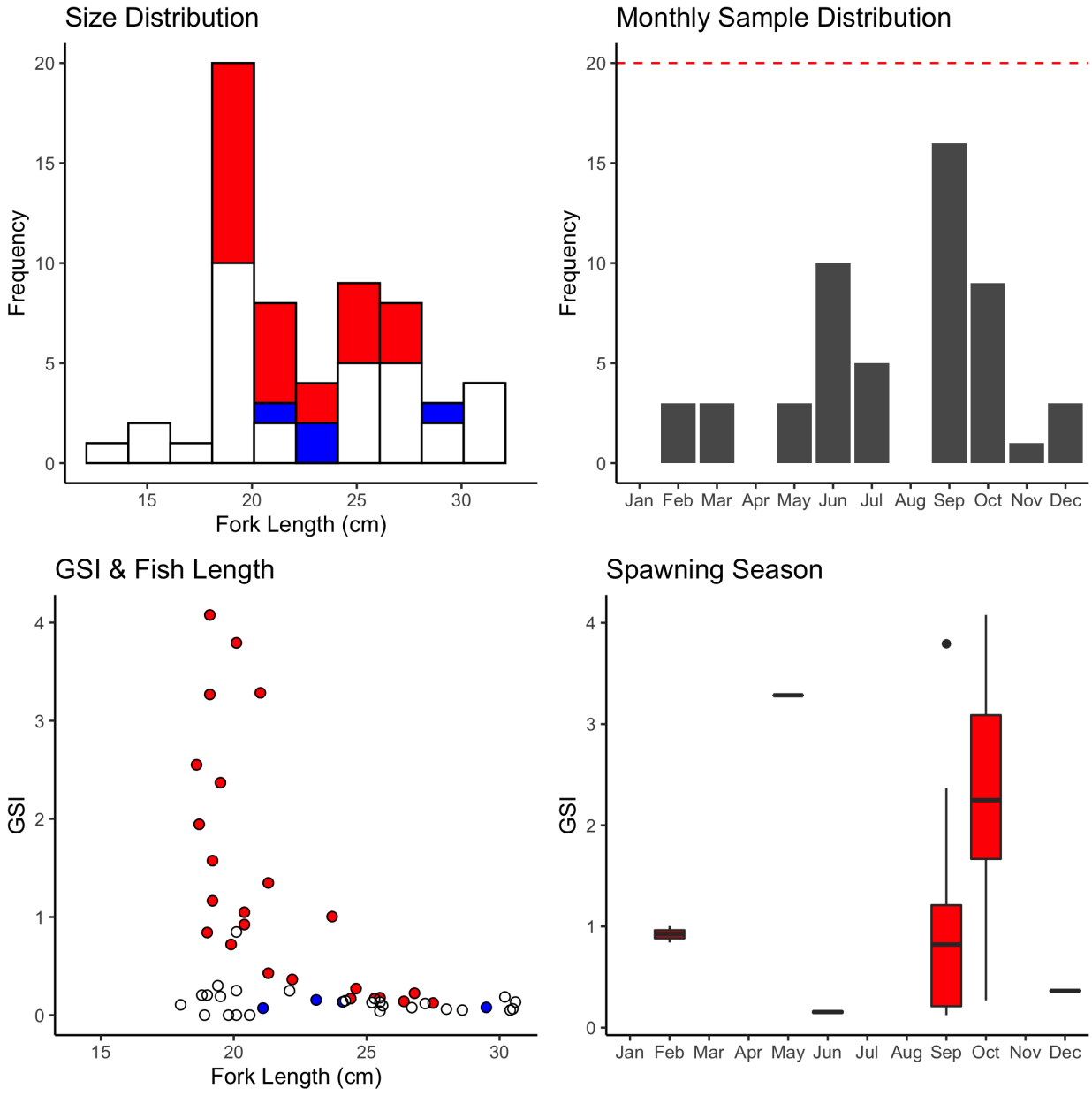

Figure A-16. *E. fasciatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus obsoletus

A total of 57 *Lethrinus obsoletus* samples (females=14, males=35, unknown/na=8) have been collected to date (2022-12-02). Median fork length is 22.2 cm (min=16 cm, max=32.2 cm).

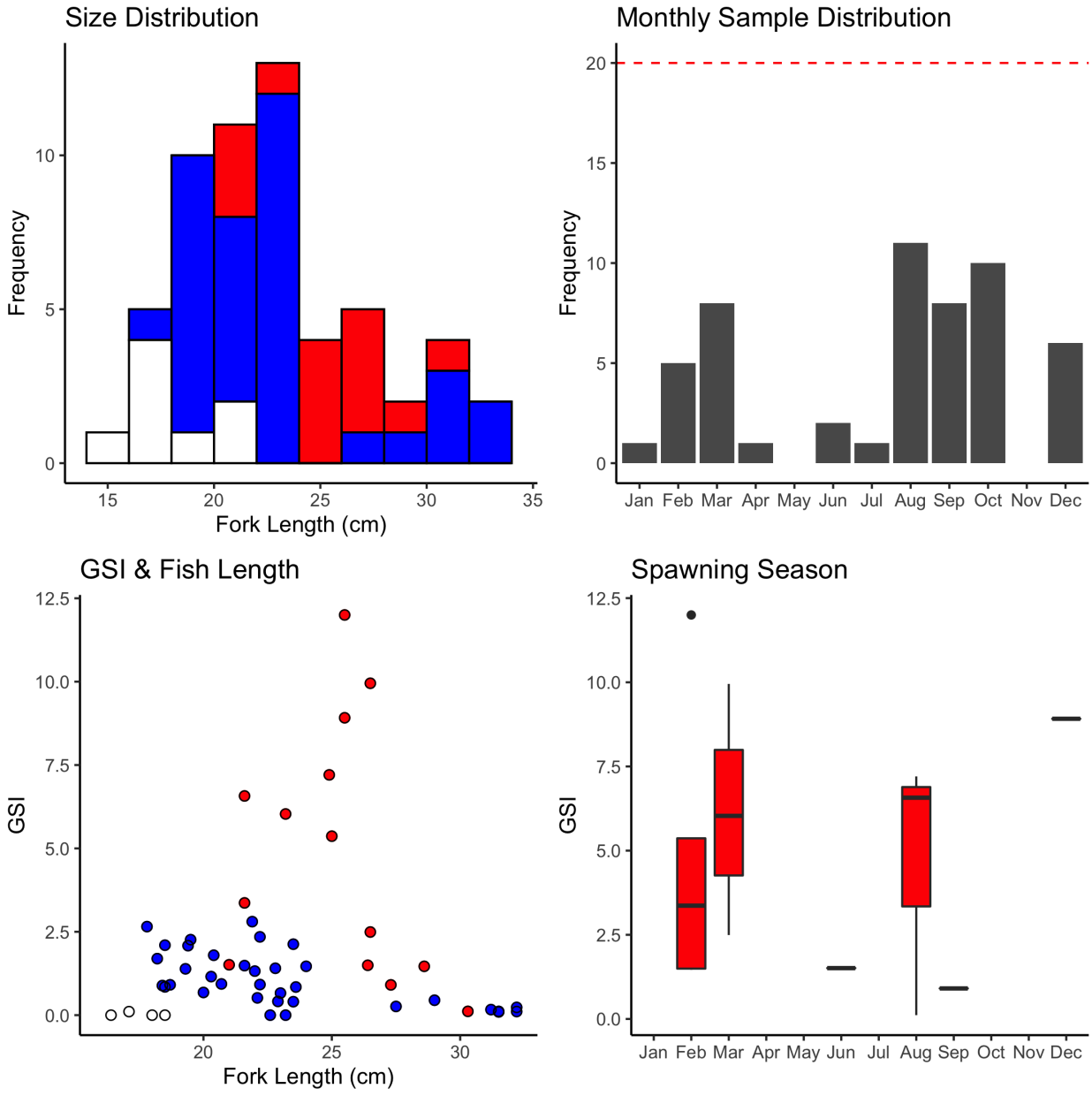

Figure A-17. *L. obsoletus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Monotaxis grandoculis

A total of 422 *Monotaxis grandoculis* samples (females=133, males=82, unknown/na=207) have been collected to date (2022-12-02). Median fork length is 26.8 cm (min=8.7 cm, max=48.6 cm).

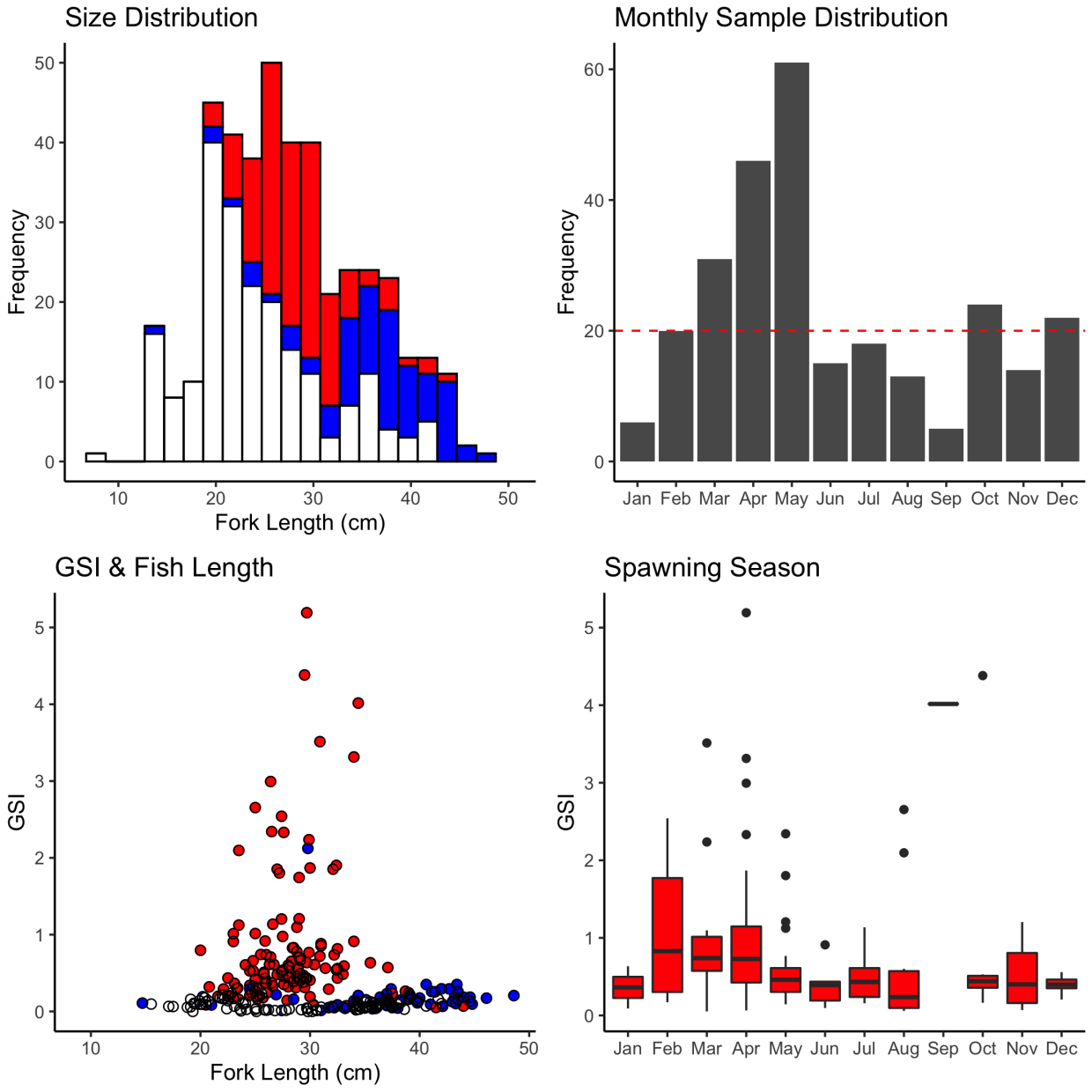

Figure A-18. *M. grandoculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Siganus punctatus

A total of 88 *Siganus punctatus* samples (females=26, males=13, unknown/na=49) have been collected to date (2022-12-02). Median fork length is 22.45 cm (min=15.8 cm, max=30.1 cm).

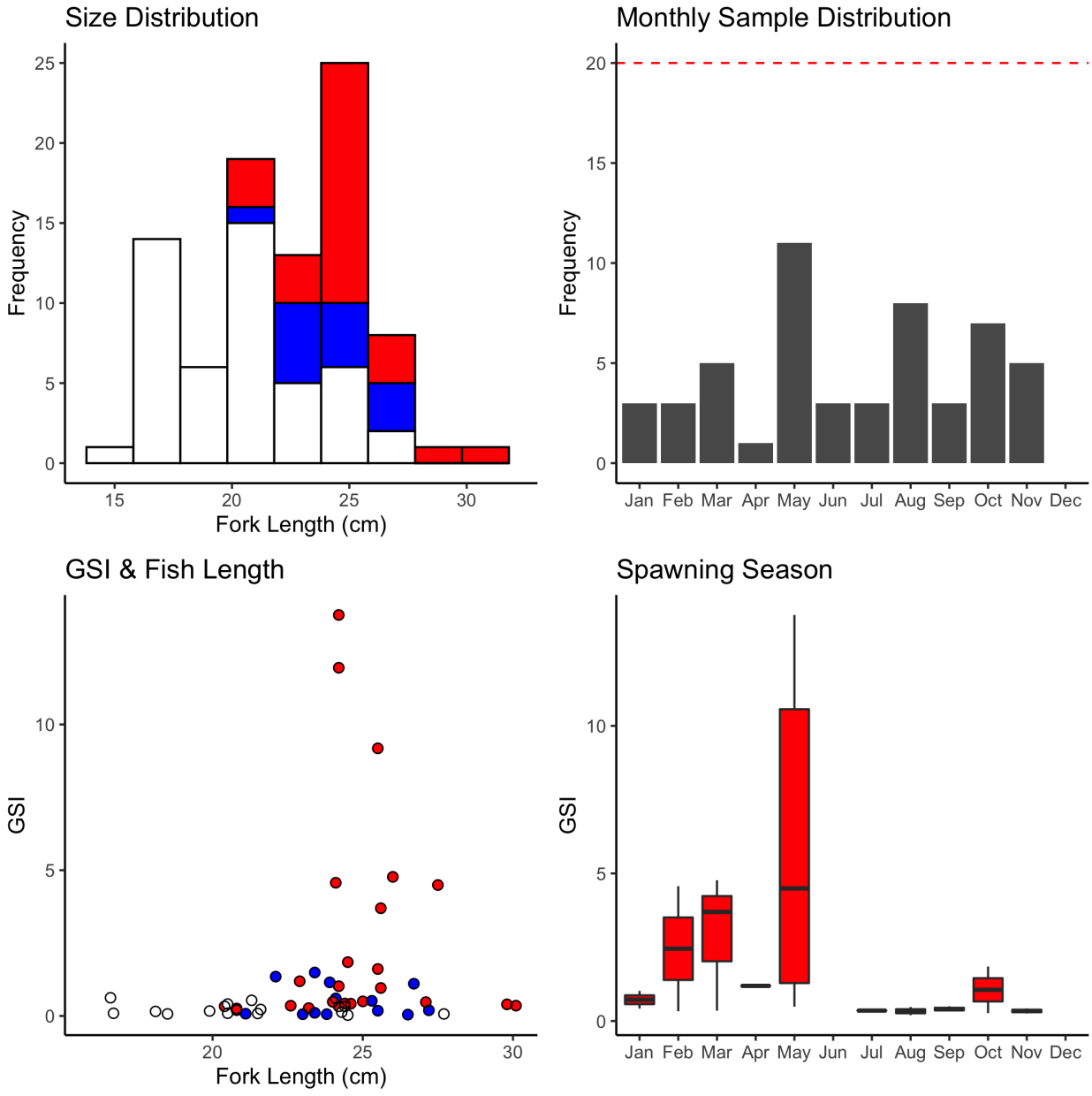

Figure A-19. *S. punctatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Appendix B: CNMI Species Summaries

CNMI Fished Species

Updated April 2022 (current through December 2021)

The following species were sampled through the Territory Commercial Fisheries Biosampling Program and NOAA life history surveys and are reviewed in this appendix for completeness of sampling to assess regional life history parameters for age, growth, and reproduction.

Bottomfish Management Unit Species (MUS):
Aphareus rutilans
Caranx ignobilis
Caranx lugubris
Etelis carbunculus
Etelis coruscans
Lethrinus rubrioperculatus
Lutjanus kasmira
Pristipomoides auricilla
Pristipomoides filamentosus
Pristipomoides flavipinnis
Pristipomoides sieboldii
Pristipomoides zonatus
Variola louti

Non-BMUS:
Acanthurus lineatus
Acanthurus nigricauda
Acanthurus triostegus
Calotomus carolinus
Caranx melampygus
Cephalopholis argus
Cheilinus trilobatus
Cheilinus undulatus
Chlorurus sordidus
Kyphosus cinerascens
Monotaxis grandoculis
Mulloidichthus vanicolensis
Naso lituratus
Naso unicornis
Sargocentron spiniferum
Sargocentron tiere
Scarus ghobban
Scarus ruboviolaceus
Siganus punctatus
Siganus spinus
Zanclus cornutus

This species summary is a guide to inform future sampling collection efforts and life history assessments. Species with completed life history assessments for the territory are excluded unless continued sample collection is recommended for additional research to meet fisheries science and management needs. All BMUS and non-BMUS with a sample size greater or equal to 50 are included in this appendix. Sample sizes should be considered as approximate as there is not always an otolith and gonad for every entry in the database due to otoliths breaking or gonads not being collected.

Data for each species are reviewed across four categories: fish size distribution, monthly sample distribution, relationship between gonadosomatic index (GSI) and fish length, and mean female GSI by month. Each of these categories allows for a review of the sample collection progress to meet the needs of the life history assessments for age, growth, spawning season, and size/age at maturity.

Size distribution: The length frequency distribution is a proxy for looking at the sampling coverage to estimate age and growth. It also allows for a first look at the size distribution of females and males. This is a proxy, and histological assessment is recommended to confirm gender and to identify unknowns.

Monthly sample distribution: The total number of samples per month are plotted. A sample size of 20 individuals per month is recommended (red dashed line).

GSI and fish length: Gonadosomatic index (gonad weight/fish weight *100) is plotted against fish size to visualize the sample distribution as a proxy for size at maturity.

Spawning season: Female Gonadosomatic Index (GSI) is plotted by month to visualize if sampling is adequate to determine spawning seasonality.

Bottomfish Management Unit Species

Aphareus rutilans

A total of 38 *Aphareus rutilans* samples (females=23, males=15, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 73.3 cm (min=25.5 cm, max=99.2 cm).

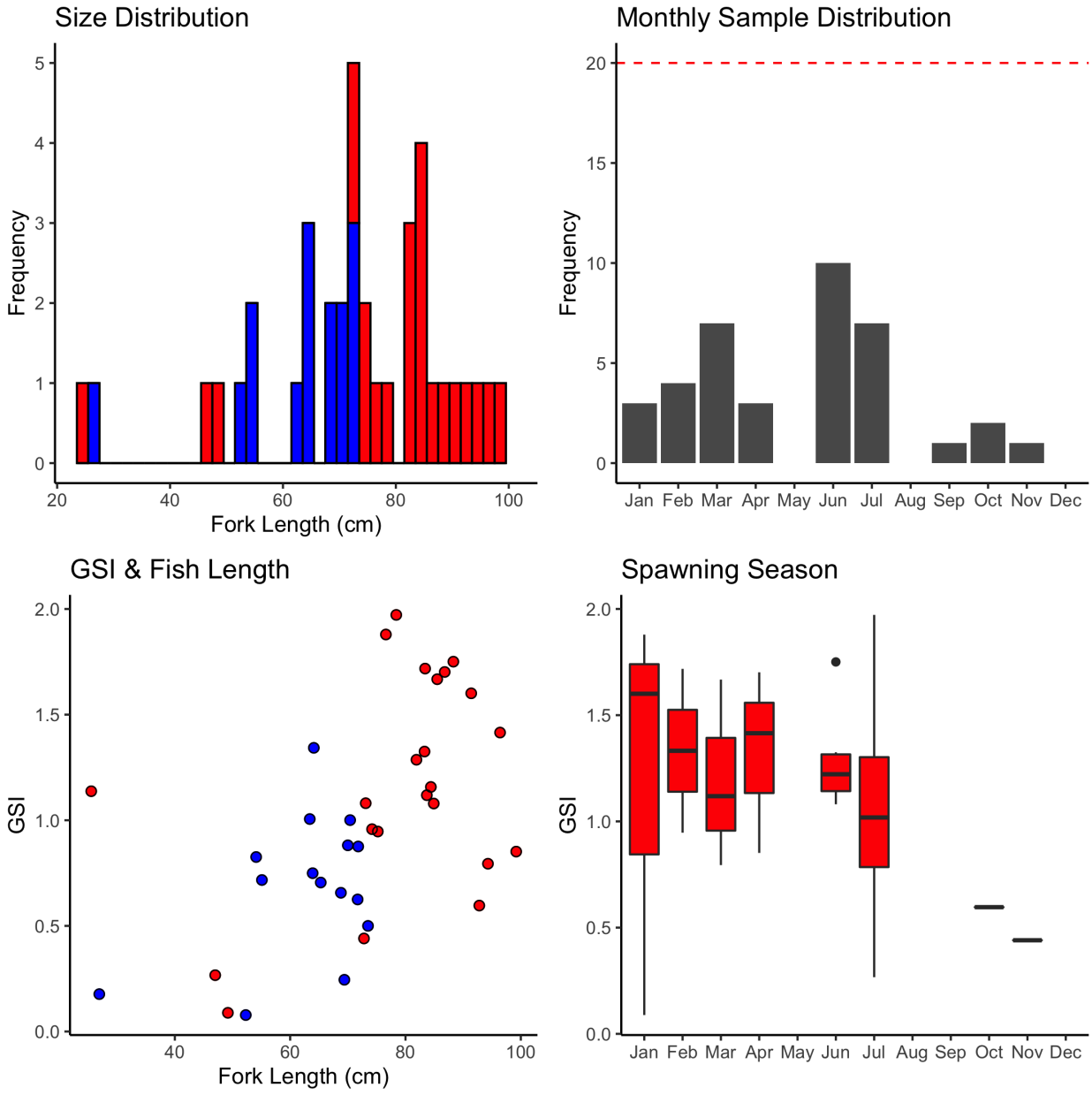

Figure B-1. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx ignobilis

A total of 1 *Caranx ignobilis* samples (females=1, males=NA, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 94.6 cm (min=94.6 cm, max=94.6 cm).

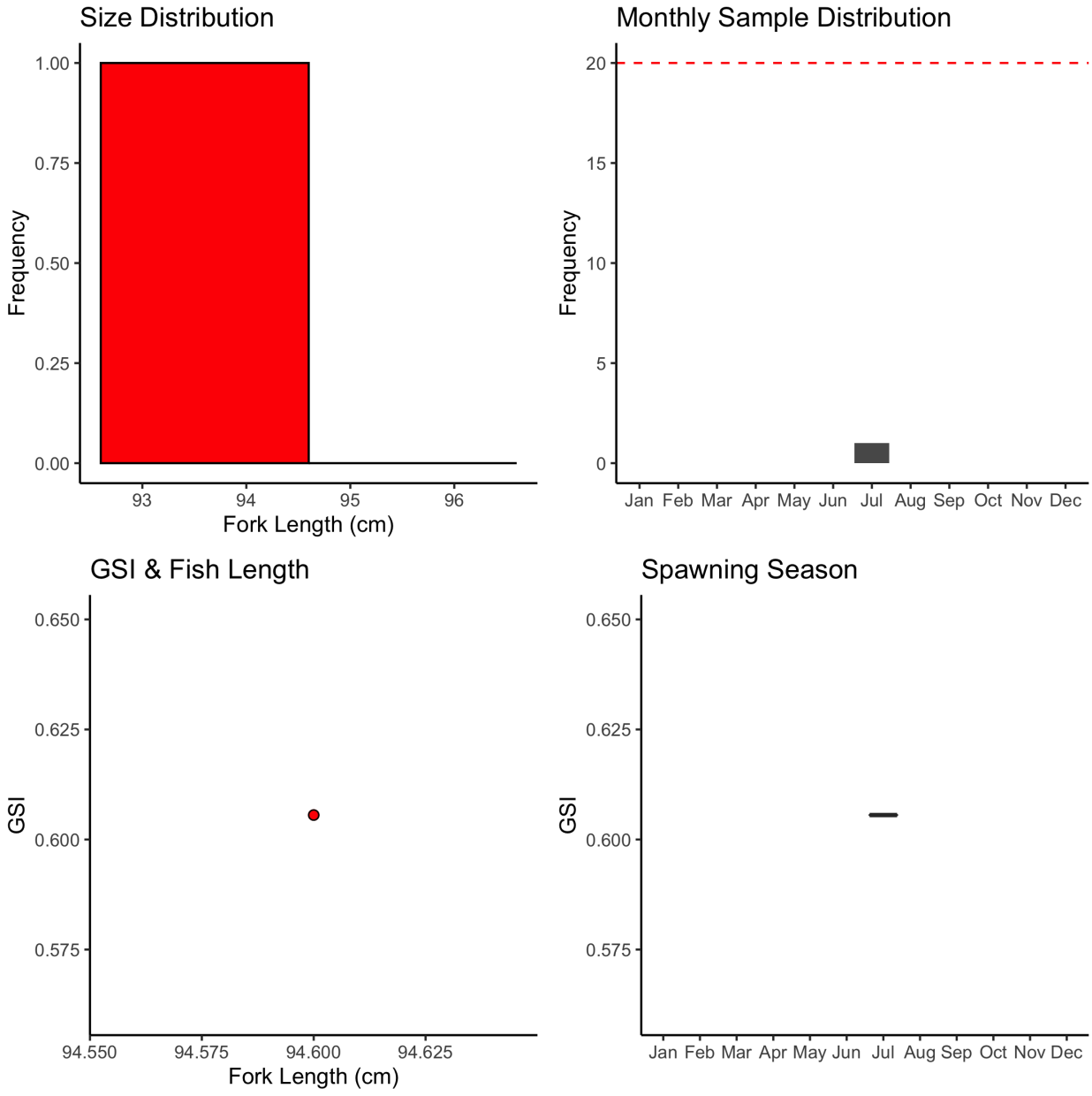

Figure B-2. *C. ignobilis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx lugubris

A total of 33 *Caranx lugubris* samples (females=18, males=13, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 41.1 cm (min=30.3 cm, max=68.1 cm).

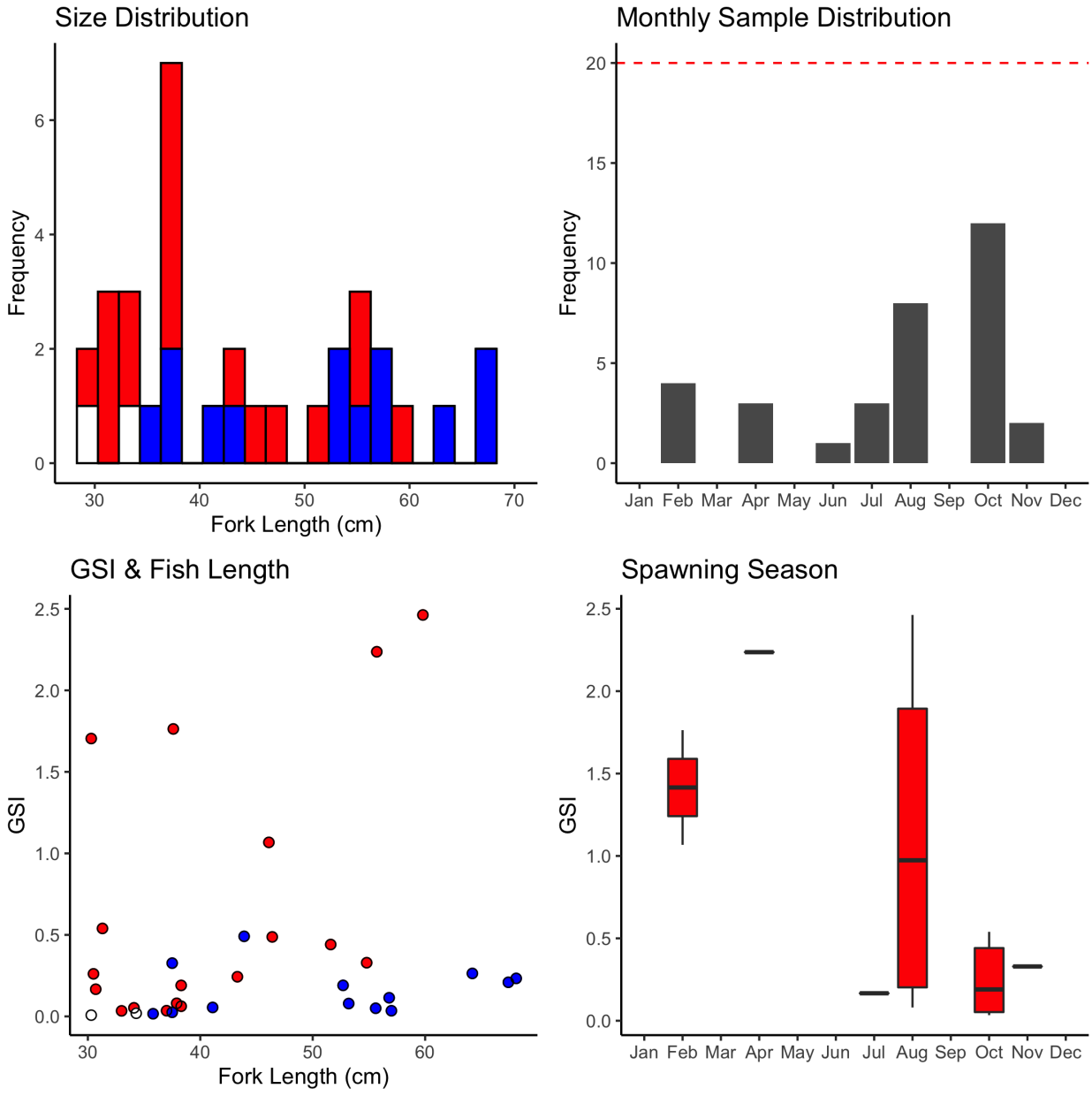

Figure B-3. *C lugubris* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis carbunculus

A total of 506 *Etelis carbunculus* samples (females=335, males=168, unknown/na=3) have been collected to date (2022-12-02). Median fork length is 31.1 cm (min=15.7 cm, max=82.5 cm).

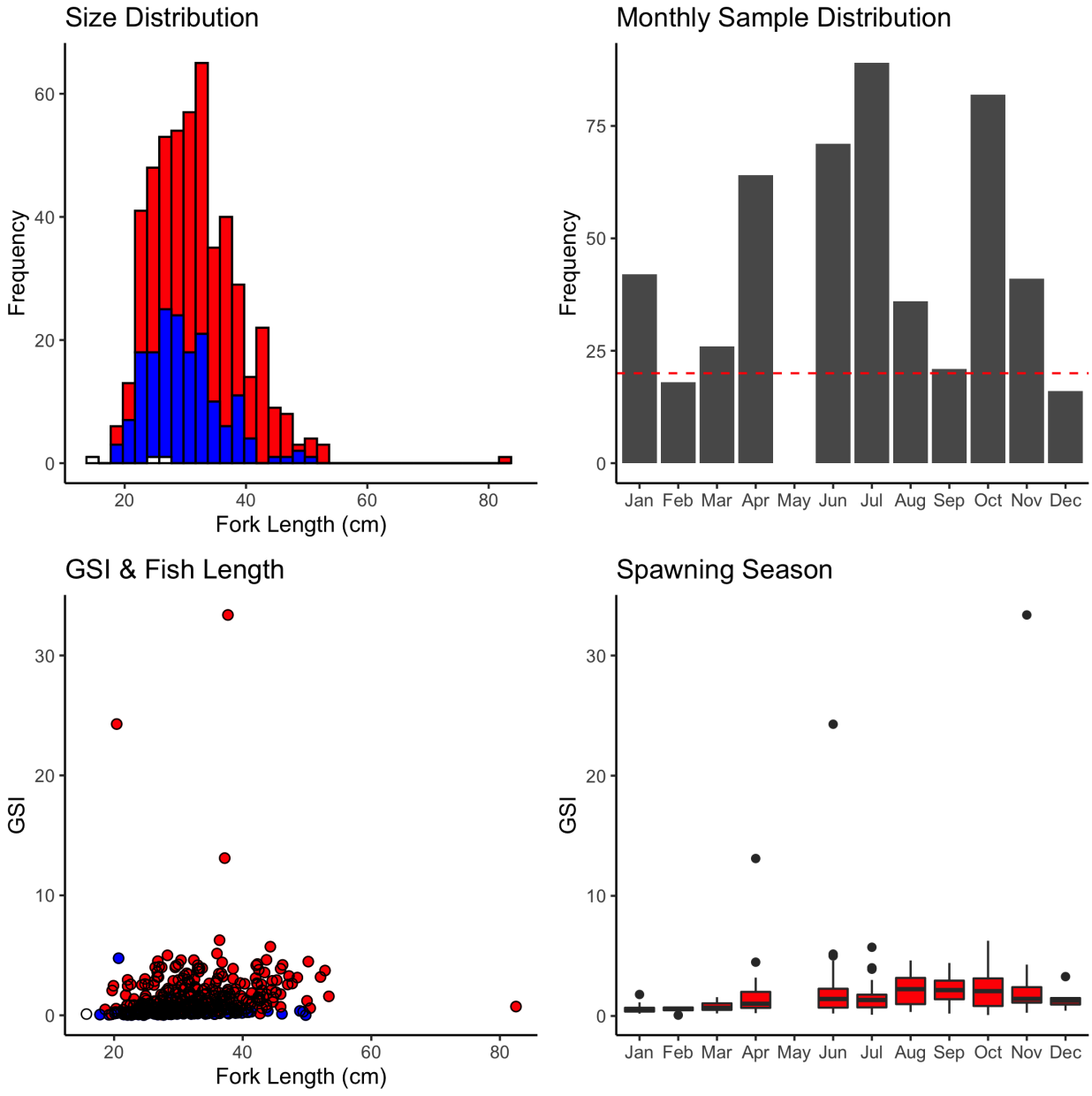

Figure B-4. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 222 *Etelis coruscans* samples (females=111, males=110, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 71.7 cm (min=24.8 cm, max=99.5 cm).

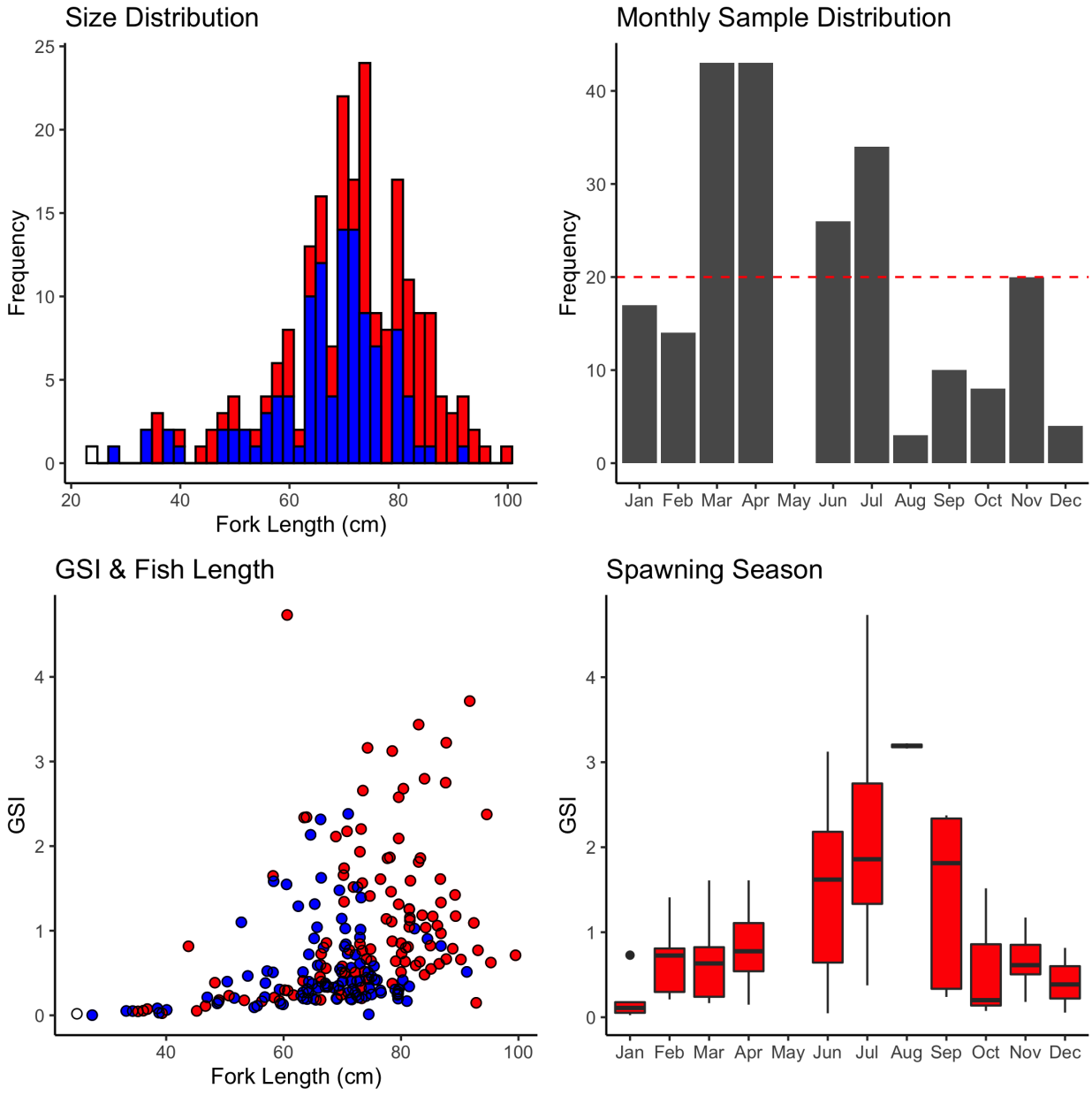

Figure B-5. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus rubrioperculatus

A total of 2 *Lethrinus rubrioperculatus* samples (females=1, males=1, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 27.55 cm (min=27.5 cm, max=27.6 cm).

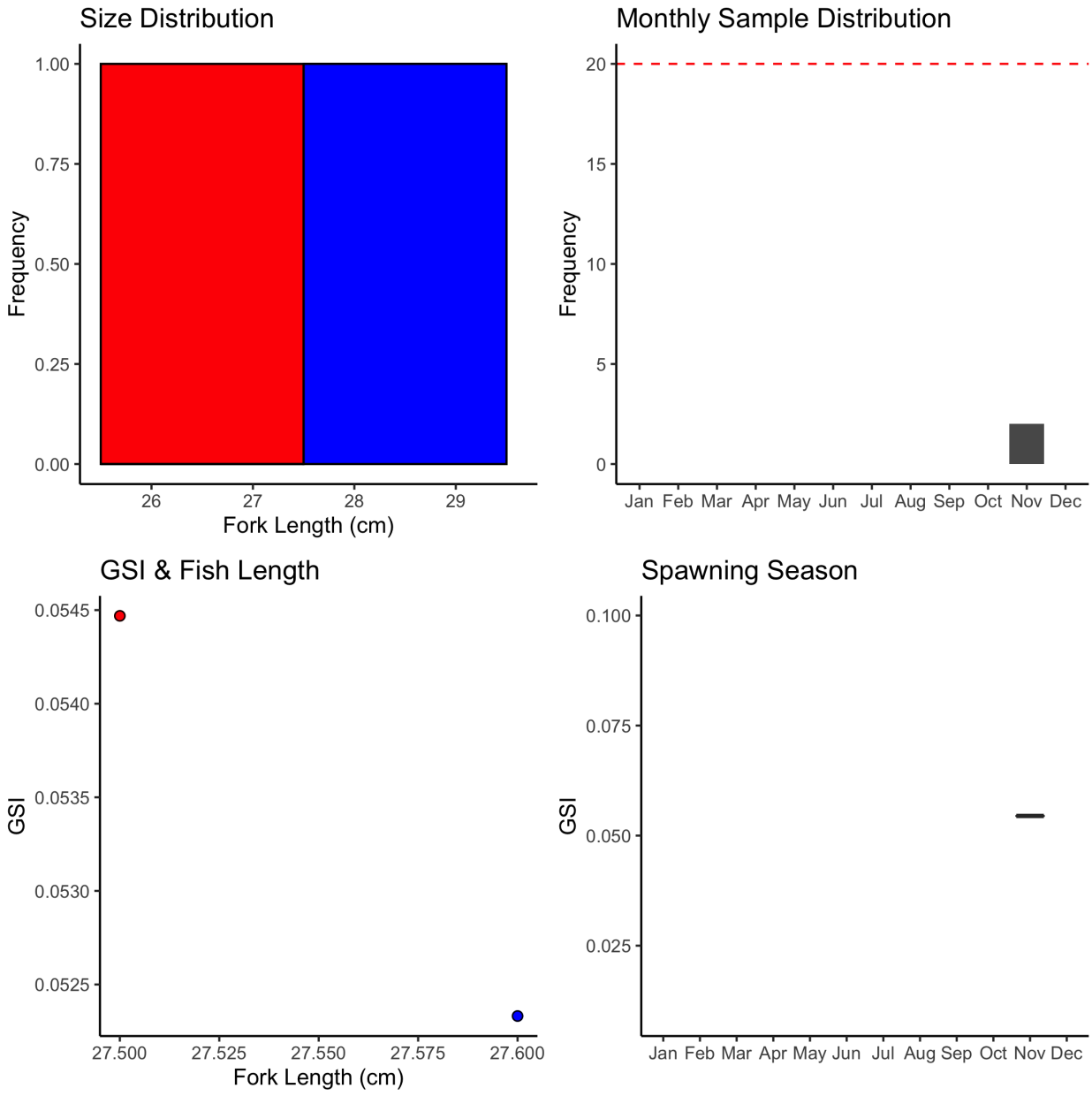

Figure B-6. *L rubrioperculatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lutjanus kasmira

A total of 32 *Lutjanus kasmira* samples (females=8, males=21, unknown/na=3) have been collected to date (2022-12-02). Median fork length is 23.45 cm (min=19.6 cm, max=29.7 cm).

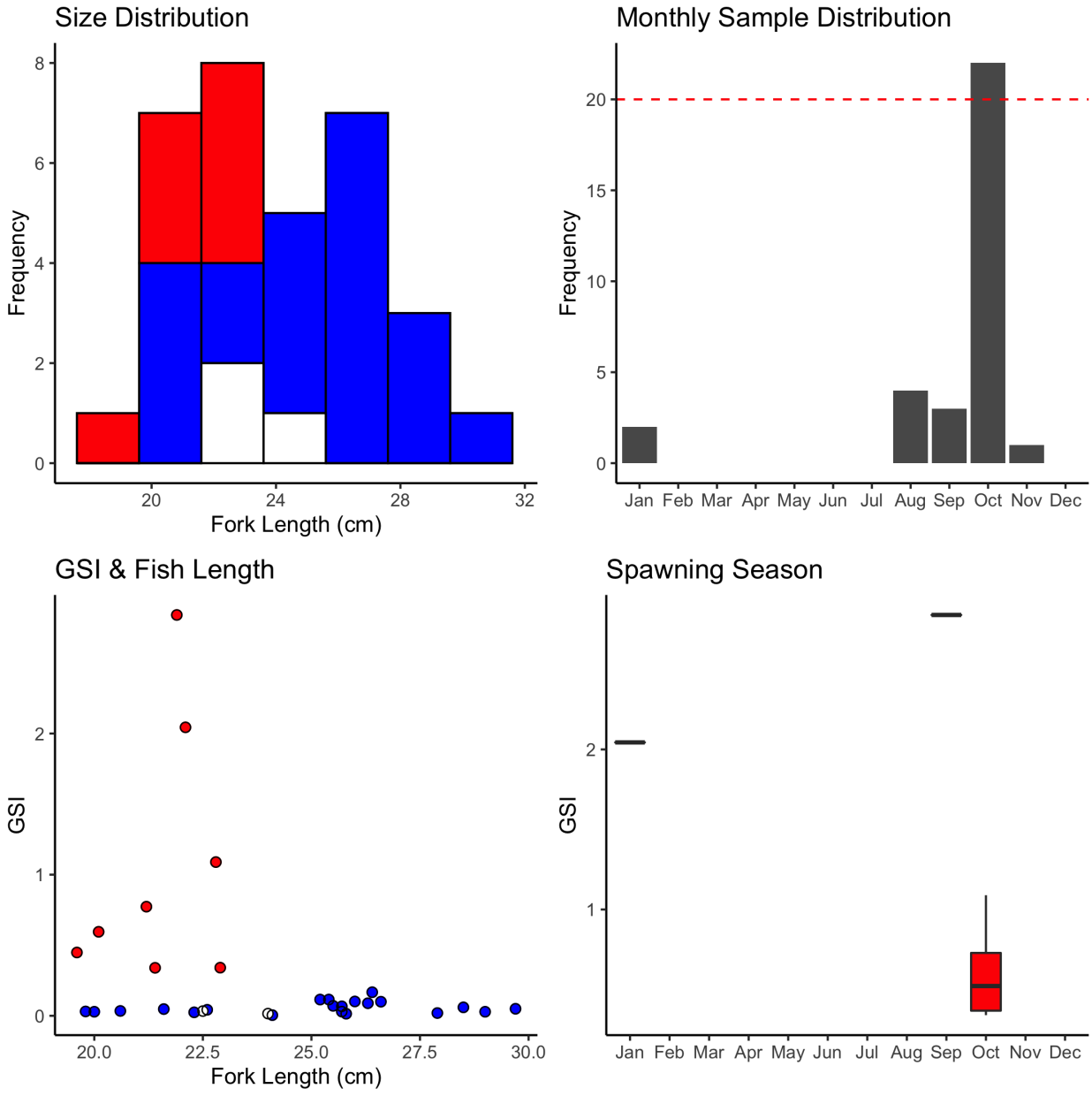

Figure B- 7. L kasmira sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides auricilla

A total of 196 *Pristipomoides auricilla* samples (females=88, males=103, unknown/na=5) have been collected to date (2022-12-02). Median fork length is 29 cm (min=23.3 cm, max=38.9 cm).

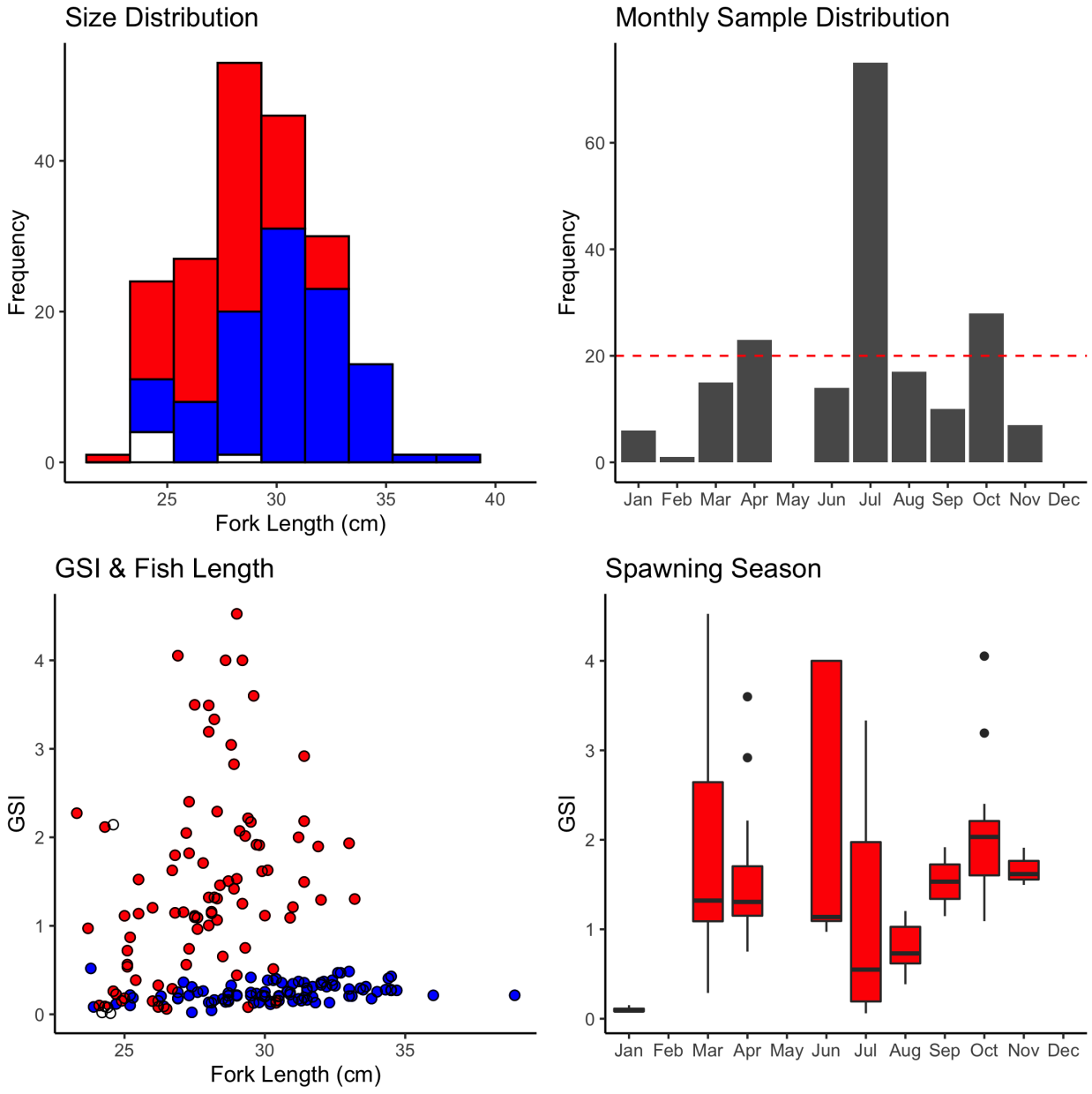

Figure B-8. *P. auricilla* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides filamentosus

A total of 20 *Pristipomoides filamentosus* samples (females=7, males=13, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 50.7 cm (min=31.7 cm, max=60 cm).

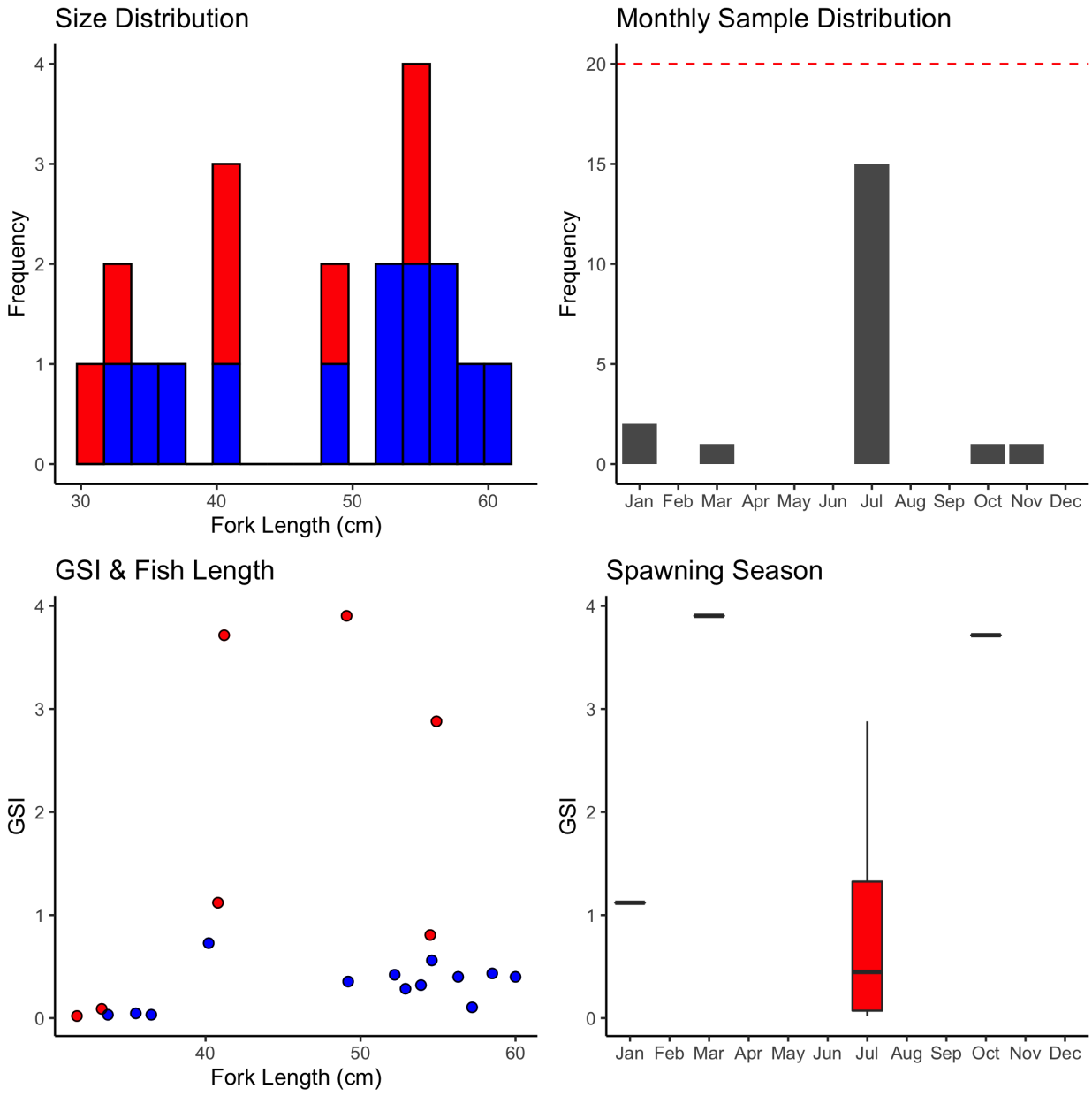

Figure B-9. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides flavipinnis

A total of 67 *Pristipomoides flavipinnis* samples (females=28, males=39, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 36.2 cm (min=26.8 cm, max=44.1 cm).

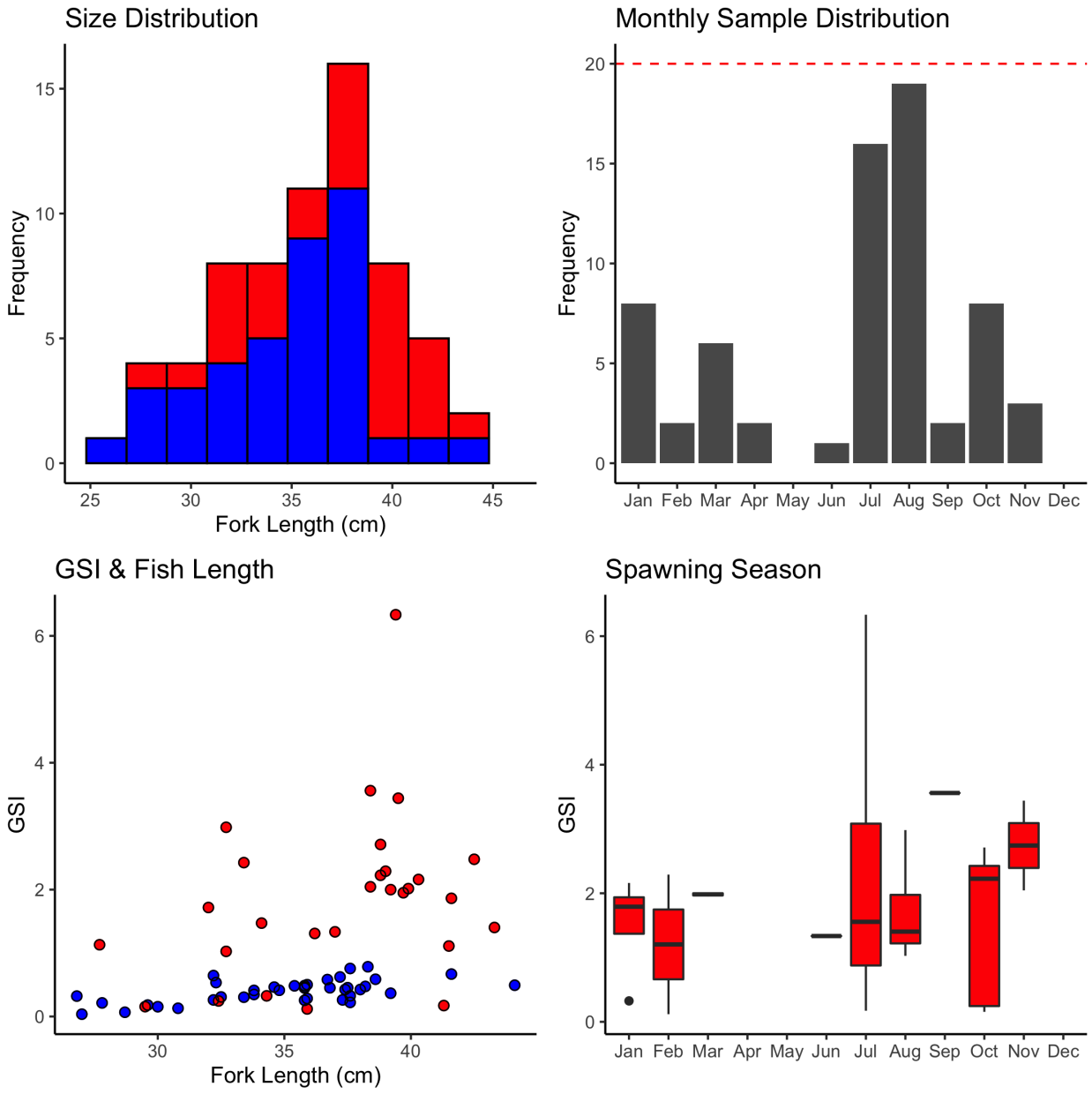

Figure B-10. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides sieboldii

A total of 67 *Pristipomoides sieboldii* samples (females=32, males=35, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 31.4 cm (min=21.5 cm, max=34.7 cm).

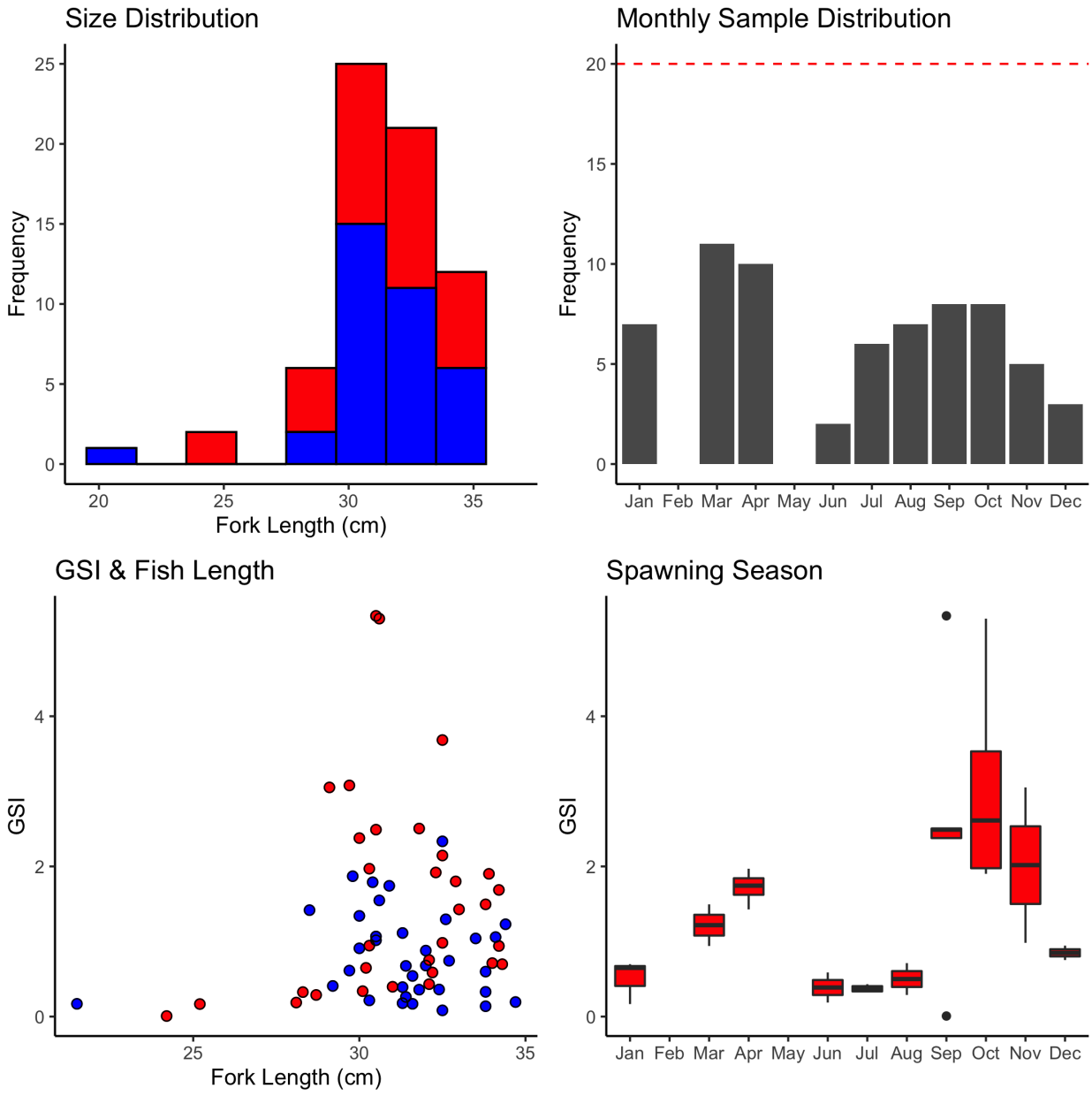

Figure B-11. *P. sieboldii* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides zonatus

A total of 336 *Pristipomoides zonatus* samples (females=207, males=100, unknown/na=29) have been collected to date (2022-12-02). Median fork length is 33.4 cm (min=17.5 cm, max=41.3 cm).

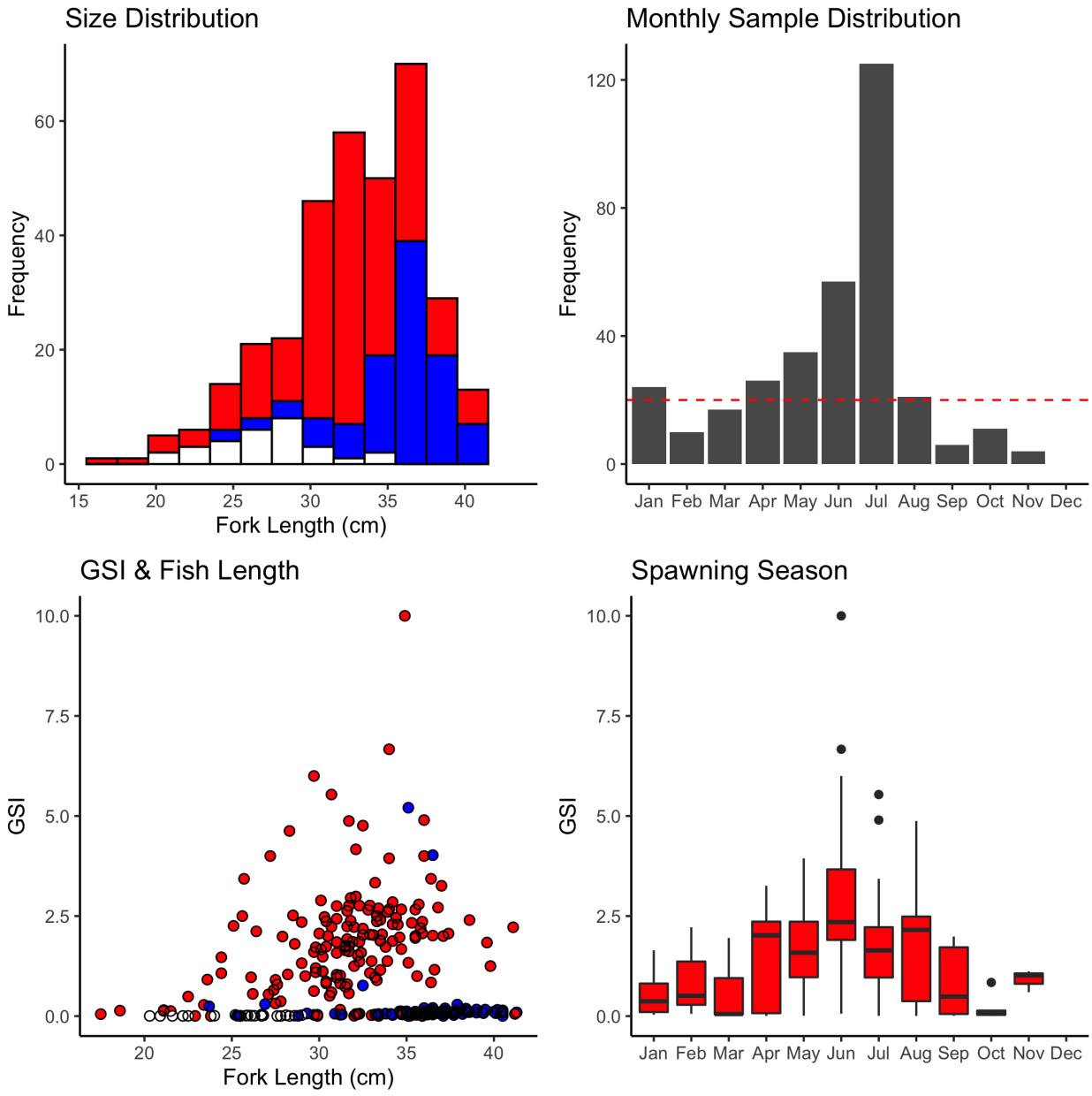

Figure B-12. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Variola louti

A total of 0 *Variola louti* samples (females=NA, males=NA, unknown/na=NA) have been collected to date (2022-12-02).

Non-BMUS

Acanthurus lineatus

A total of 1010 *Acanthurus lineatus* samples (females=426, males=429, unknown/na=155) have been collected to date (2022-12-02). Median fork length is 17.7 cm (min=4.8 cm, max=30 cm).

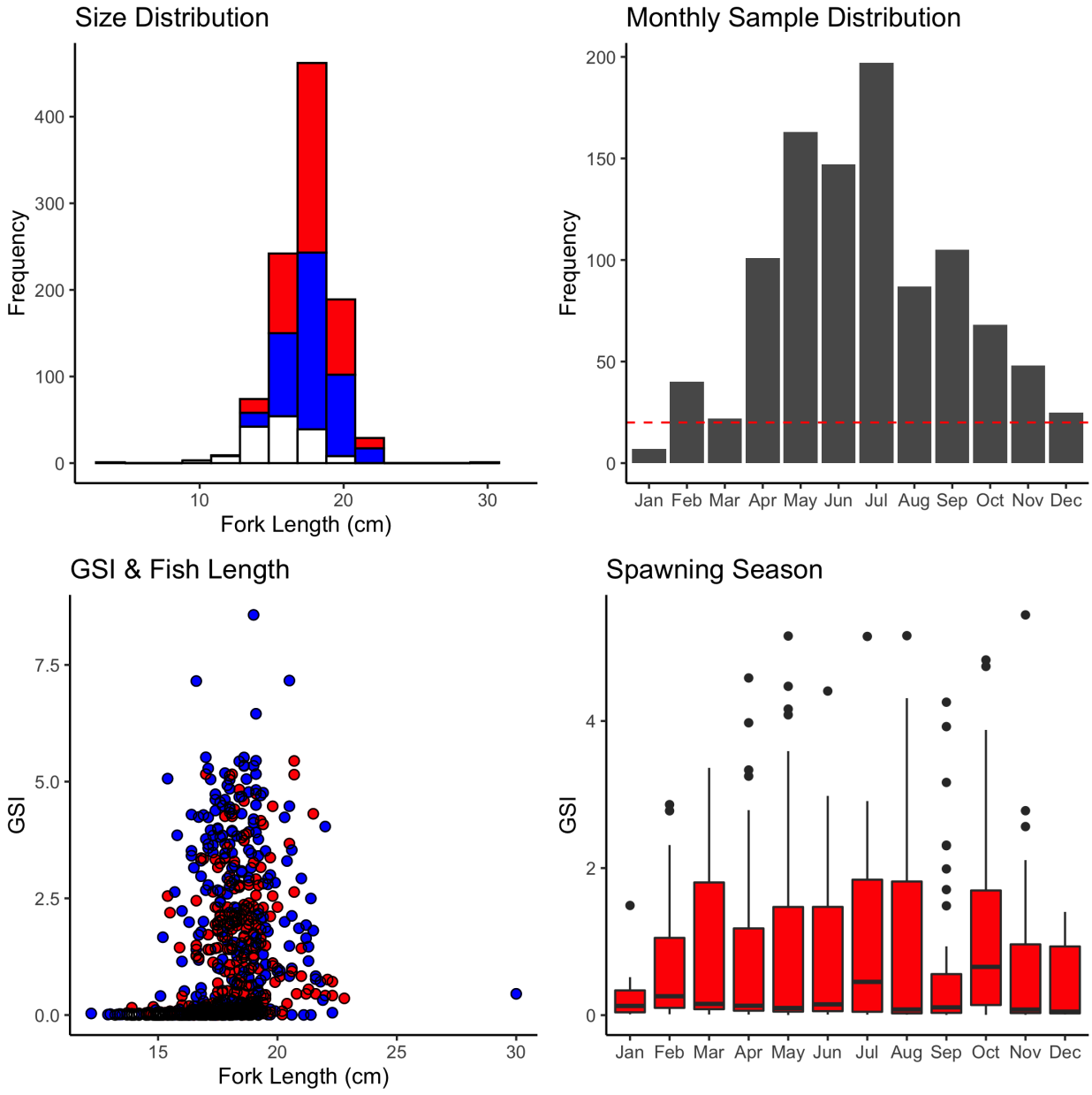

Figure B-13. *A. lineatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Acanthurus nigricauda

A total of 588 *Acanthurus nigricauda* samples (females=200, males=197, unknown/na=191) have been collected to date (2022-12-02). Median fork length is 18.45 cm (min=12.5 cm, max=25.3 cm).

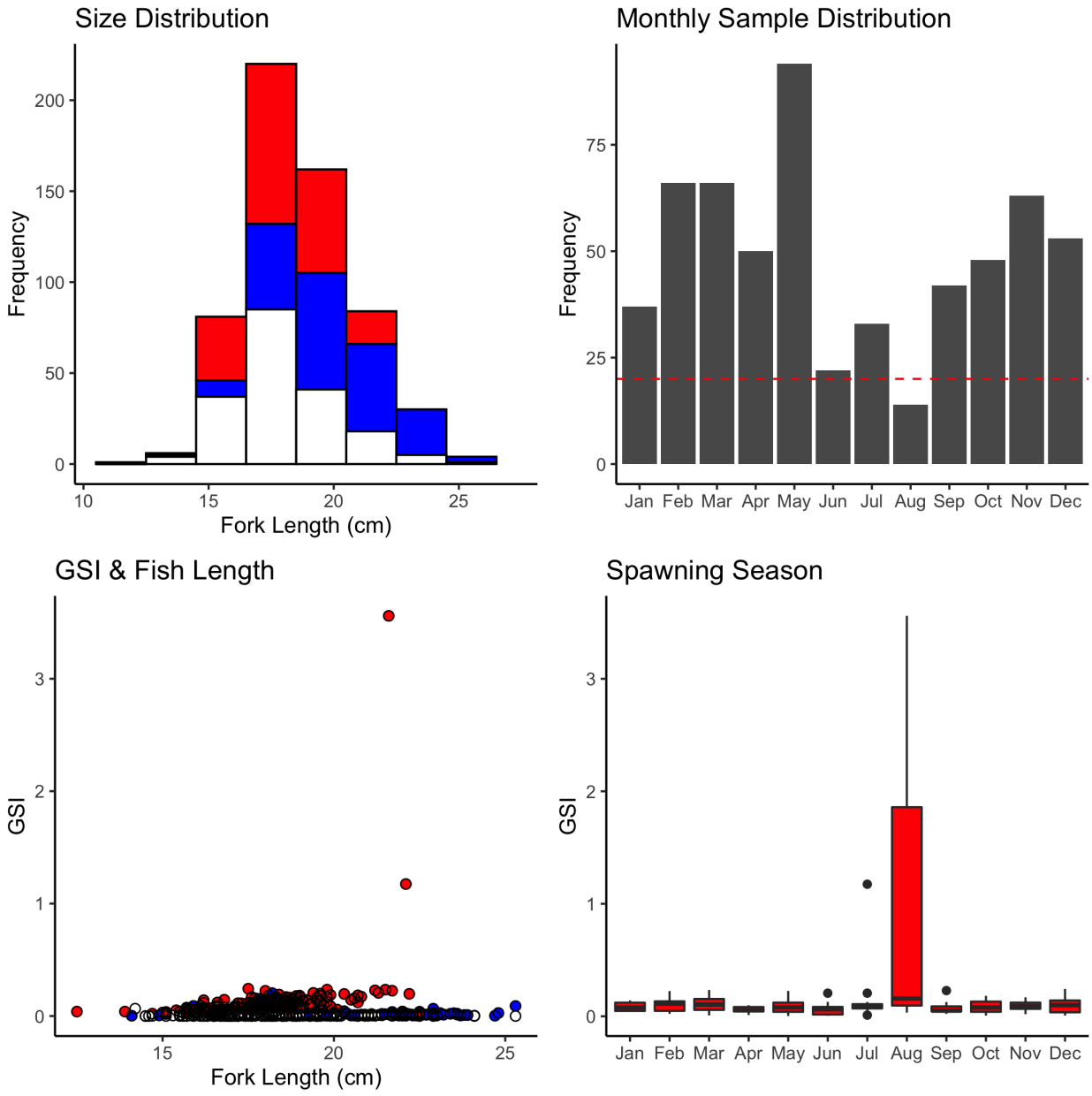

Figure B-14. *A. nigricauda* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Acanthurus triostegus

A total of 372 *Acanthurus triostegus* samples (females=195, males=175, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 15.3 cm (min=11.7 cm, max=18.7 cm).

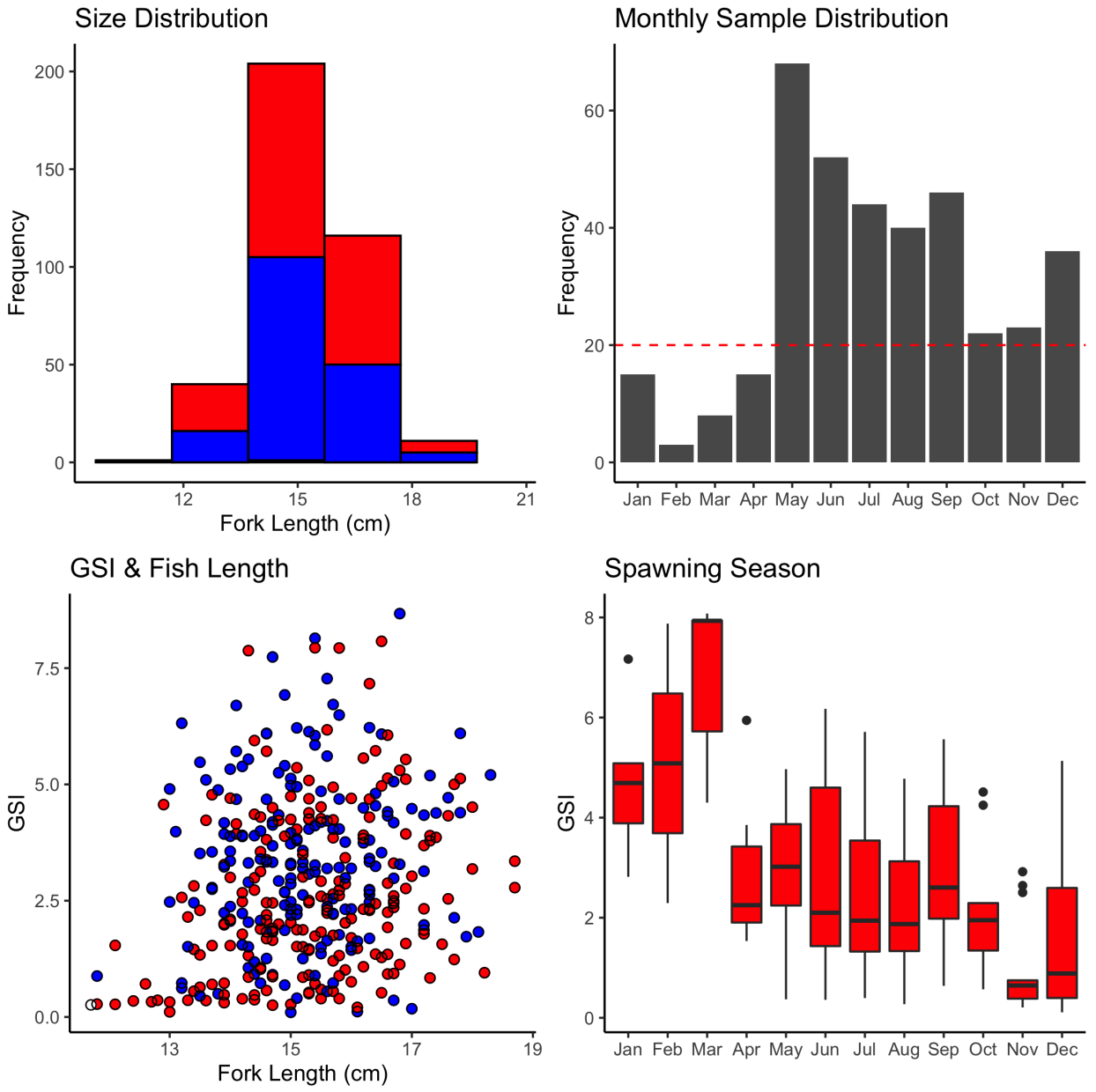

Figure B-15. *L. rubioperculatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Calotomus carolinus

A total of 426 *Calotomus carolinus* samples (females=277, males=147, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 24.65 cm (min=17 cm, max=32.2 cm).

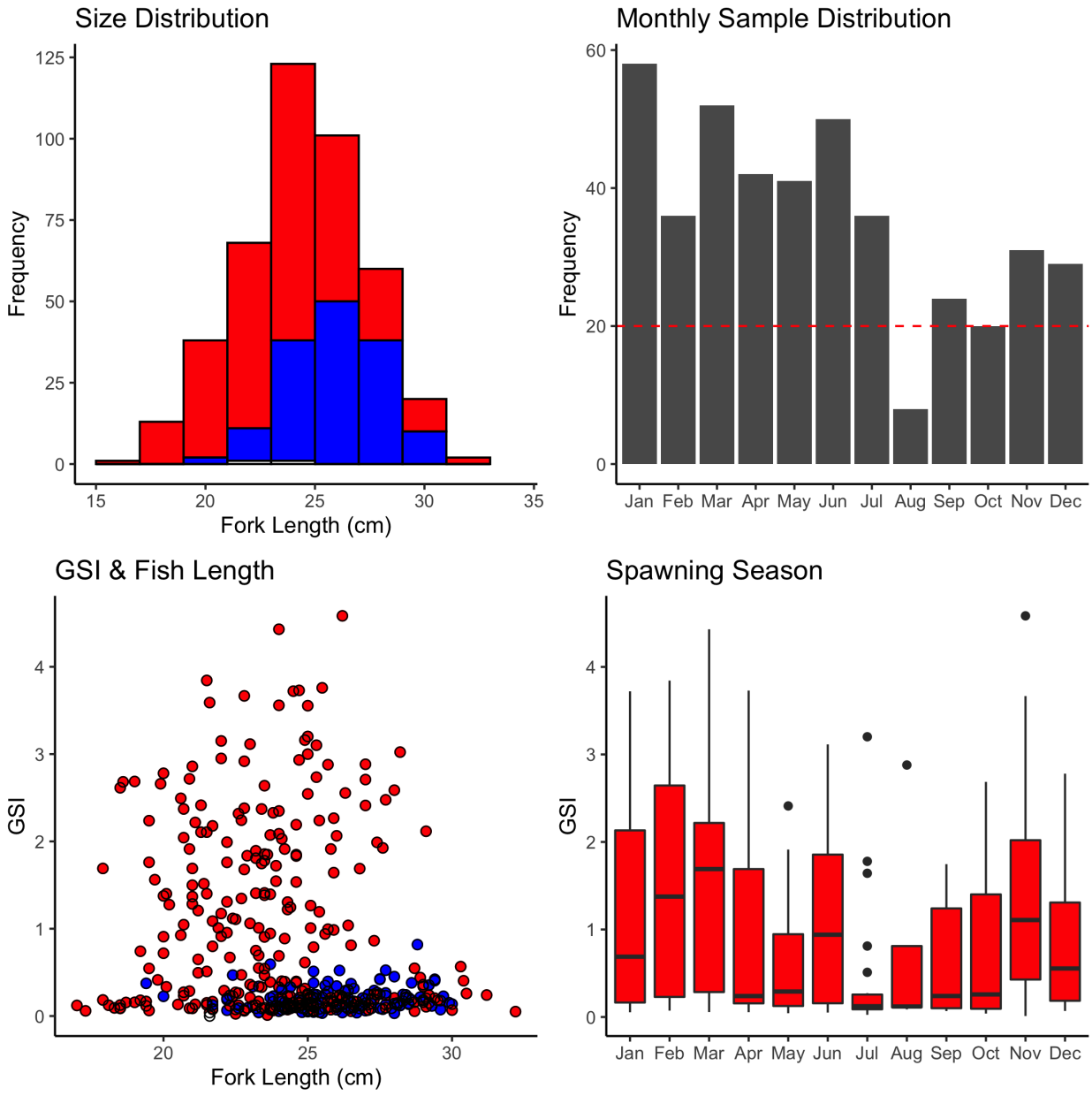

Figure B-16. *C. carolinus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx melampygus

A total of 109 *Caranx melampygus* samples (females=54, males=49, unknown/na=6) have been collected to date (2022-12-02). Median fork length is 39.5 cm (min=2.5 cm, max=68.9 cm).

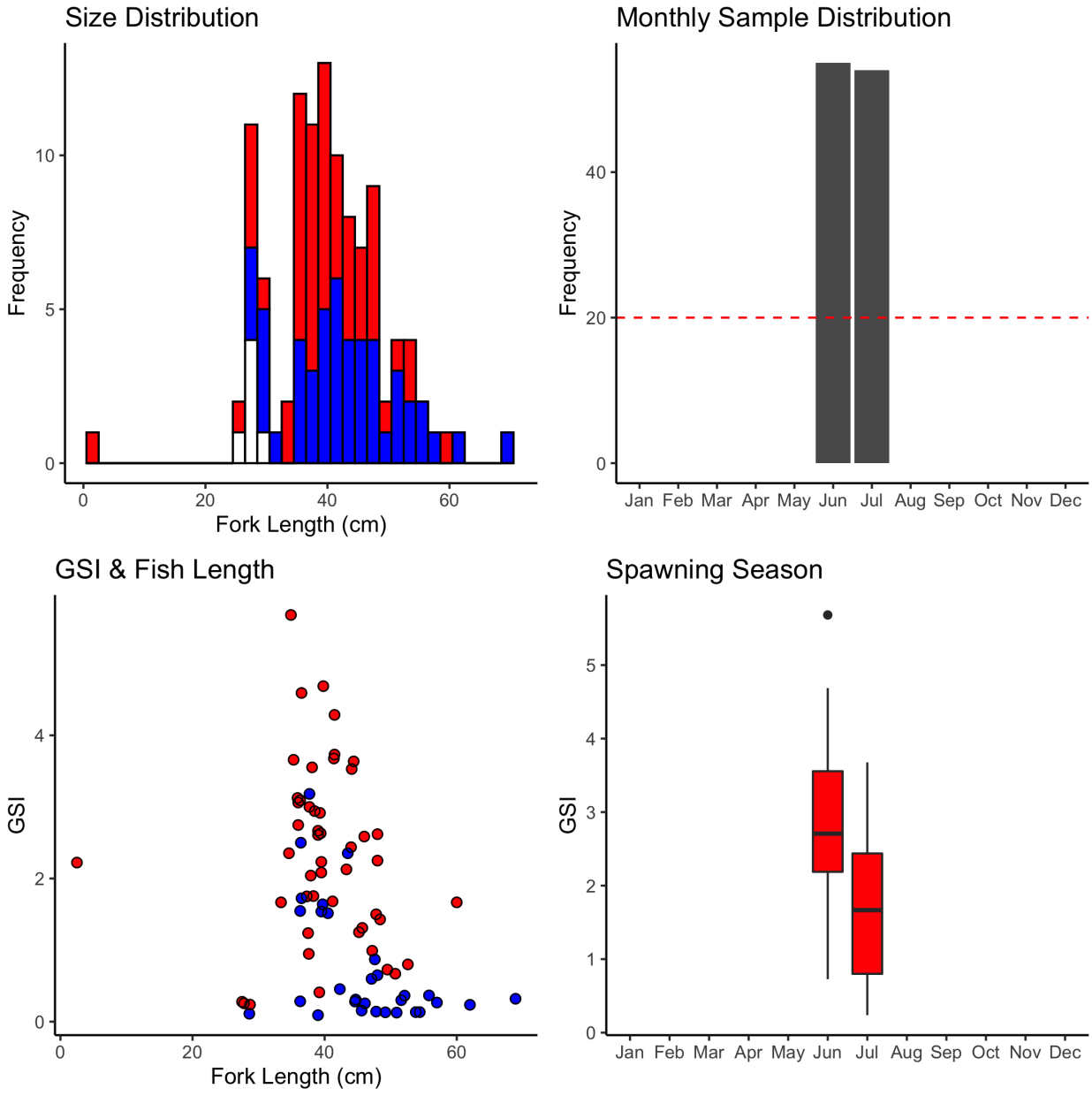

Figure B-17. *C. melampygus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cephalopholis argus

A total of 117 *Cephalopholis argus* samples (females=65, males=34, unknown/na=18) have been collected to date (2022-12-02). Median fork length is 28 cm (min=16.5 cm, max=41.1 cm).

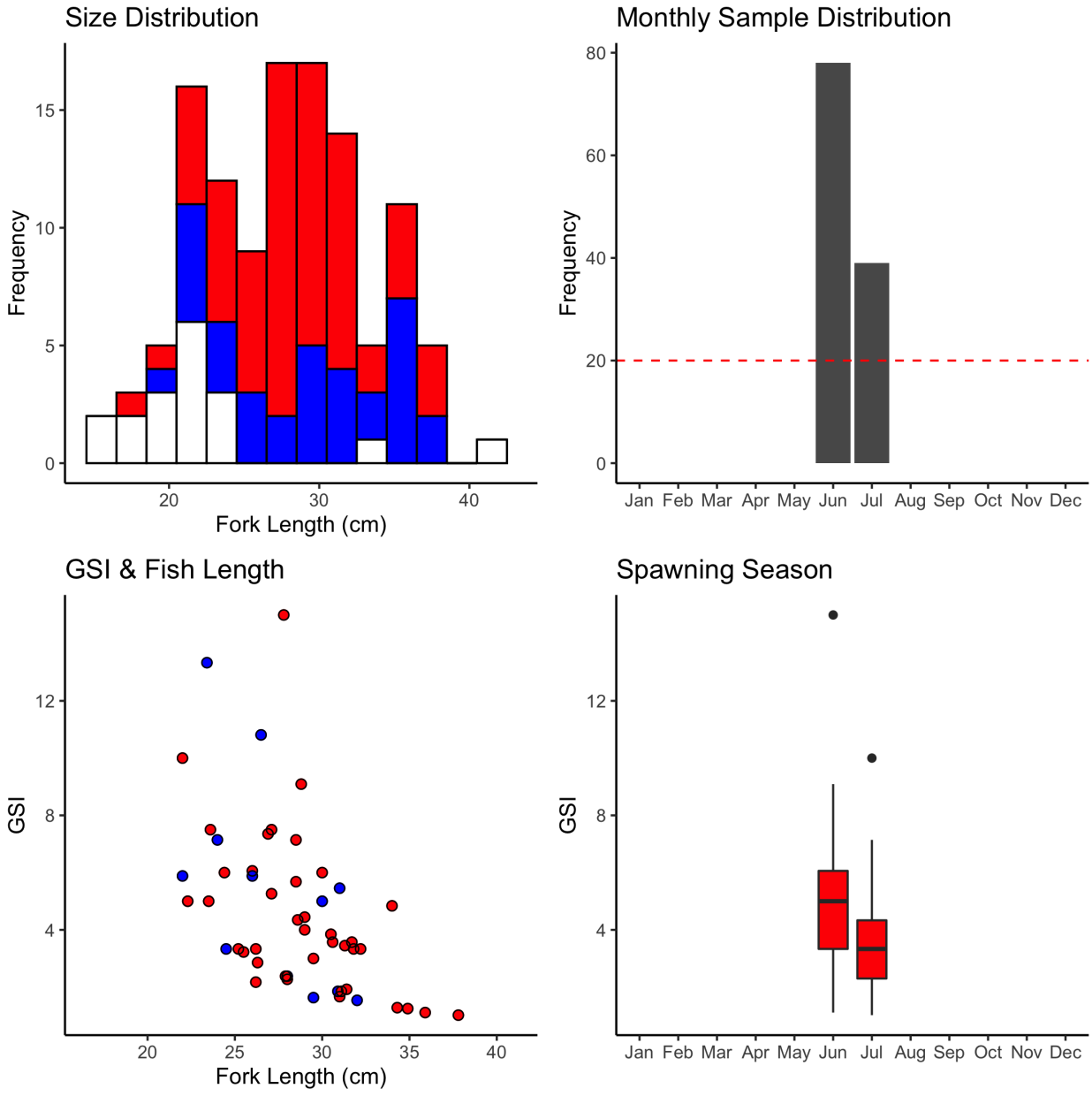

Figure B-18. *C. argus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cheilinus trilobatus

A total of 411 *Cheilinus trilobatus* samples (females=284, males=91, unknown/na=36) have been collected to date (2022-12-02). Median fork length is 22.7 cm (min=16.2 cm, max=34.1 cm).

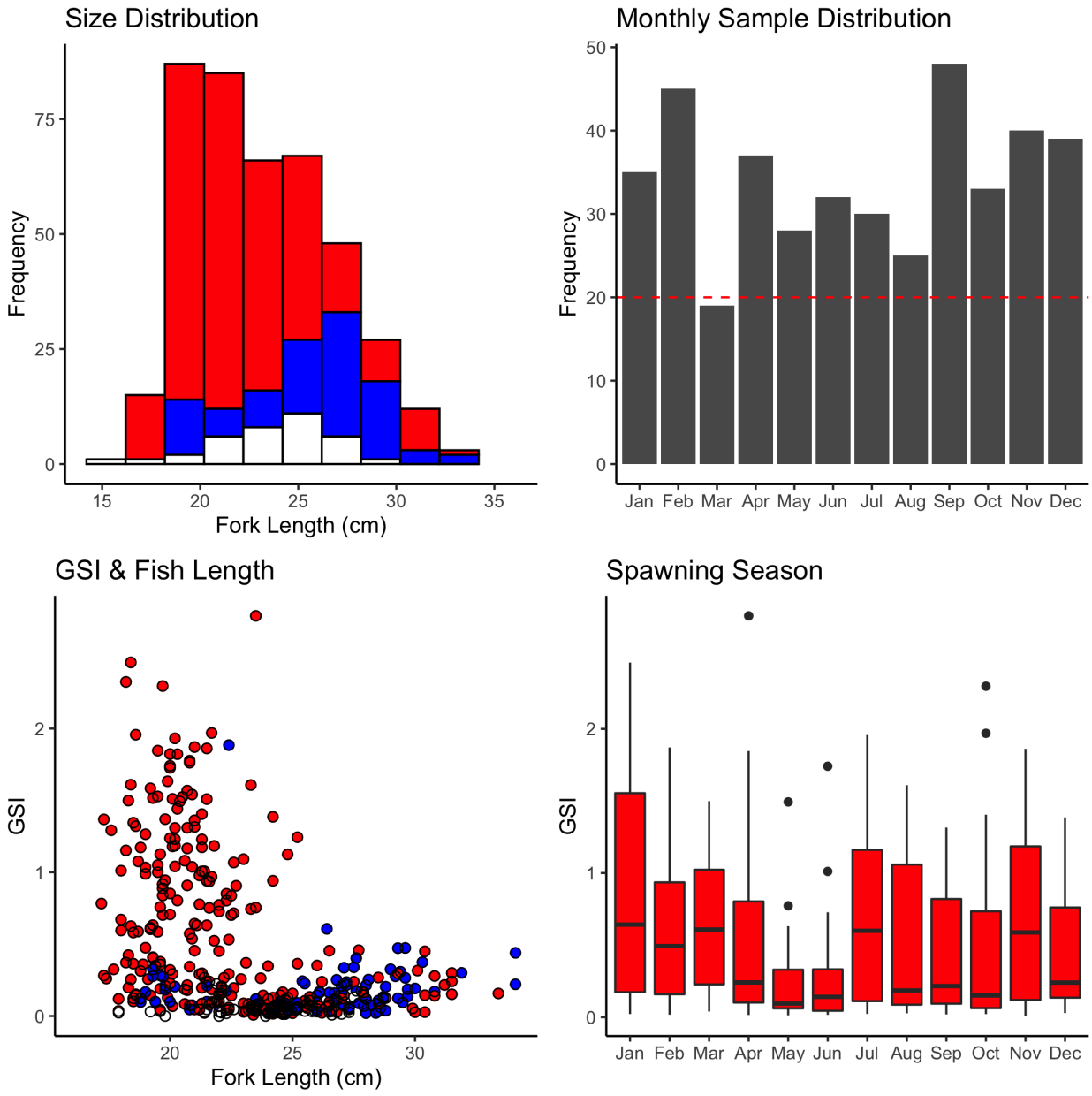

Figure B-19. *C. trilobatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cheilinus undulatus

A total of 306 *Cheilinus undulatus* samples (females=113, males=12, unknown/na=181) have been collected to date (2022-12-02). Median fork length is 26.5 cm (min=15.5 cm, max=126.2 cm).

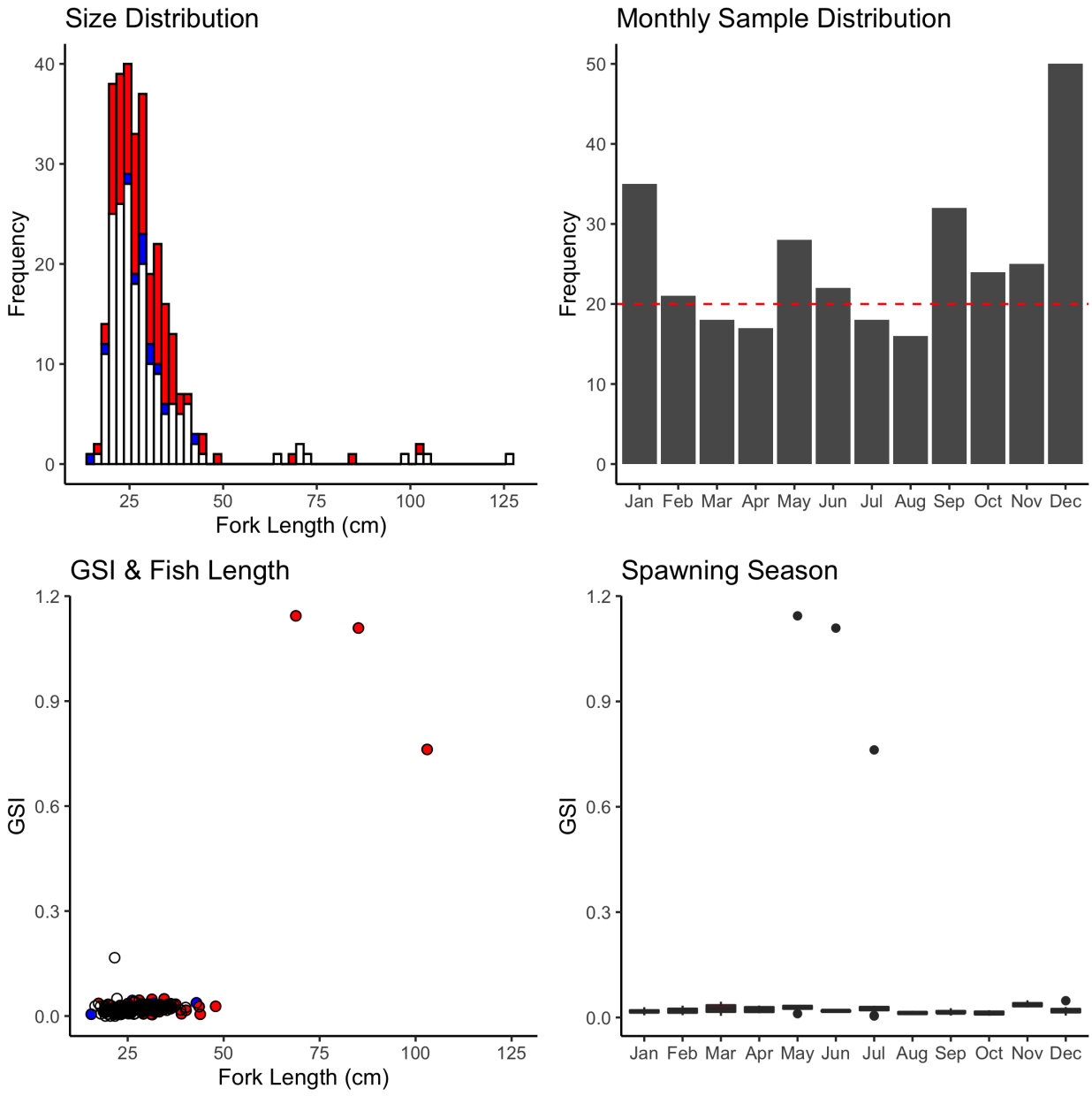

Figure B-20. C. undulatus sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Chlorurus sordidus

A total of 723 *Chlorurus sordidus* samples (females=444, males=277, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 20.5 cm (min=14.5 cm, max=27.1 cm).

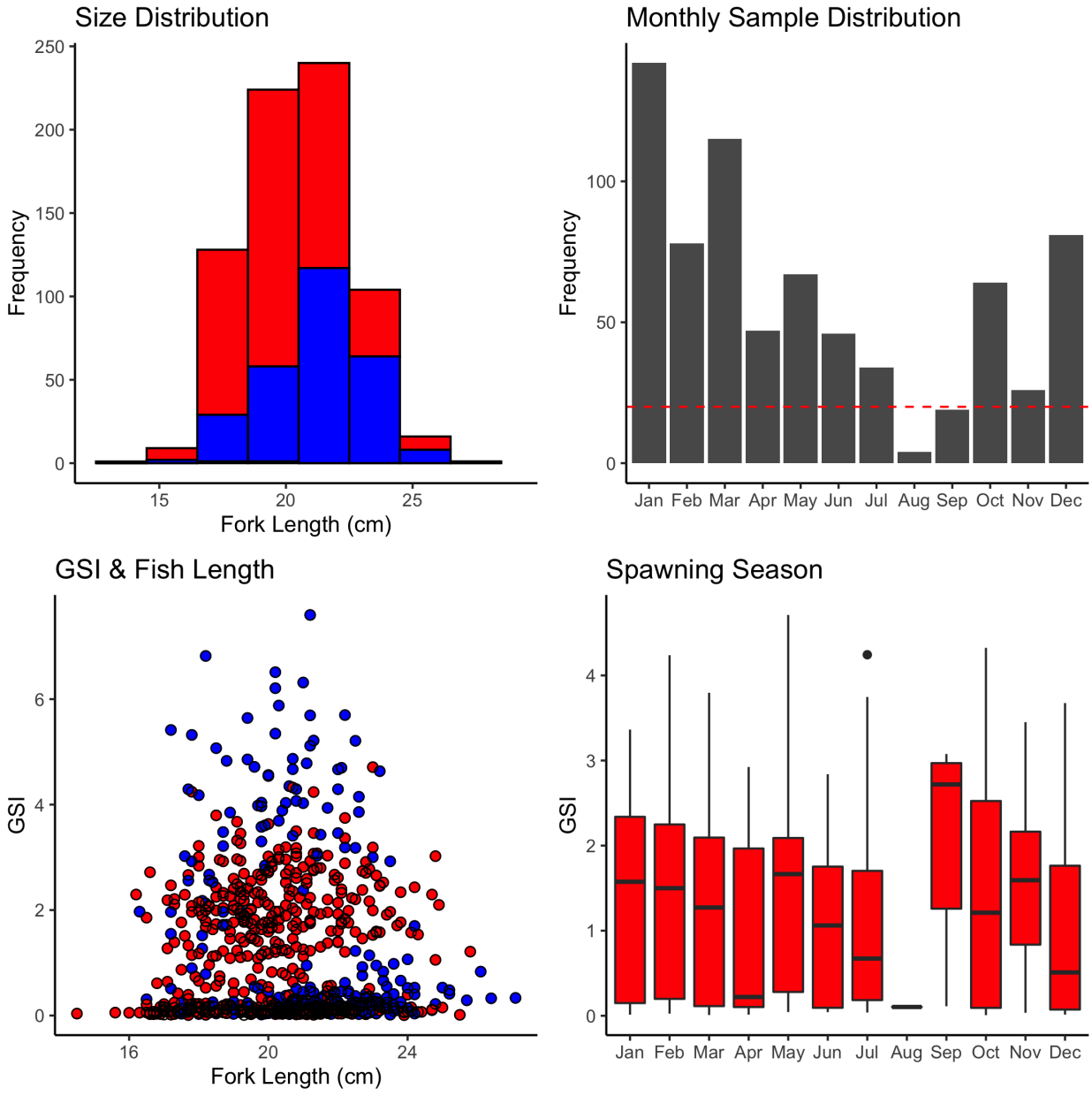

Figure B-21. *C. sordidius* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Kyphosus cinerascens

A total of 297 *Kyphosus cinerascens* samples (females=125, males=166, unknown/na=6) have been collected to date (2022-12-02). Median fork length is 23.9 cm (min=17.5 cm, max=40.1 cm).

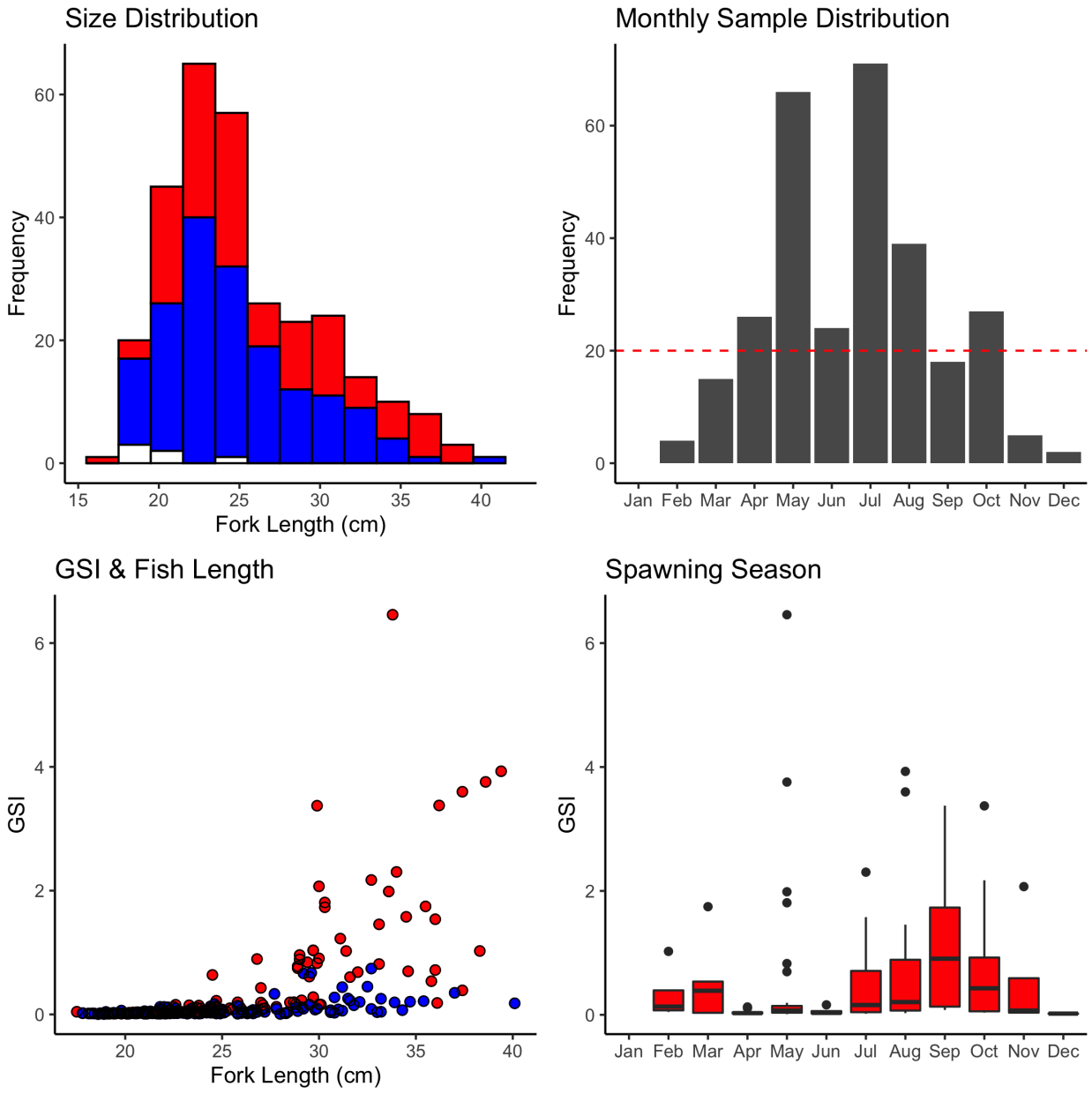

Figure B-22. *K. cinerascens* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus obsoletus

A total of 1011 *Lethrinus obsoletus* samples (females=678, males=175, unknown/na=158) have been collected to date (2022-12-02). Median fork length is 20.5 cm (min=14.1 cm, max=29.7 cm).

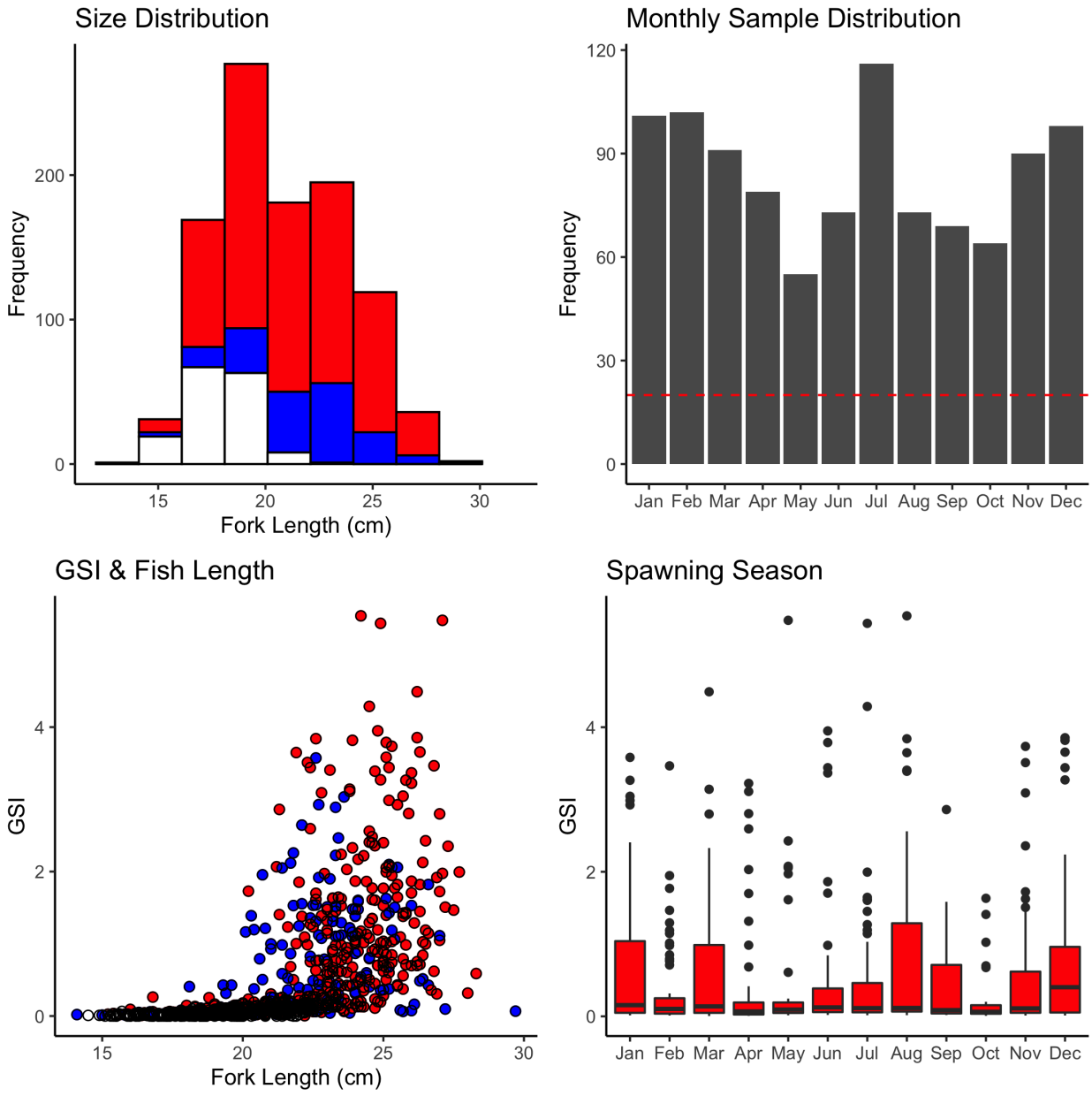

Figure B-23. *L. obsoletus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Monotaxis grandoculis

A total of 248 *Monotaxis grandoculis* samples (females=121, males=90, unknown/na=37) have been collected to date (2022-12-02). Median fork length is 30.2 cm (min=15.8 cm, max=46.2 cm).

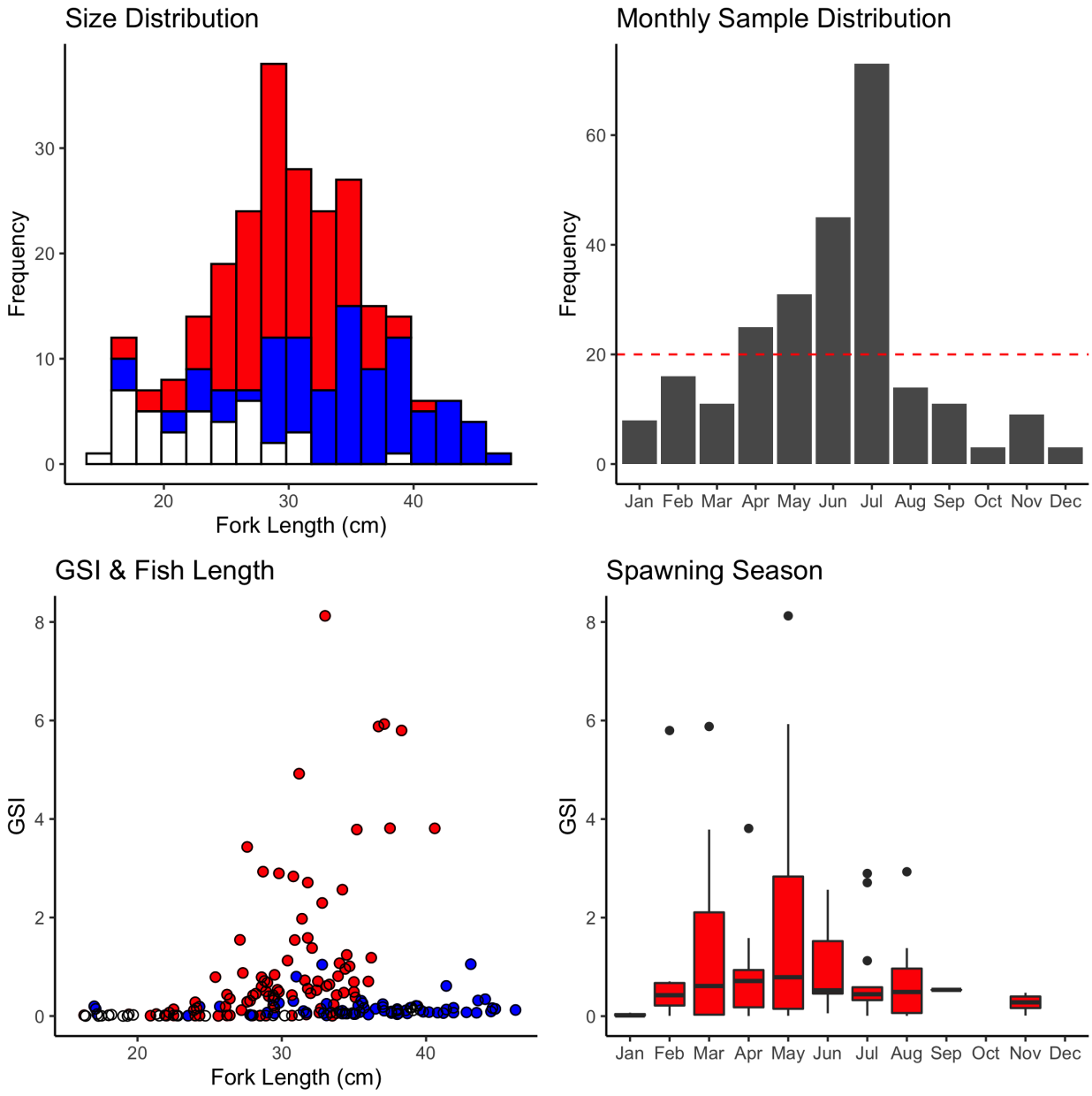

Figure B-24. *M. grandoculis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Mulloidichthys vanicolensis

A total of 985 *Mulloidichthys vanicolensis* samples (females=460, males=402, unknown/na=123) have been collected to date (2022-12-02). Median fork length is 18.1 cm (min=8.9 cm, max=28.5 cm).

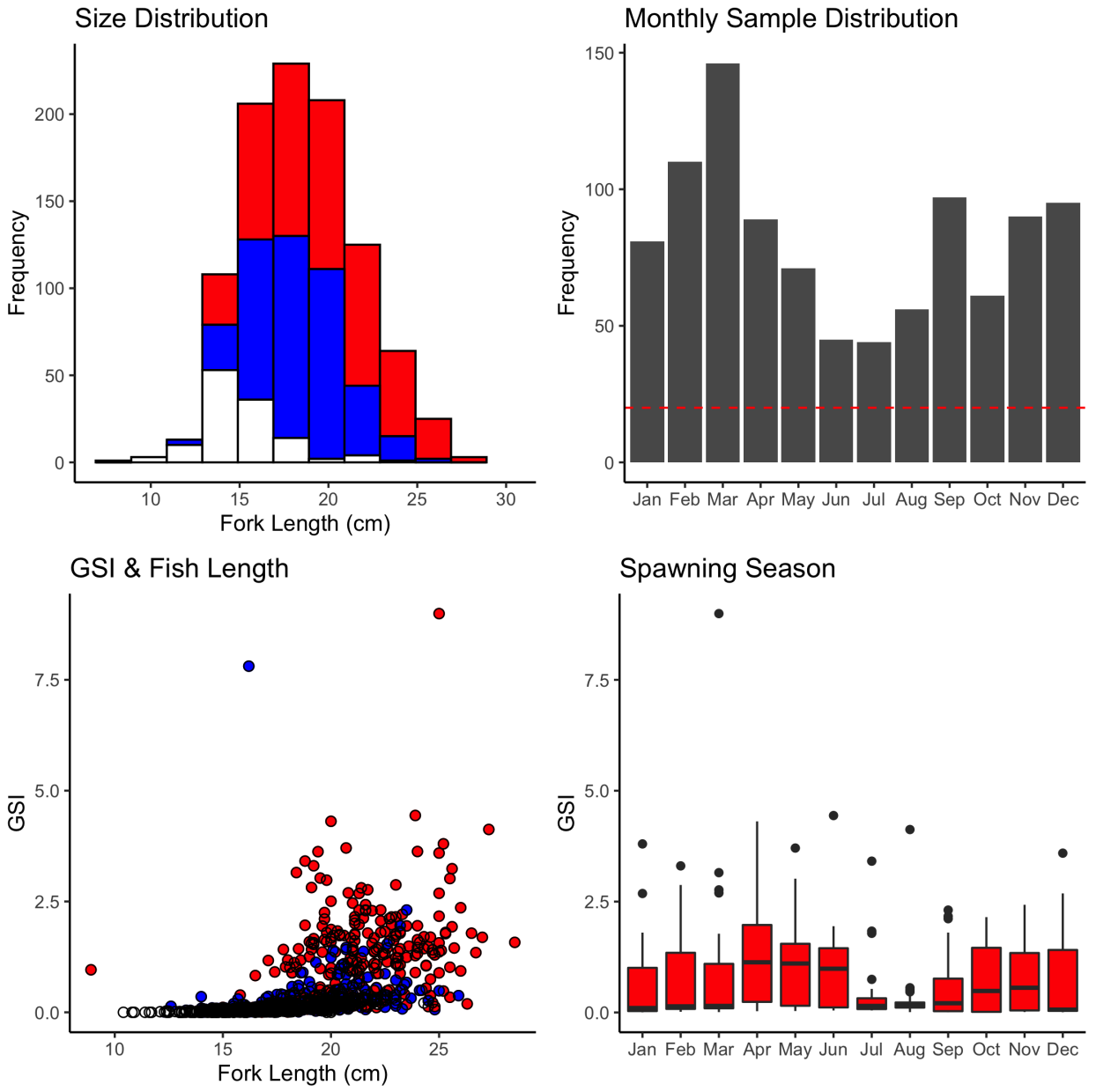

Figure B-25. *M. vanicolensis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso lituratus

A total of 1408 *Naso lituratus* samples (females=503, males=850, unknown/na=55) have been collected to date (2022-12-02). Median fork length is 20.2 cm (min=7.9 cm, max=29.8 cm).

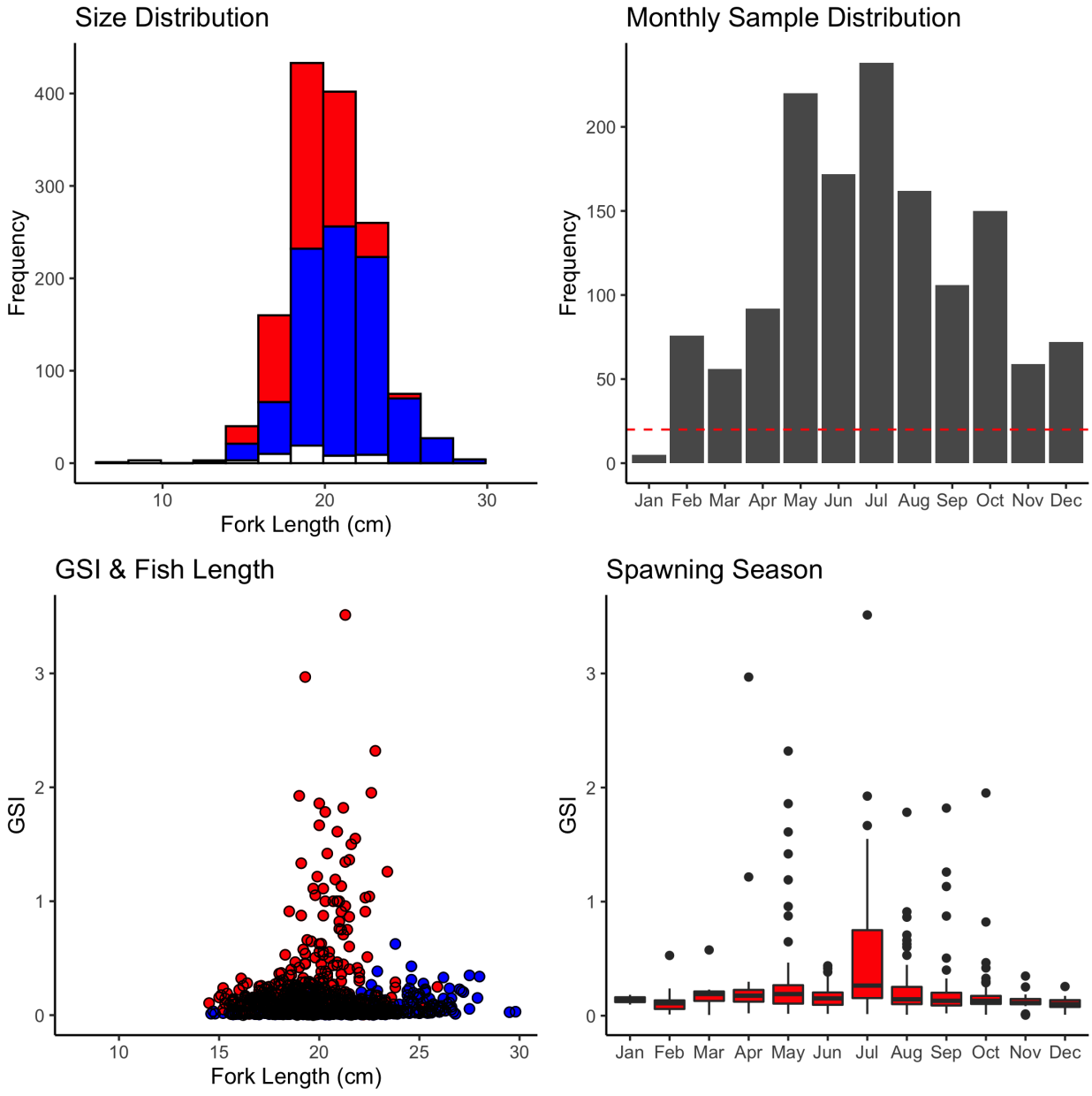

Figure B-26. *N. literatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso unicornis

A total of 2558 *Naso unicornis* samples (females=1269, males=1209, unknown/na=80) have been collected to date (2022-12-02). Median fork length is 27.1 cm (min=10.4 cm, max=53.2 cm).

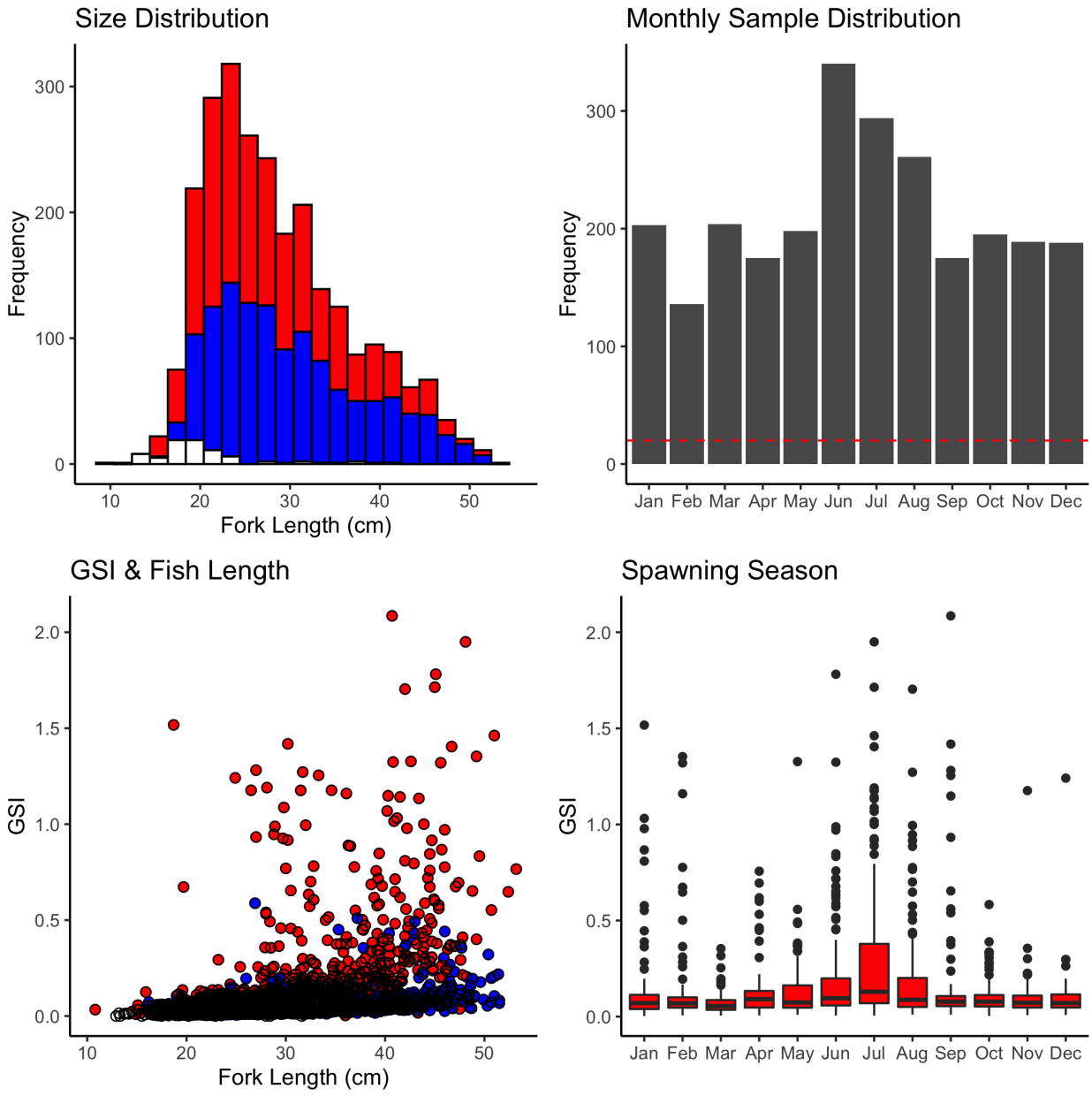

Figure B-27. *N. unicornis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Sargocentron spiniferum

A total of 950 *Sargocentron spiniferum* samples (females=348, males=171, unknown/na=431) have been collected to date (2022-12-02). Median fork length is 18.45 cm (min=11.5 cm, max=34.2 cm).

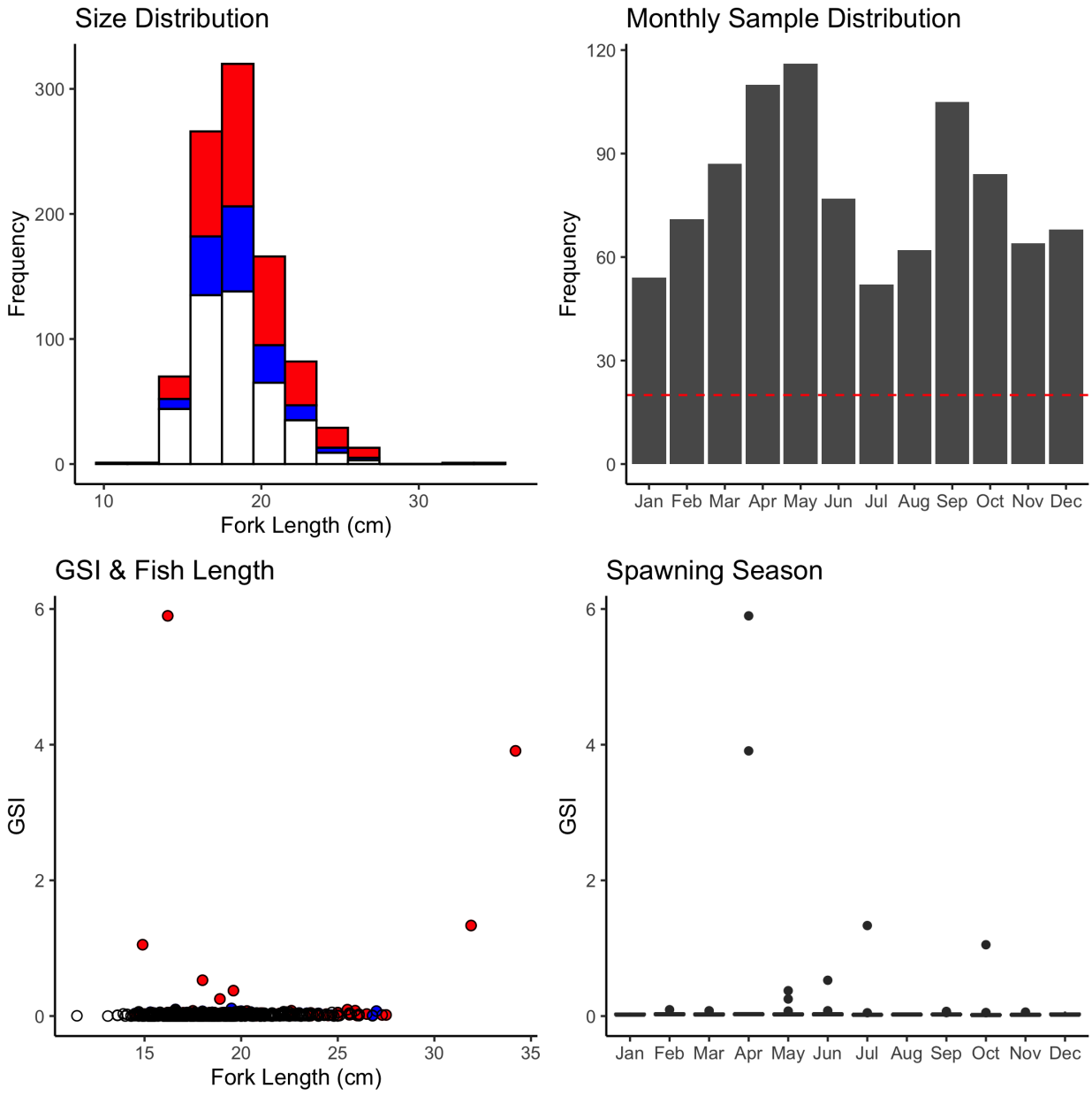

Figure B-28. *S. spiniferum* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Sargocentron tiere

A total of 722 *Sargocentron tiere* samples (females=444, males=202, unknown/na=76) have been collected to date (2022-12-02). Median fork length is 17.5 cm (min=12.9 cm, max=23.2 cm).

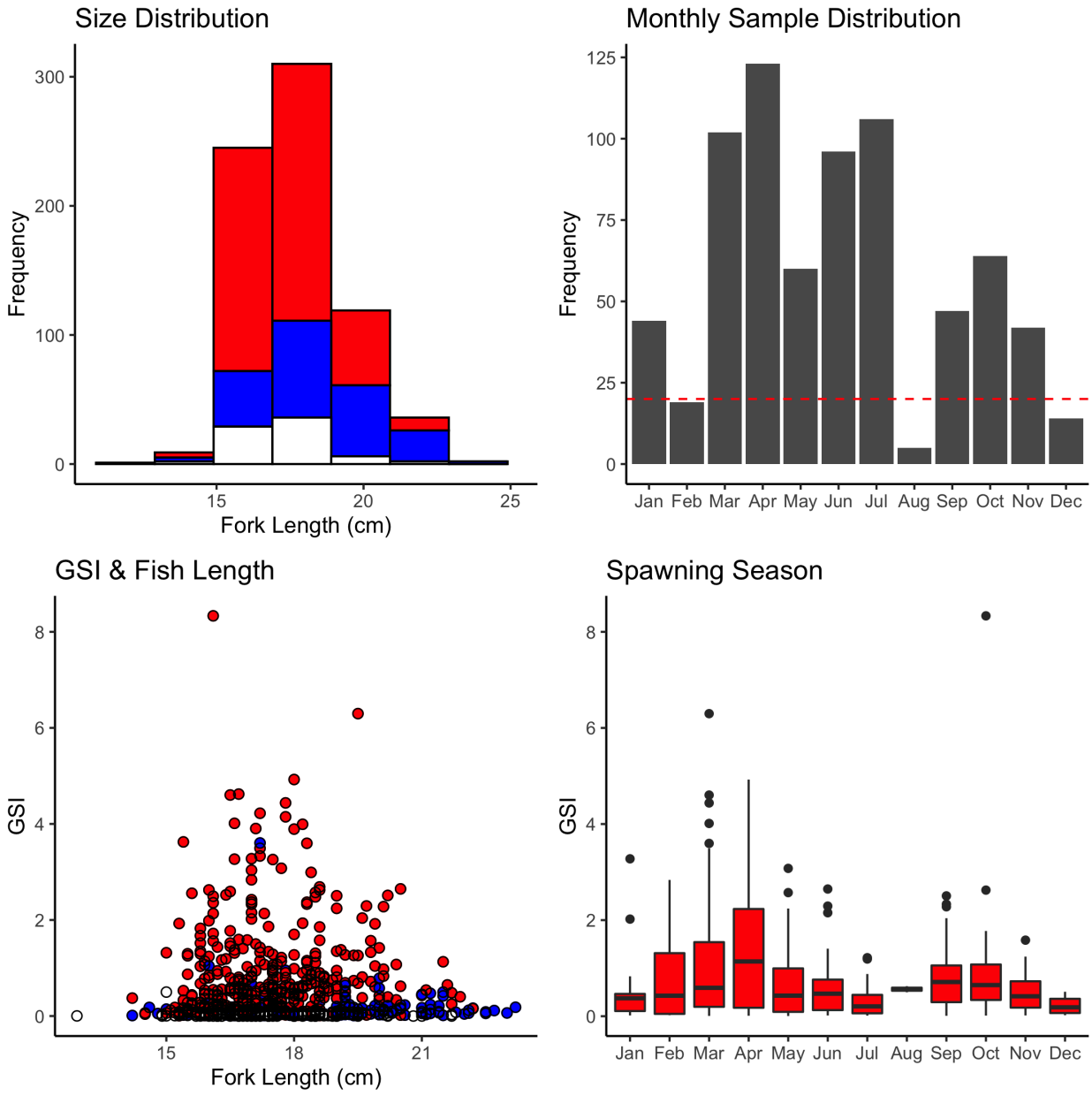

Figure B-29. *S. tiere* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Scarus rubroviolaceus

A total of 102 *Scarus rubroviolaceus* samples (females=57, males=33, unknown/na=12) have been collected to date (2022-12-02). Median fork length is 32.8 cm (min=17 cm, max=43.5 cm).

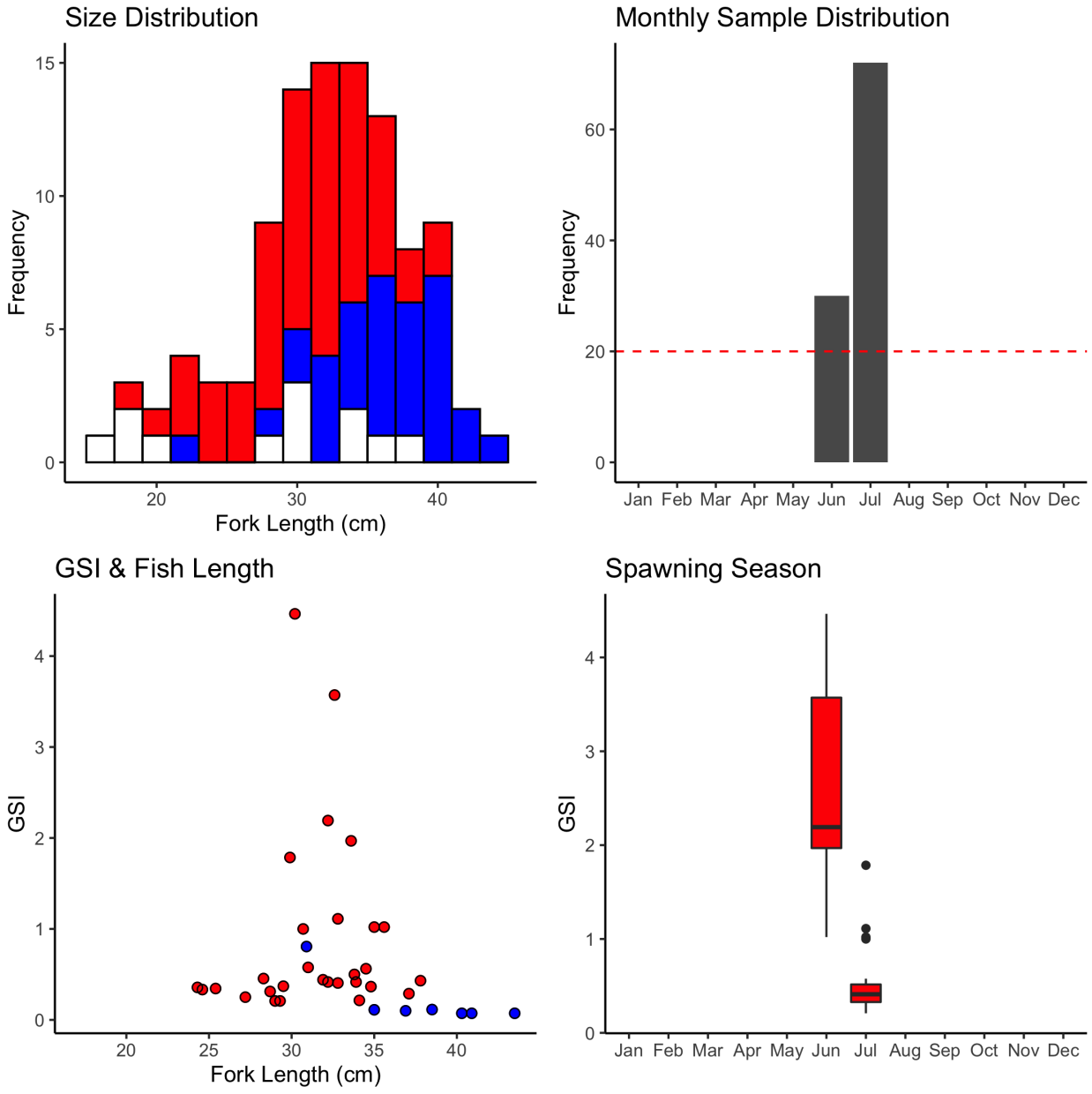

Figure B-30. *S. rubroviolaceus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Siganus spinus

A total of 2026 *Siganus spinus* samples (females=1169, males=828, unknown/na=29) have been collected to date (2022-12-02). Median fork length is 17.7 cm (min=10.2 cm, max=25.6 cm).

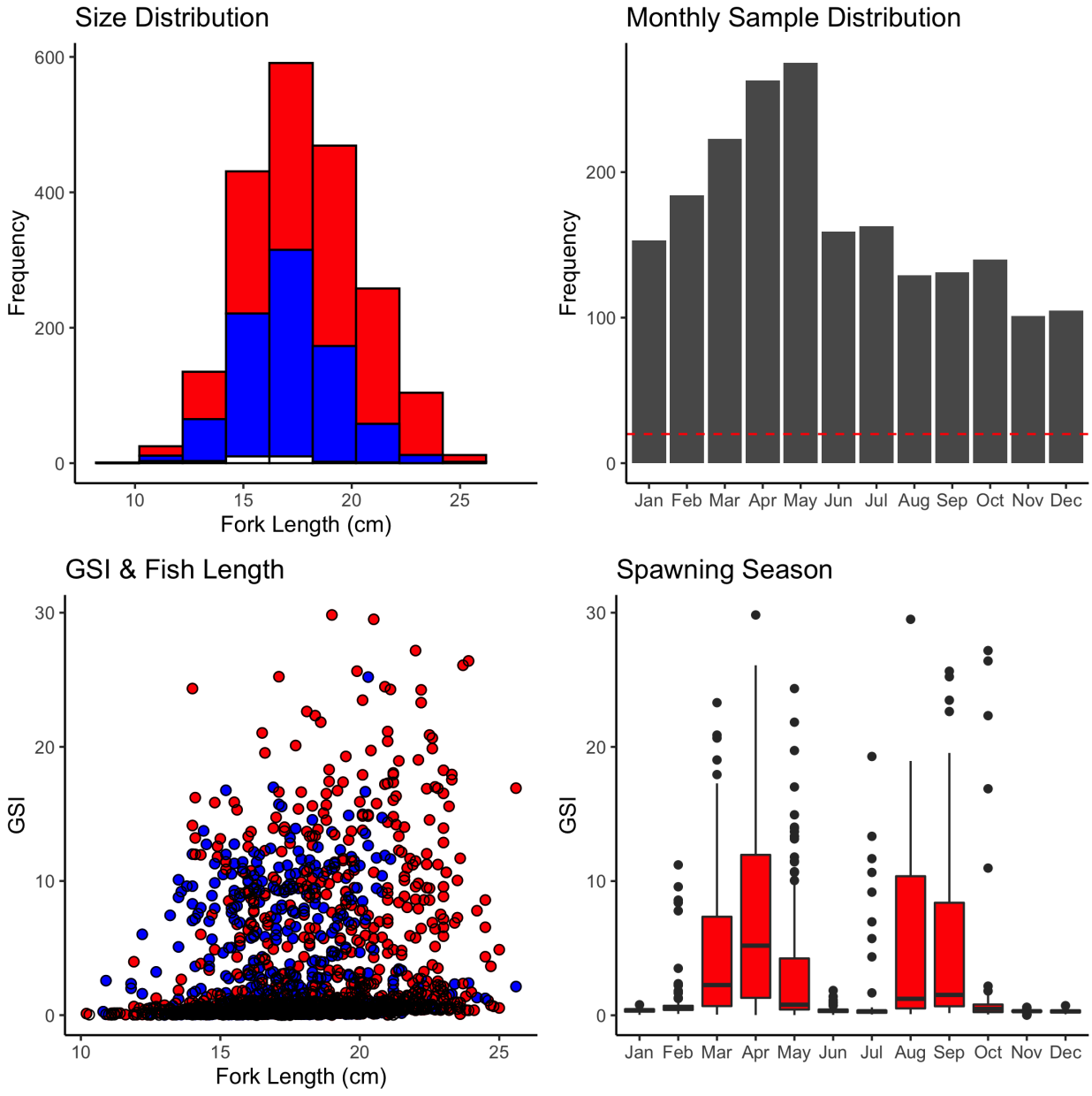

Figure B-31. *S. spinus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Zanclus cornutus

A total of 118 *Zanclus cornutus* samples (females=60, males=55, unknown/na=3) have been collected to date (2022-12-02). Median fork length is 16.7 cm (min=7.4 cm, max=24.8 cm).

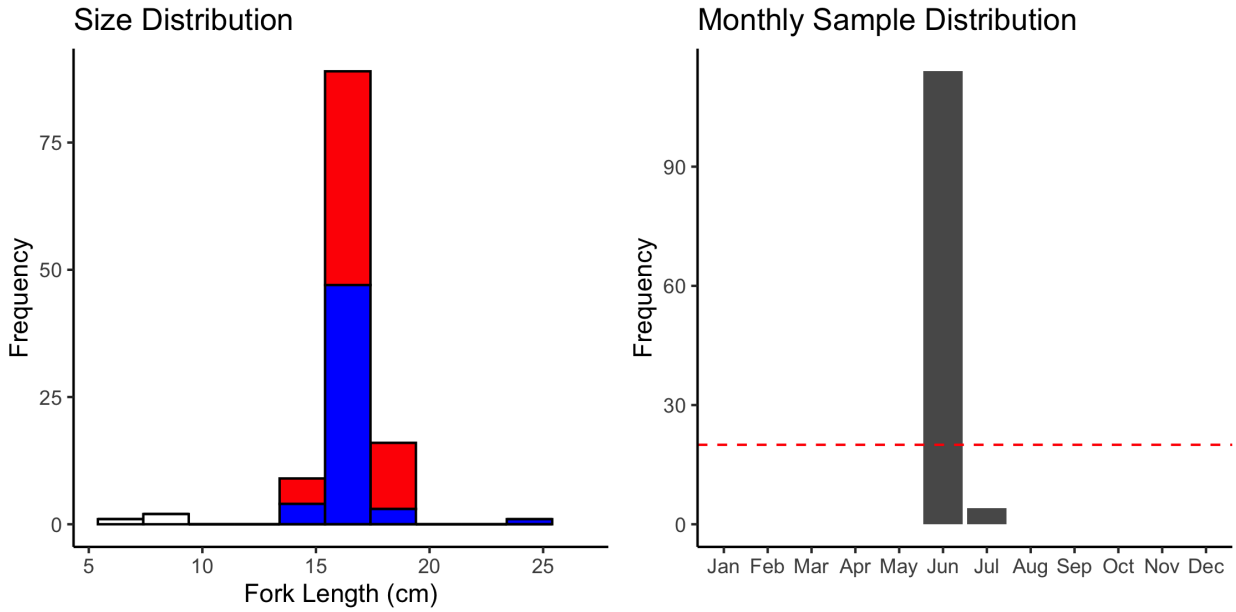

Figure B-32. *Z. cornutus* sampling summaries for size distribution and monthly sample collection. Gonad weight was not recorded for this species and thus GSI and fish length and spawning season summary figures are not available at this time.

CNMI Unfished Species Summaries (Northern Islands)

Updated April 2022 (current through December 2021)

The following species were sampled through the NOAA life history surveys and are reviewed in this appendix for completeness of sampling to assess regional life history parameters for age, growth, and reproduction.

Bottomfish Management Unit Species (BMUS):
Aphareus rutilans
Caranx ignobilis
Caranx lugubris
Etelis carbunculus
Etelis coruscans
Lethrinus rubrioperculatus
Lutjanus kasmira
Pristipomoides auricilla
Pristipomoides filamentosus
Pristipomoides flavipinnis
Pristipomoides sieboldii
Pristipomoides zonatus
Variola louti

Non-BMUS:
Acanthurus lineatus
Caranx melampygus
Cephalopholis argus
Monotaxis grandoculis
Naso lituratus
Naso unicornis
Scarus rubroviolaceus
Zanclus cornutus

This species summary is a guide to inform future sampling collection efforts and life history assessments. Species with completed life history assessments for the territory are excluded unless continued sample collection is recommended for additional research to meet fisheries science and management needs. All BMUS and non-BMUS with a sample size greater or equal to 50 are included in this appendix. Sample sizes should be considered as approximate, as there is not always an otolith and gonad for every entry in the database due to otoliths breaking or gonads not being collected.

Data for each species are reviewed across four categories: fish size distribution, monthly sample distribution, relationship between gonadosomatic index (GSI) and fish length and mean female GSI by month. Each of these categories allows for a review of the sample collection progress to meet the needs of the life history assessments for age, growth, spawning season, and size/age at maturity.

Size distribution: The length frequency distribution is a proxy for looking at the sampling

coverage to estimate age and growth. It also allows for a first look at the size distribution of females and males. This is a proxy and histological assessment is recommended to confirm gender and to identify unknowns.

Monthly sample distribution: The total number of samples per month are plotted. A sample size of 20 individuals per month is recommended (red dashed line).

GSI and fish length: Gonadosomatic index (gonad weight/fish weight *100) is plotted against fish size to visualize the sample distribution as a proxy for size at maturity.

Spawning season: Female Gonadosomatic Index (GSI) is plotted by month to visualize if sampling is adequate to determine spawning seasonality.

Bottomfish Management Unit Species

Aphareus rutilans

A total of 25 *Aphareus rutilans* samples (females=15, males=9, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 73.6 cm (min=38.4 cm, max=96.1 cm).

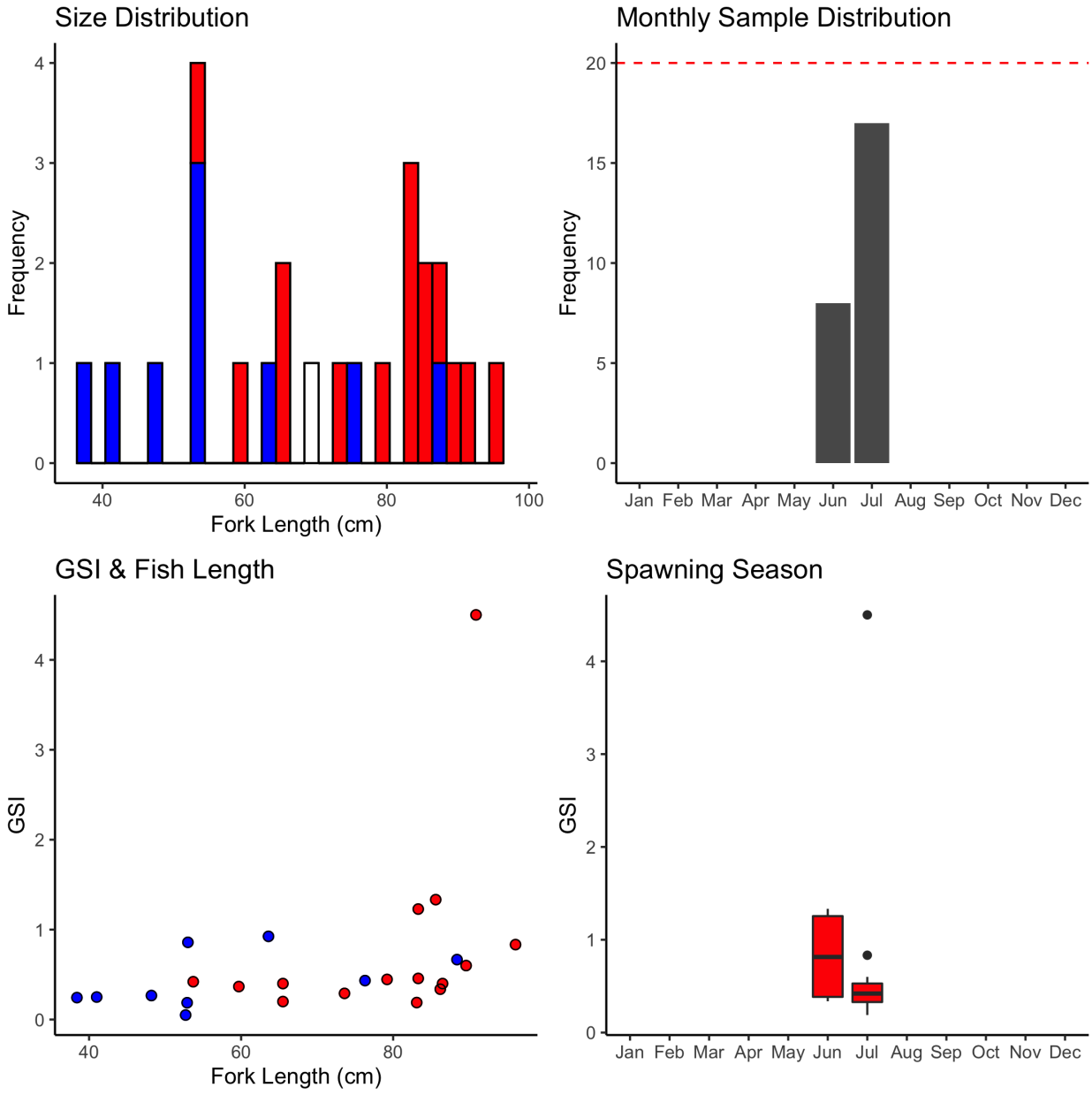

Figure B-33. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx ignobilis

A total of 0 *Caranx ignobilis* samples (females=0, males=0, unknown/na=0) have been collected to date (2022-12-02).

Caranx lugubris

A total of 6 *Caranx lugubris* samples (females=1, males=2, unknown/na=3) have been collected to date (2022-12-02). Median fork length is 36.2 cm (min=29.2 cm, max=56.9 cm).

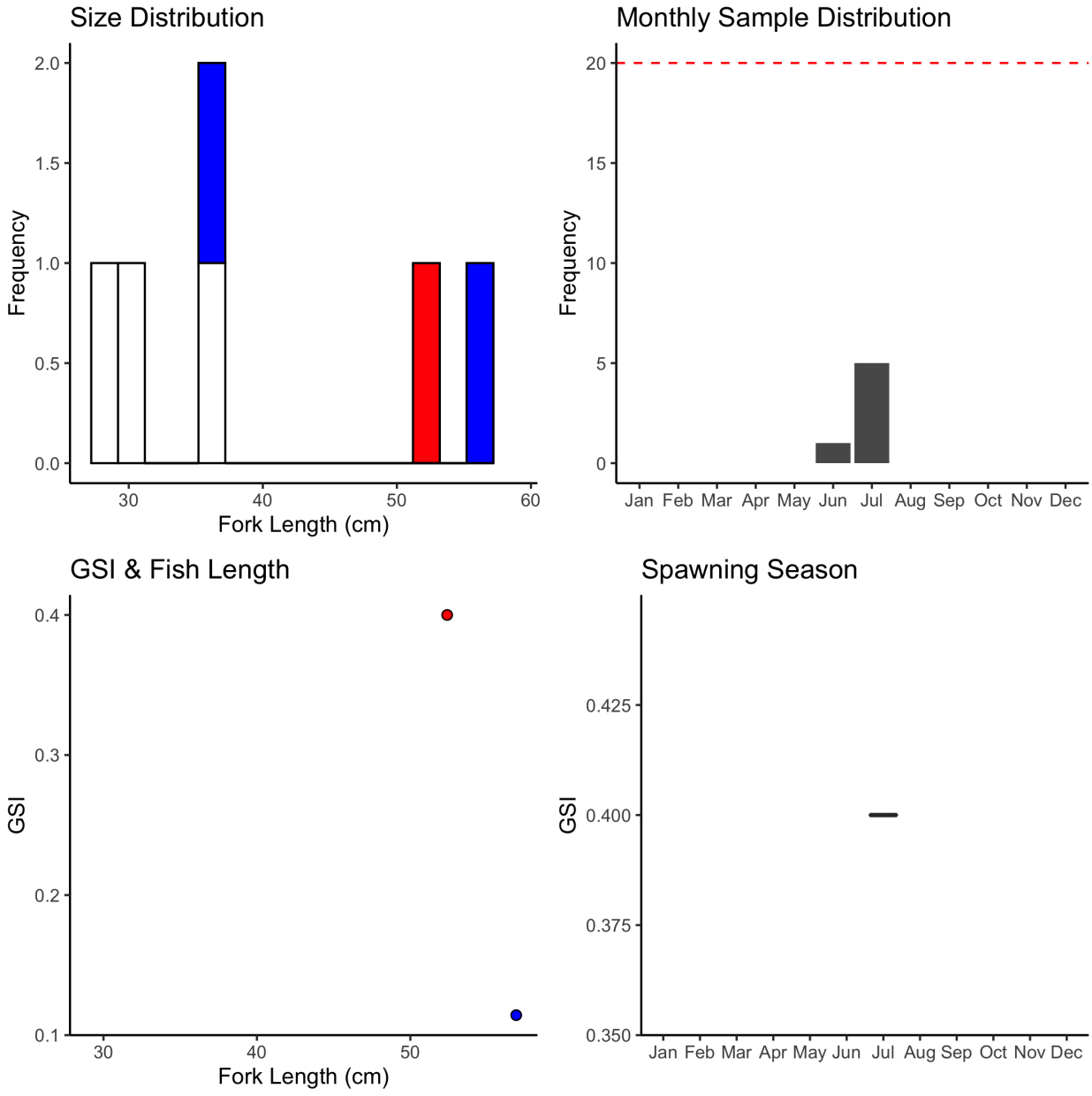

Figure B-34. *C. lugubris* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis carbunculus

A total of 156 *Etelis carbunculus* samples (females=91, males=64, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 33.45 cm (min=20.8 cm, max=51.2 cm).

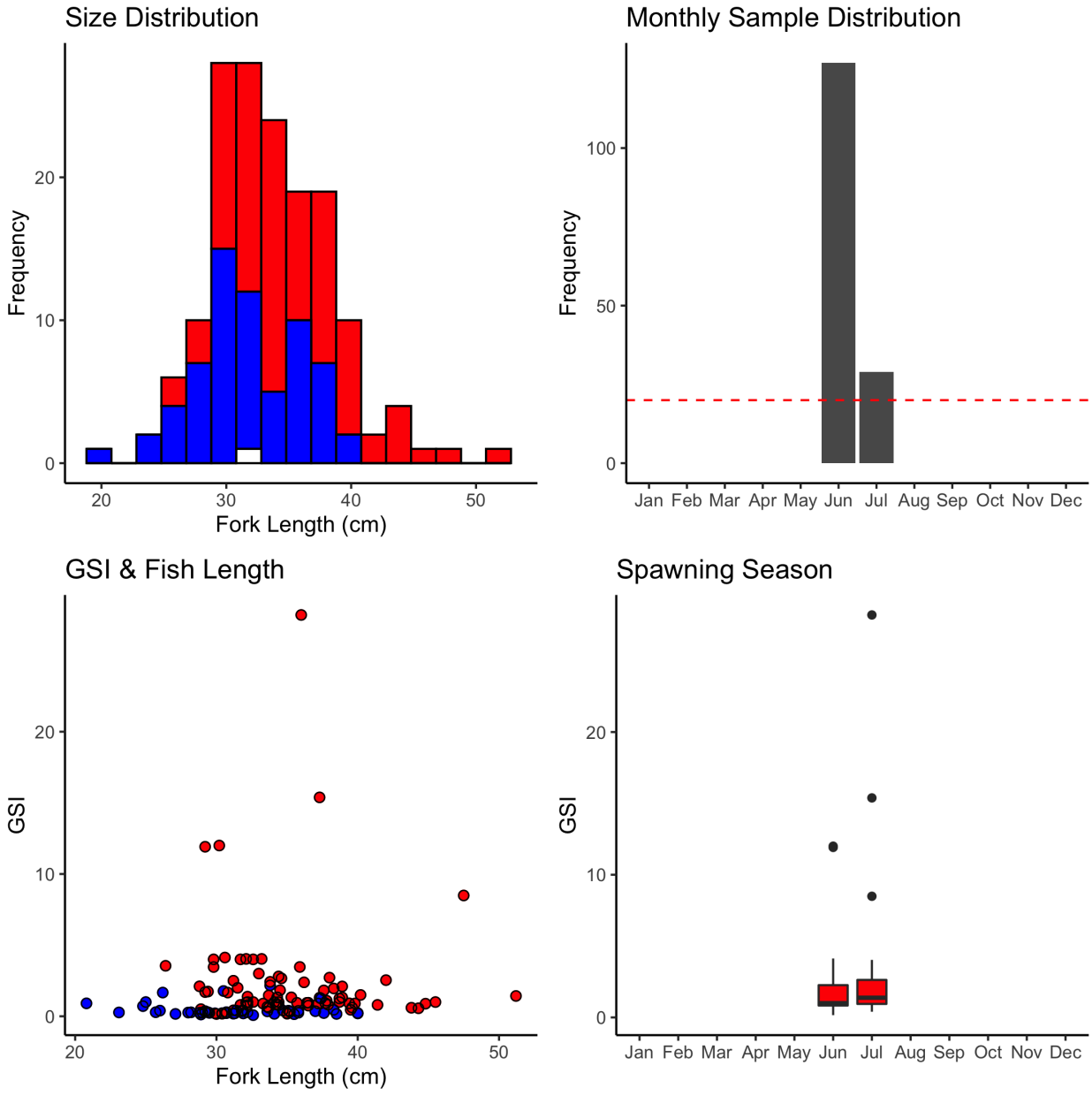

Figure B-35. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 214 *Etelis coruscans* samples (females=91, males=121, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 74.95 cm (min=47.8 cm, max=92 cm).

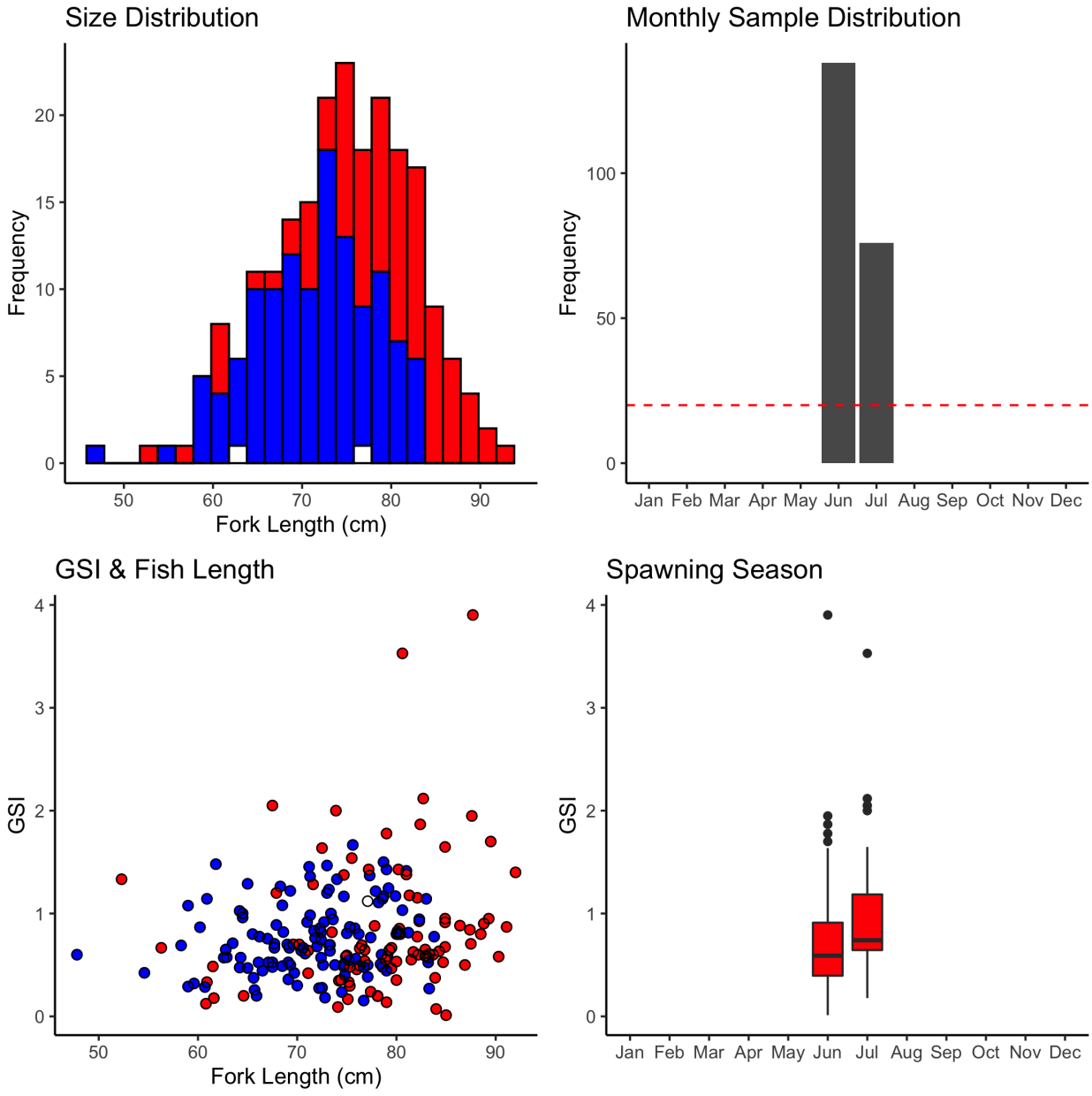

Figure B-36. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus rubrioperculatus

A total of 0 *Lethrinus rubrioperculatus* samples (females=0, males=0, unknown/na=0) have been collected to date (2022-12-02).

Lutjanus kasmira

A total of 0 *Lutjanus kasmira* samples (females=0, males=0`, unknown/na=0) have been collected to date (2022-12-02).

Pristipomoides auricilla

A total of 212 *Pristipomoides auricilla* samples (females=78, males=129, unknown/na=5) have been collected to date (2022-12-02). Median fork length is 34.3 cm (min=22.5 cm, max=40.3 cm).

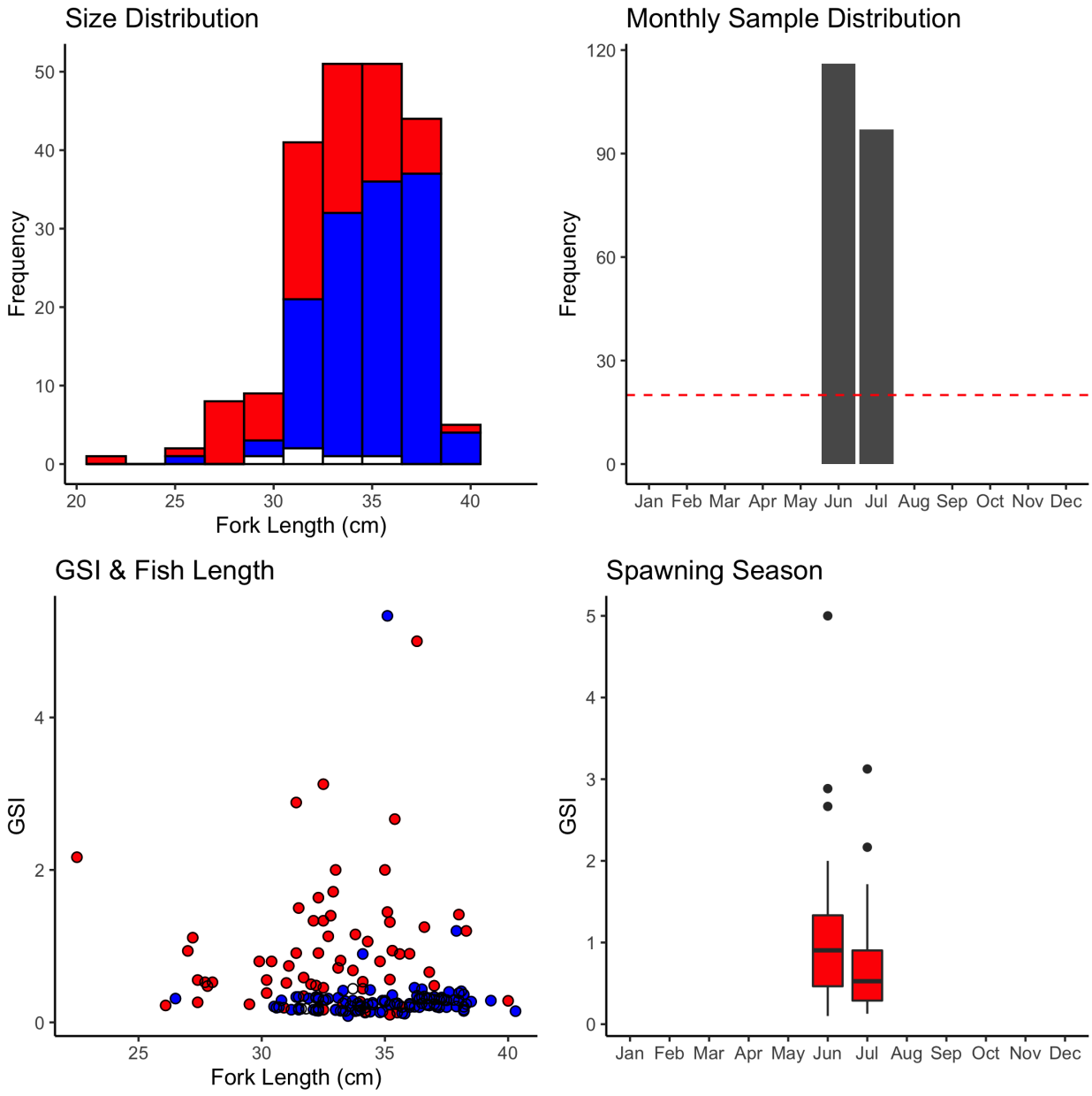

Figure B-37. *P. auricilla* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides filamentosus

A total of 133 *Pristipomoides filamentosus* samples (females=49, males=83, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 48.4 cm (min=15.06 cm, max=65.3 cm).

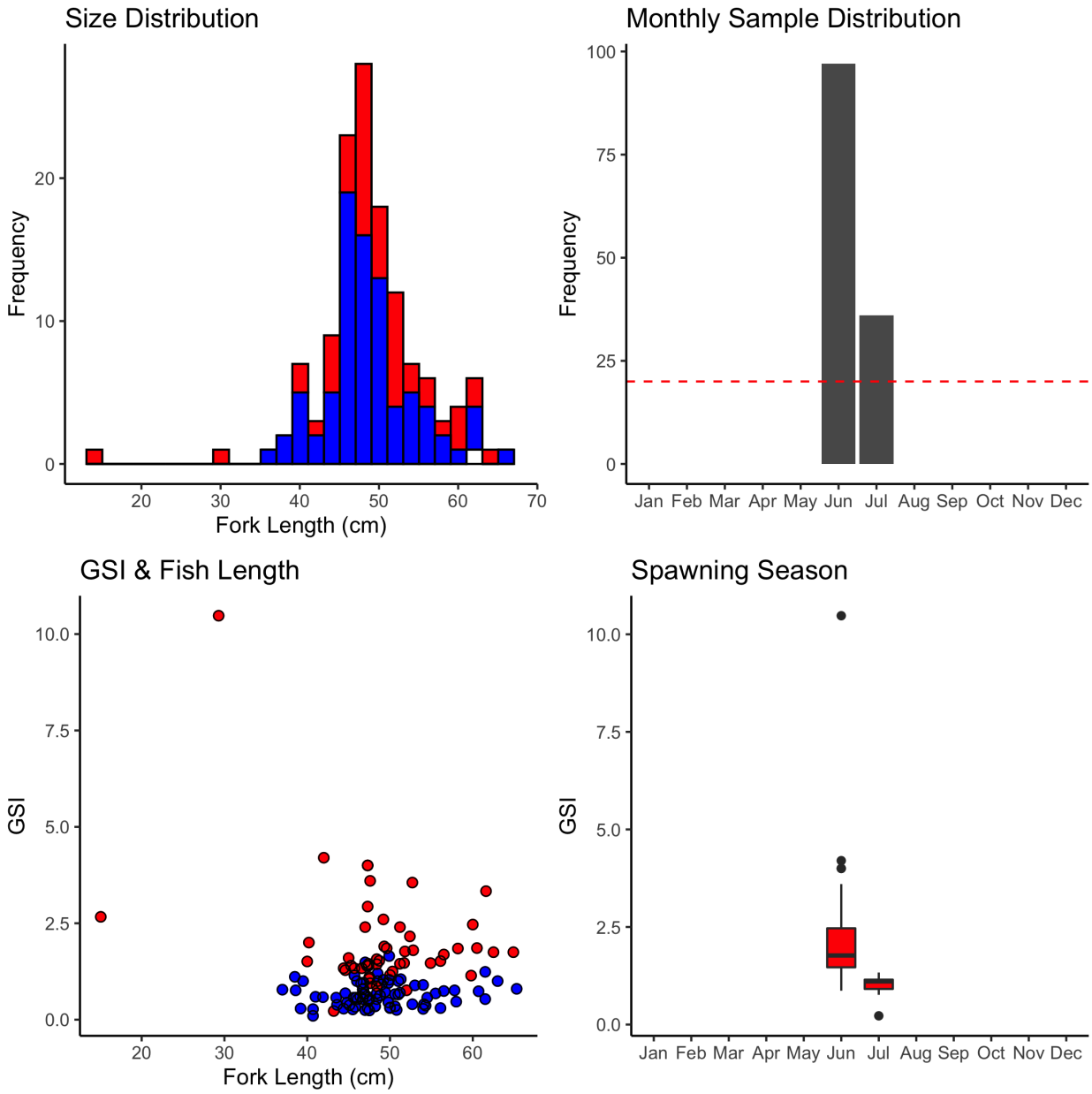

Figure B-38. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides flavipinnis

A total of 65 *Pristipomoides flavipinnis* samples (females=26, males=37, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 37.4 cm (min=30.4 cm, max=53.2 cm).

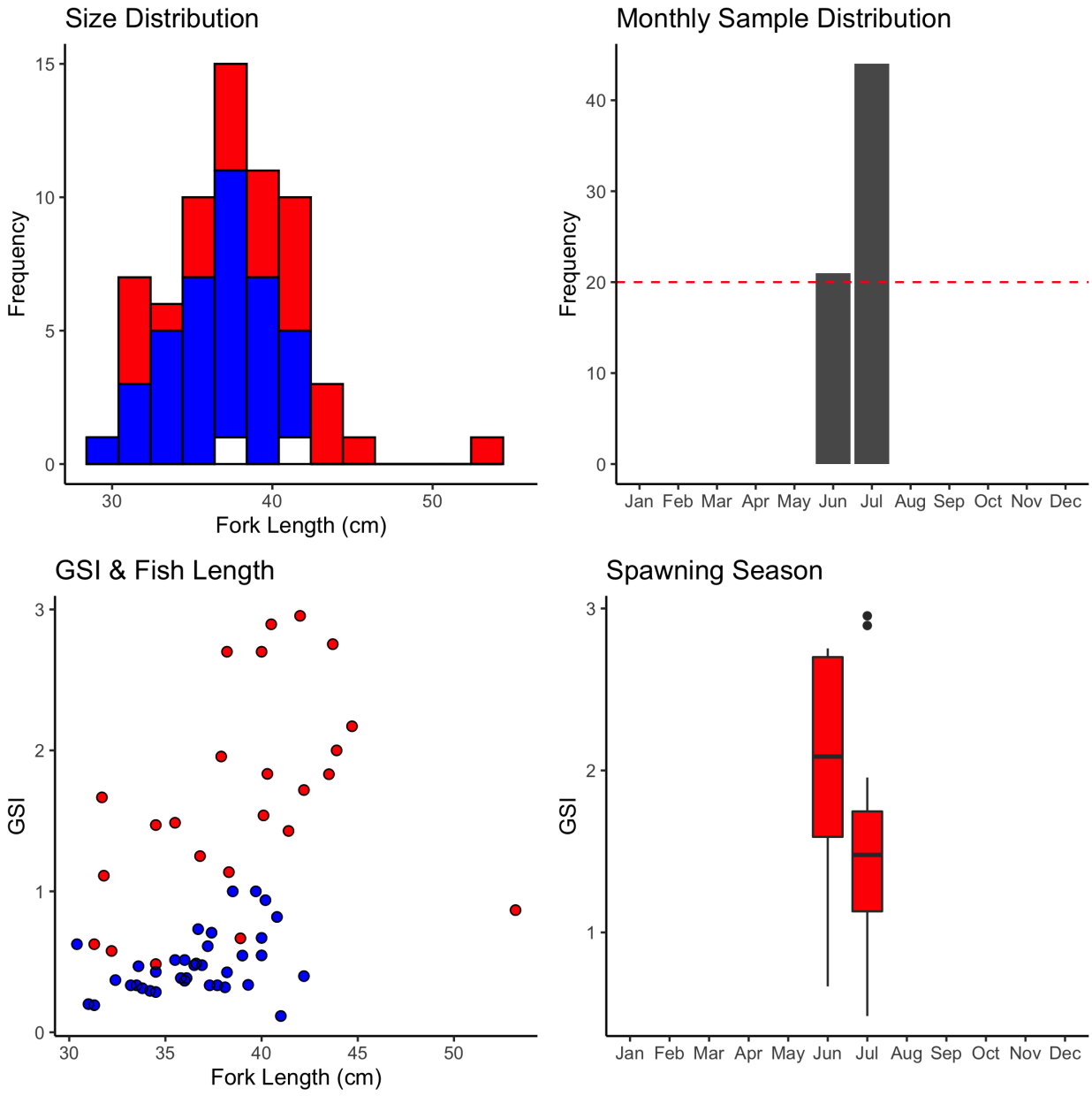

Figure B-39. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides sieboldii

A total of 6 *Pristipomoides sieboldii* samples (females=2, males=3, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 32.5 cm (min=32.2 cm, max=35.2 cm).

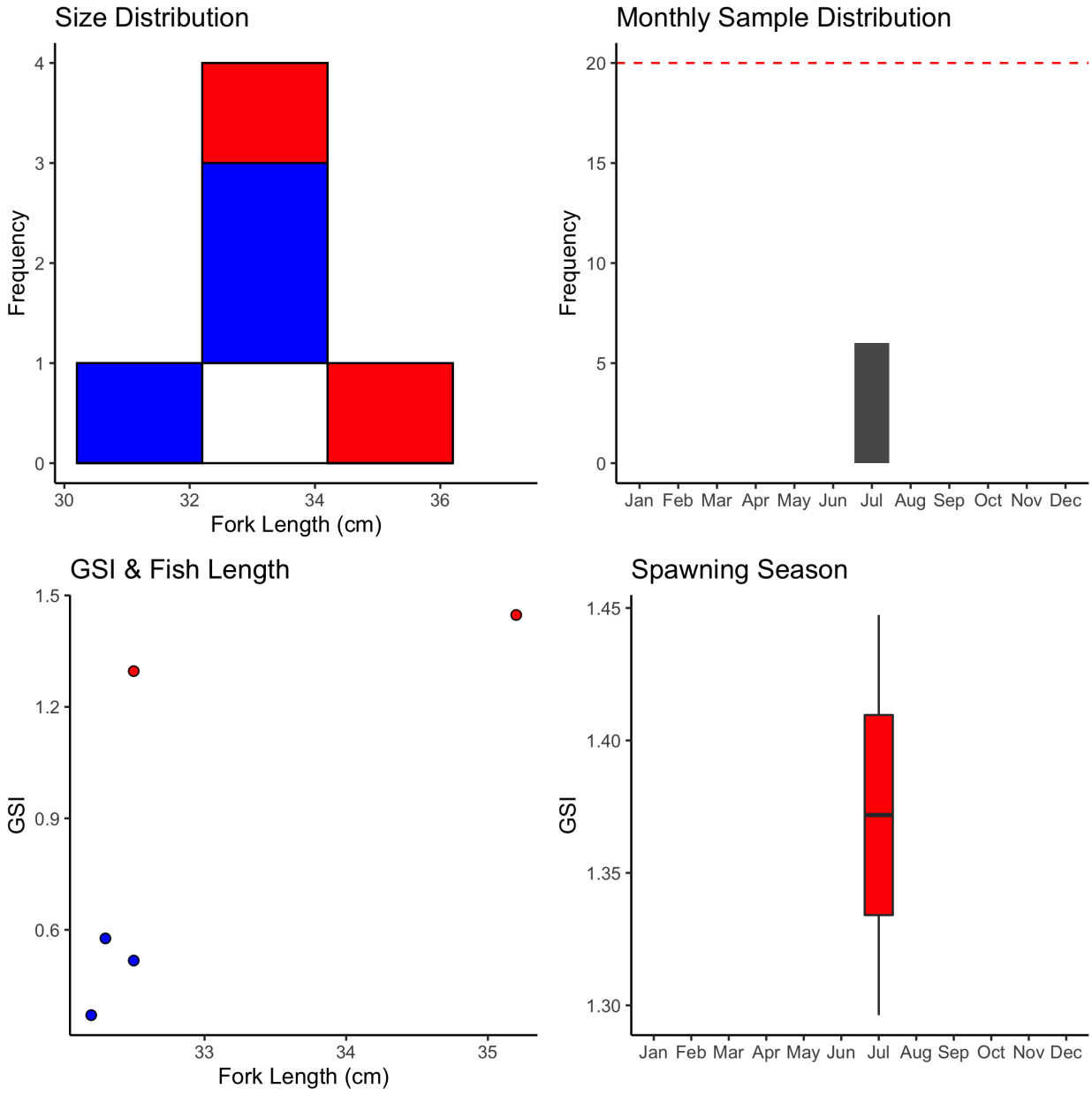

Figure B-40. *P. sieboldii* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides zonatus

A total of 485 *Pristipomoides zonatus* samples (females=329, males=102, unknown/na=54) have been collected to date (2022-12-02). Median fork length is 36.2 cm (min=23.3 cm, max=68 cm).

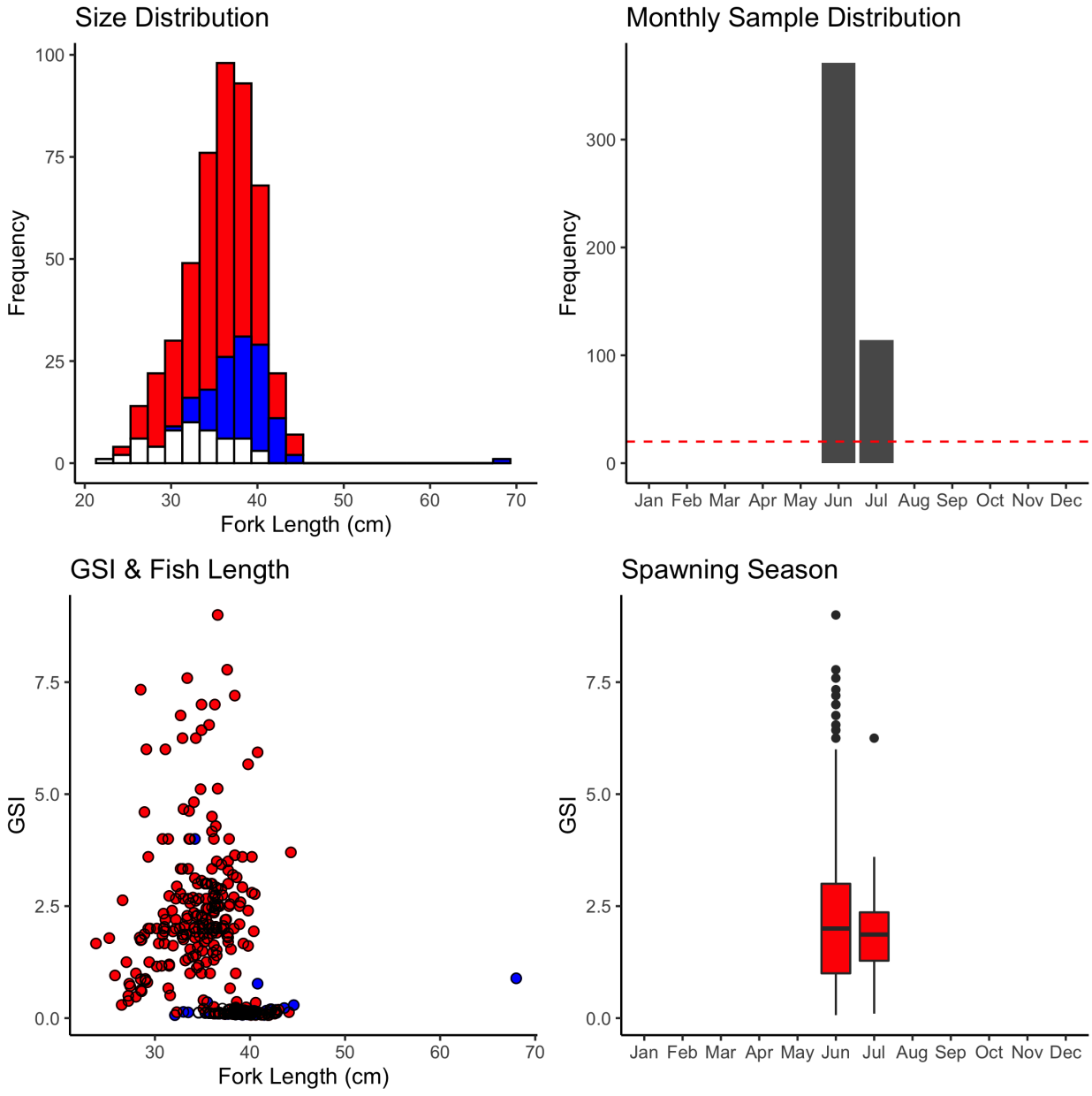

Figure B-41. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Variola louti

A total of 6 *Variola louti* samples (females=2, males=4, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 36.55 cm (min=25.9 cm, max=41.1 cm).

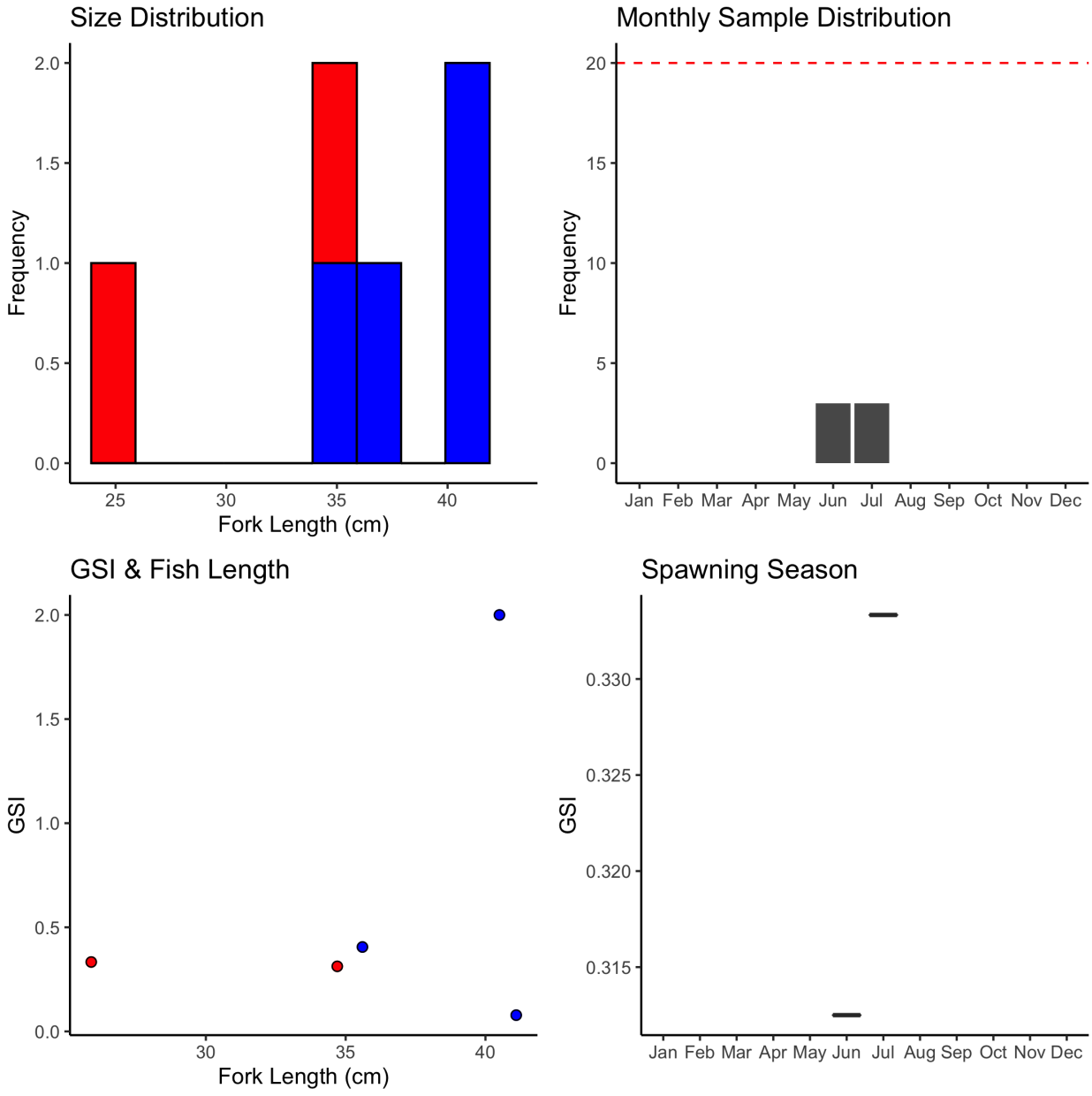

Figure B-42. *V. louti* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Non-BMUS

Acanthurus lineatus

A total of 272 *Acanthurus lineatus* samples (females=68, males=96, unknown/na=108) have been collected to date (2022-12-02). Median fork length is 19.2 cm (min=6.9 cm, max=23.9 cm).

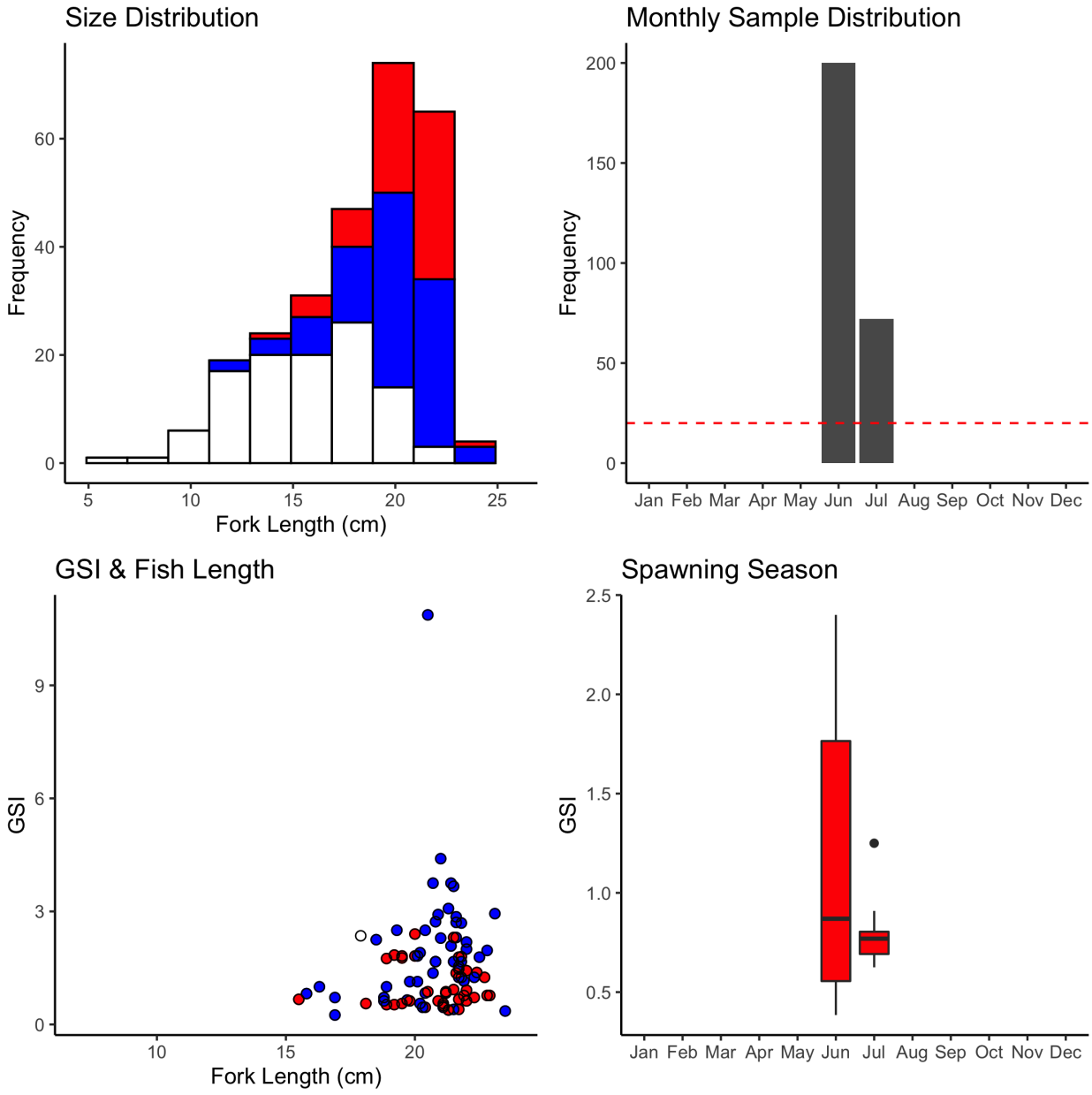

Figure B-43. *A. lineatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx melampygus

A total of 224 *Caranx melampygus* samples (females=132, males=90, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 42 cm (min=24.1 cm, max=79 cm).

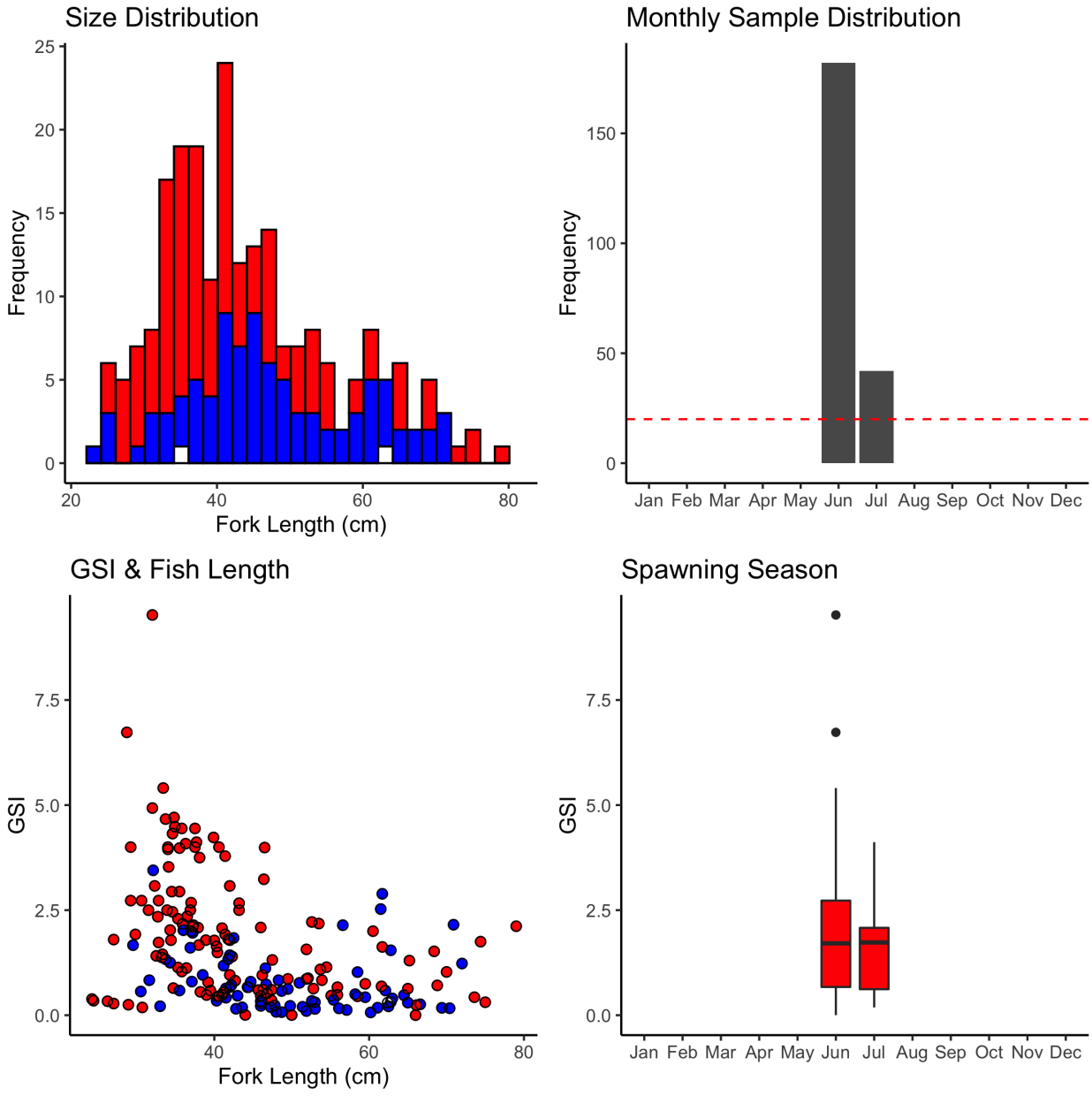

Figure B-44. *C. melampygus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cephalopholis argus

A total of 223 *Cephalopholis argus* samples (females=131, males=57, unknown/na=35) have been collected to date (2022-12-02). Median fork length is 31.5 cm (min=6.5 cm, max=44.9 cm).

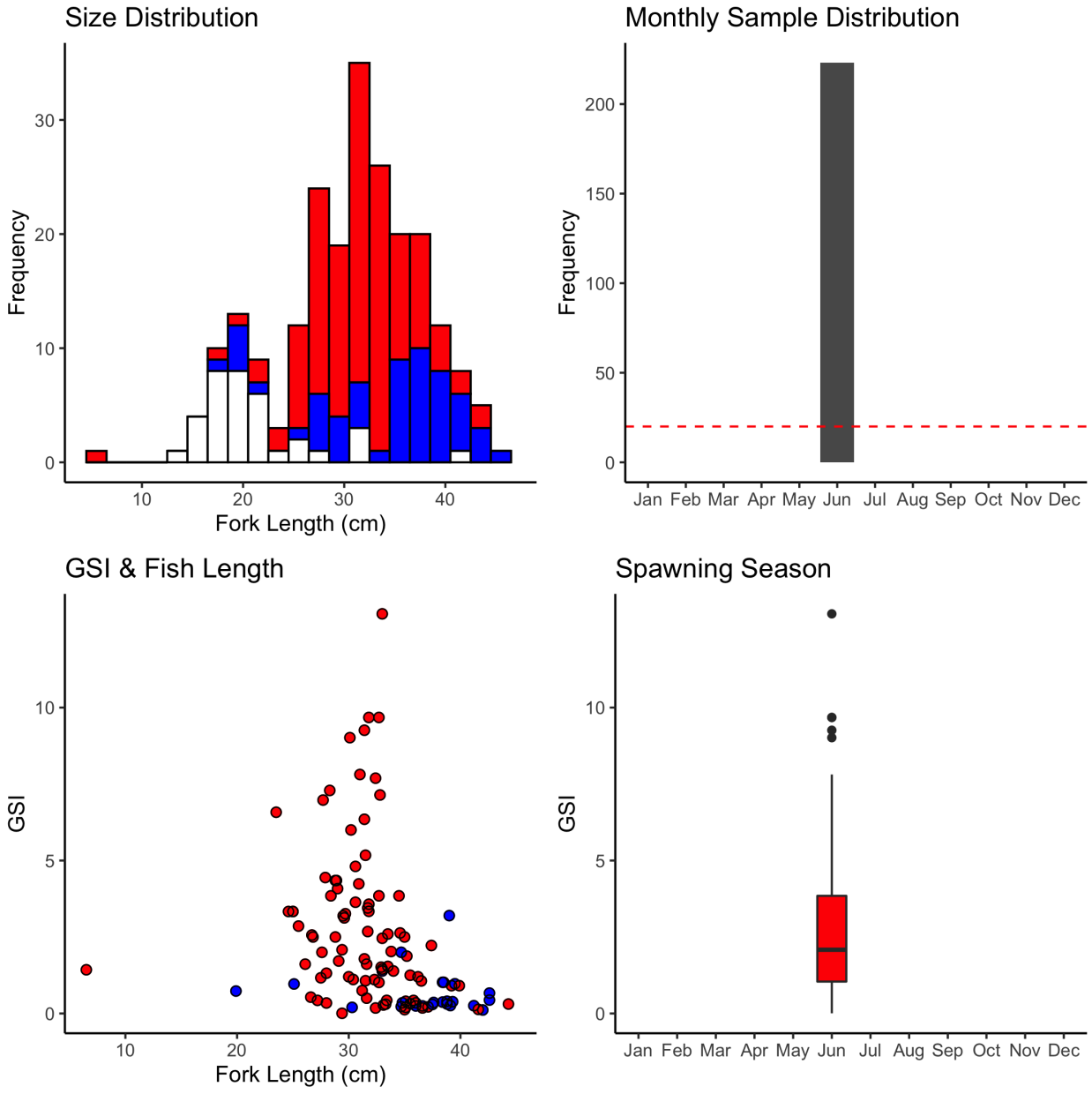

Figure B-45. *C. argus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Monotaxis grandoculis

A total of 171 *Monotaxis grandoculis* samples (females=80, males=69, unknown/na=22) have been collected to date (2022-12-02). Median fork length is 29.8 cm (min=8.6 cm, max=40 cm).

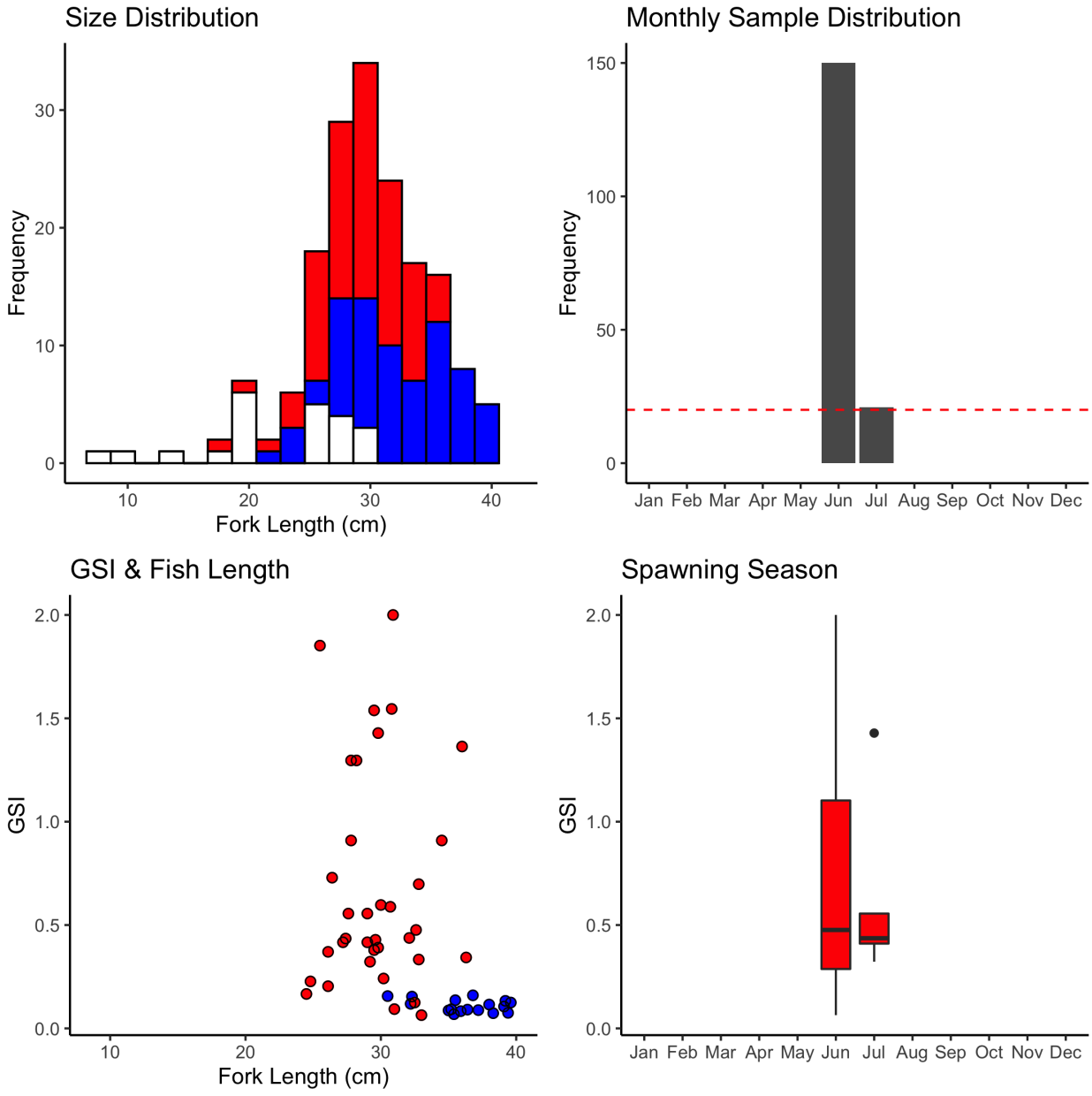

Figure B-46. *M. grandoculis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso lituratus

A total of 274 *Naso lituratus* samples (females=144, males=97, unknown/na=33) have been collected to date (2022-12-02). Median fork length is 24.2 cm (min=10.5 cm, max=30.4 cm).

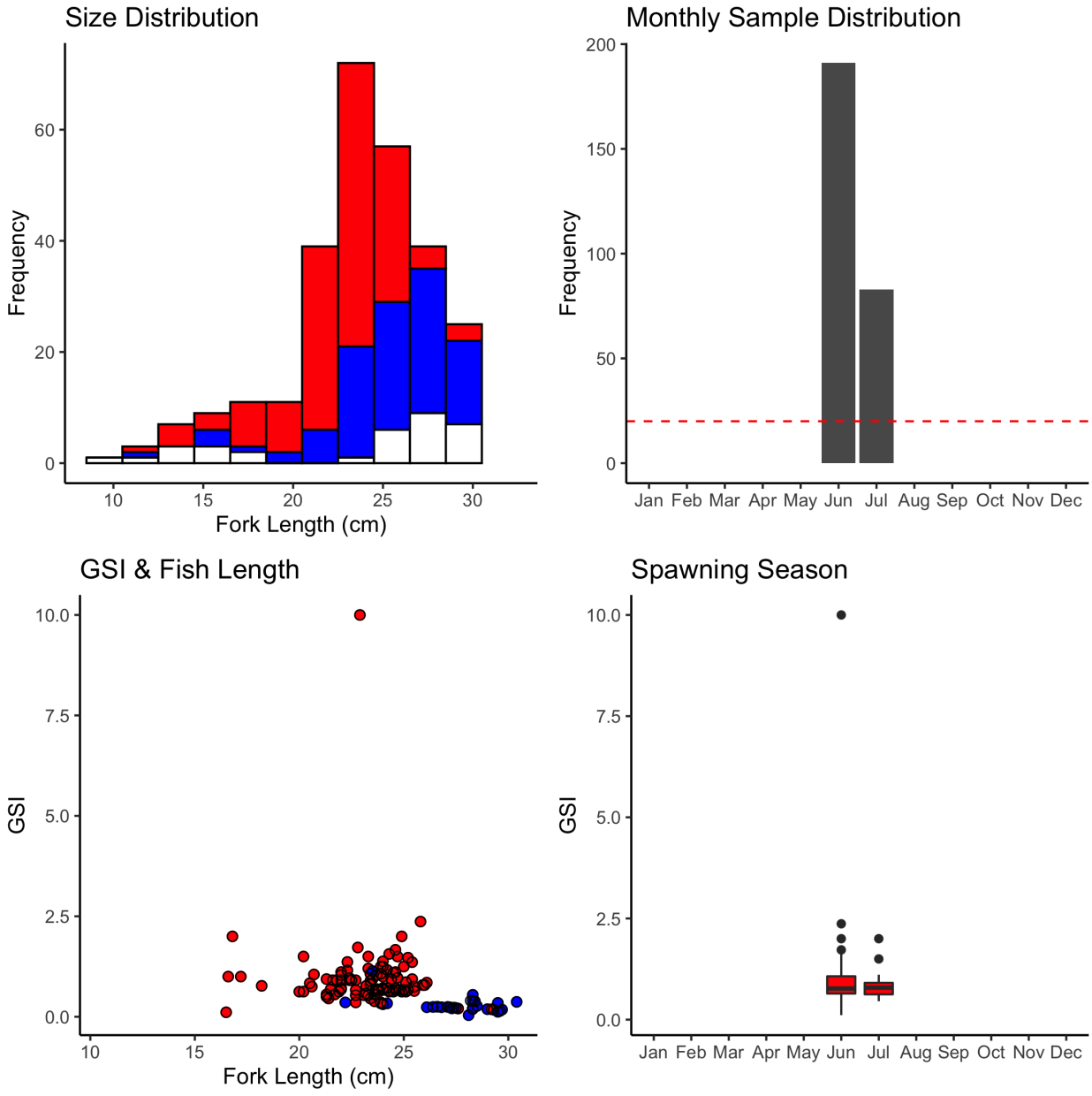

Figure B-47. *N. literatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso unicornis

A total of 178 *Naso unicornis* samples (females=84, males=81, unknown/na=13) have been collected to date (2022-12-02). Median fork length is 35.8 cm (min=16.5 cm, max=52 cm).

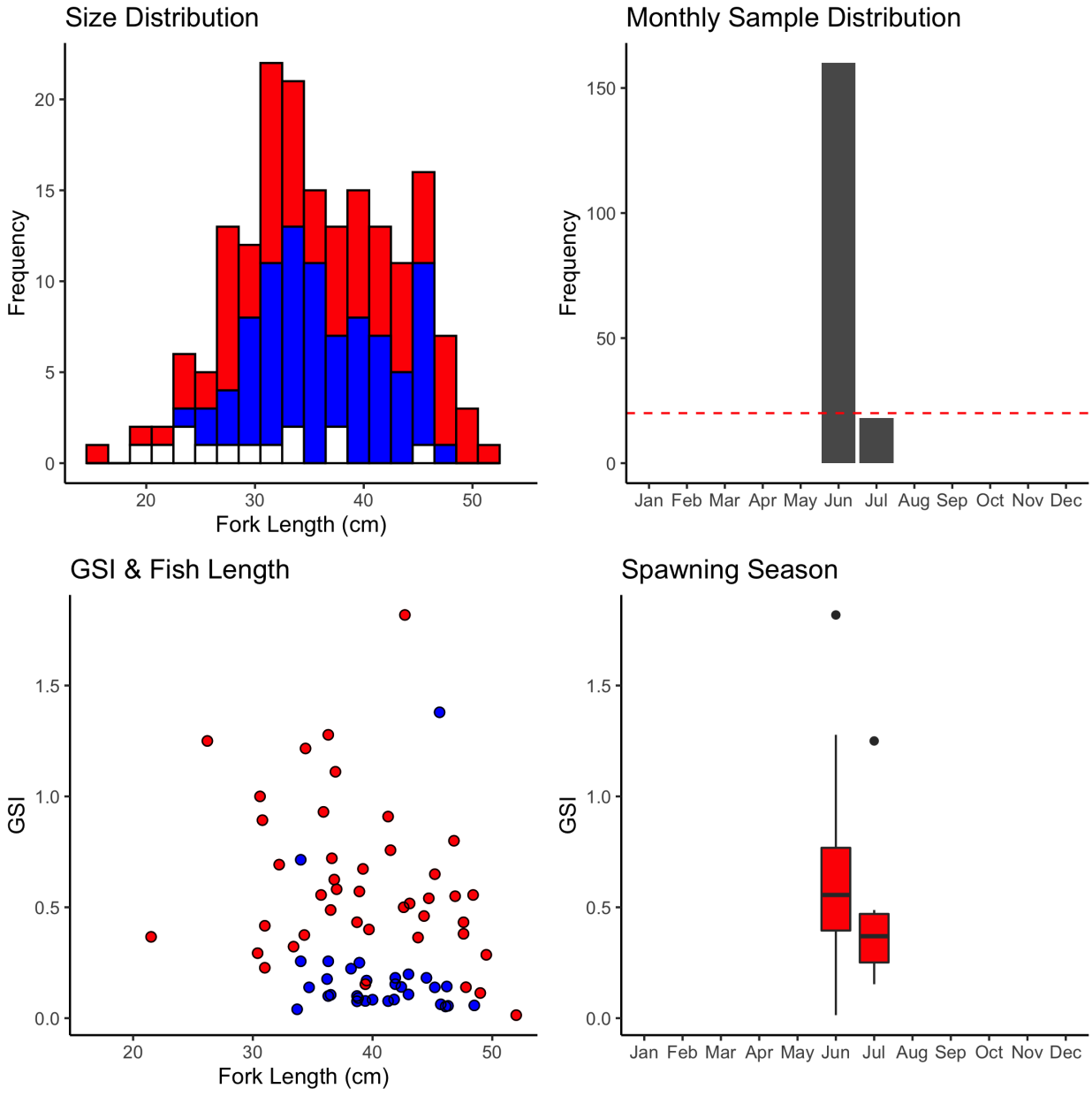

Figure B-48. *N. unicornis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Scarus rubroviolaceus

A total of 259 *Scarus rubroviolaceus* samples (females=132, males=100, unknown/na=27) have been collected to date (2022-12-02). Median fork length is 33.6 cm (min=17.2 cm, max=51.8 cm).

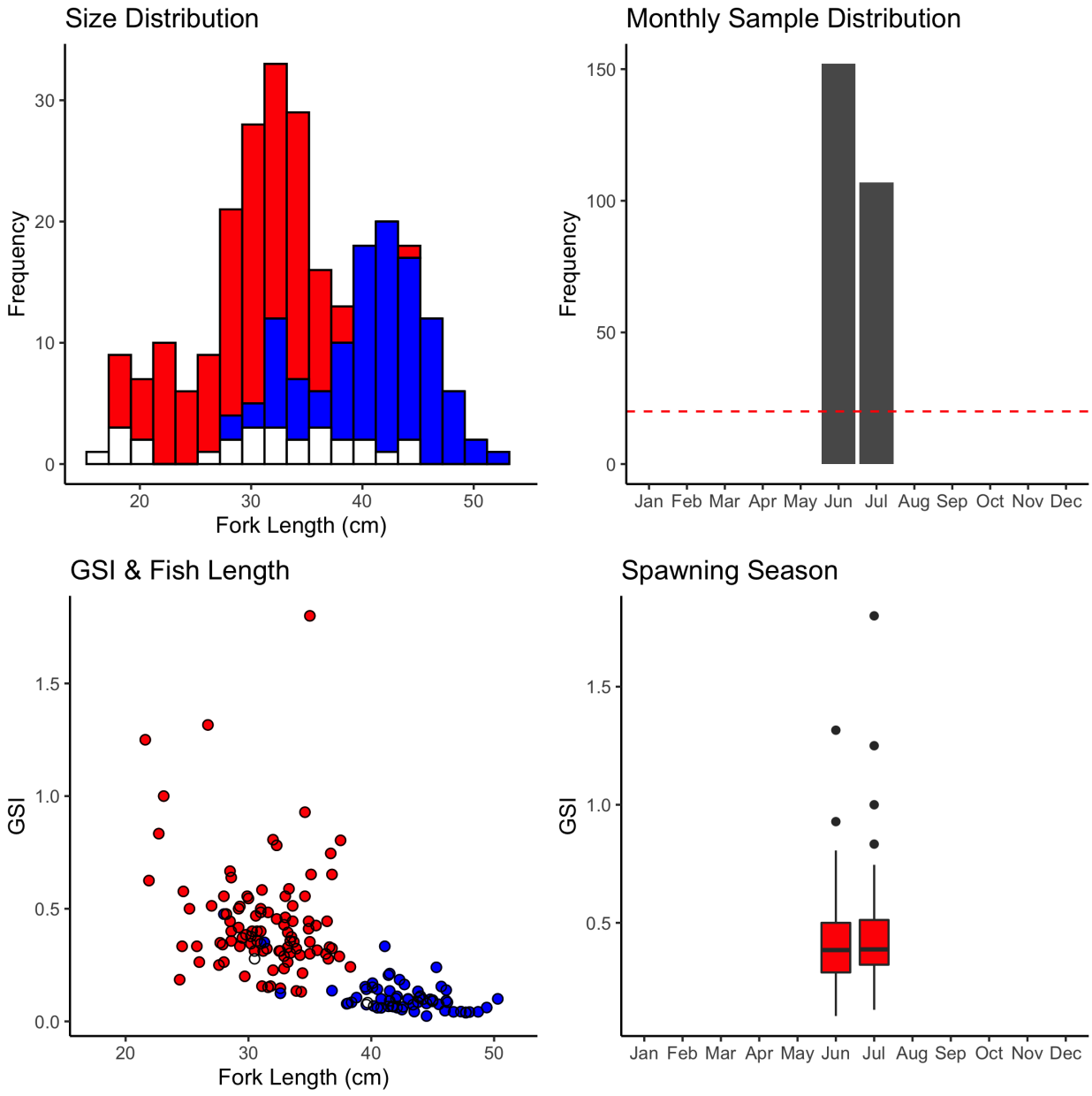

Figure B-49. *S. rubroviolaceus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Zanclus cornutus

A total of 202 *Zanclus cornutus* samples (females=124, males=76, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 17.2 cm (min=13 cm, max=20.8 cm).

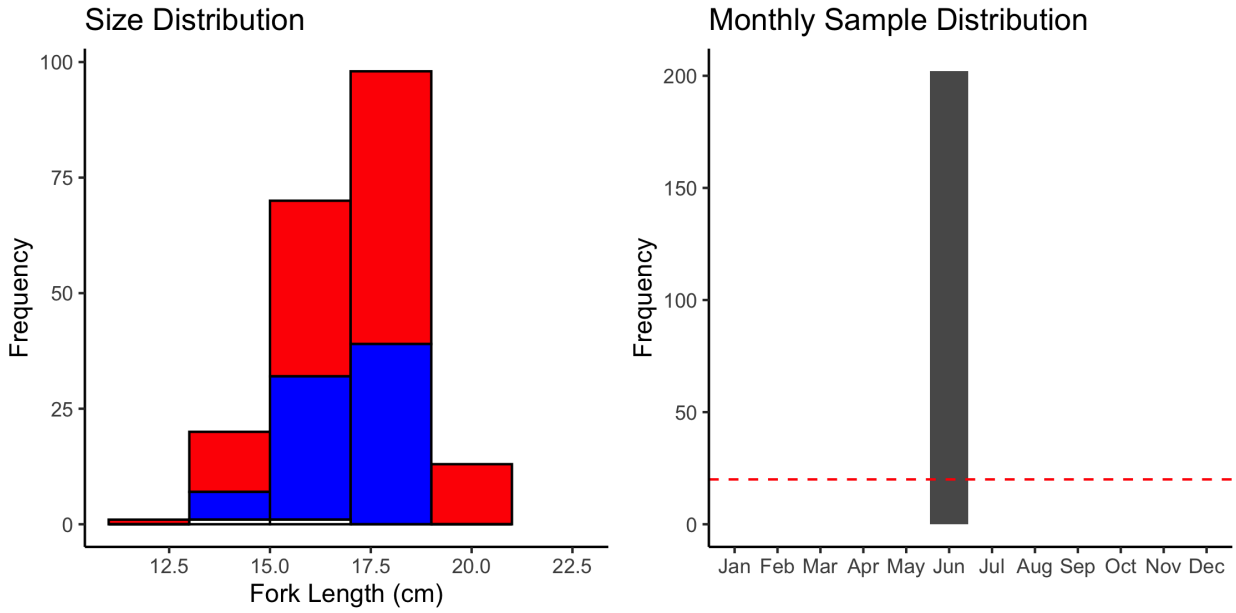

Figure B-50. Z. cornutus sampling summaries for size distribution and monthly sample collection. Gonad weight was not recorded for this species and thus GSI and fish length and spawning season summary figures are not available at this time.

Appendix C: American Samoa Fished Species Summaries

Updated April 2022 (current through December 2021)

The following species were sampled through the Territory Commercial Fisheries Biosampling Program and NOAA life history surveys and are reviewed in this appendix for completeness of sampling to assess regional life history parameters for age, growth, and reproduction.

Bottomfish Management Unit Species (BMUS):
Aphareus rutilans
Aphareus virescens
Caranx lugubris
Etelis carbunculus
Etelis coruscans
Lethrinus rubrioperculatus
Lutjanus kasmira
Pristipomoides filamentosus
Pristipomoides flavipinnis
Pristipomoides zonatus
Variola louti

Non-BMUS:
Lethrinus xanthochilus
Lutjanus rufolineatus
Myripristis amaena
Myripristis berndti
Myripristis murdjan
Naso unicornis
Sargocentron tiere

This species summary is a guide to inform future sampling collection efforts and life history assessments. Species with completed life history assessments for the territory are excluded unless continued sample collection is recommended for additional research to meet fisheries science and management needs. All BMUS and non-BMUS with a sample size greater or equal to 50 are included in this appendix. Sample sizes should be considered as approximate as there is not always an otolith and gonad for every entry in the database due to otoliths breaking or gonads not being collected.

Data for each species are reviewed across four categories: fish size distribution, monthly sample distribution, relationship between gonadosomatic index (GSI) and fish length, and mean female GSI by month. Each of these categories allows for a review of the sample collection progress to meet the needs of the life history assessments for age, growth, spawning season, and size/age at maturity.

Size distribution: The length frequency distribution is a proxy for looking at the sampling coverage to estimate age and growth. It also allows for a first look at the size distribution of females and males. This is a proxy and histological assessment is recommended to confirm gender and to identify unknowns.

Monthly sample distribution: The total number of samples per month are plotted. A sample size of 20 individuals per month is recommended (red dashed line).

GSI and fish length: Gonadosomatic index (gonad weight/fish weight *100) is plotted against fish size to visualize the sample distribution as a proxy for size at maturity.

Spawning season: Female Gonadosomatic Index (GSI) is plotted by month to visualize if sampling is adequate to determine spawning seasonality.

Bottomfish Management Unit Species

Aphareus rutilans

A total of 102 *Aphareus rutilans* samples (females=59, males=42, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 51.8 cm (min=30.9 cm, max=95.9 cm).

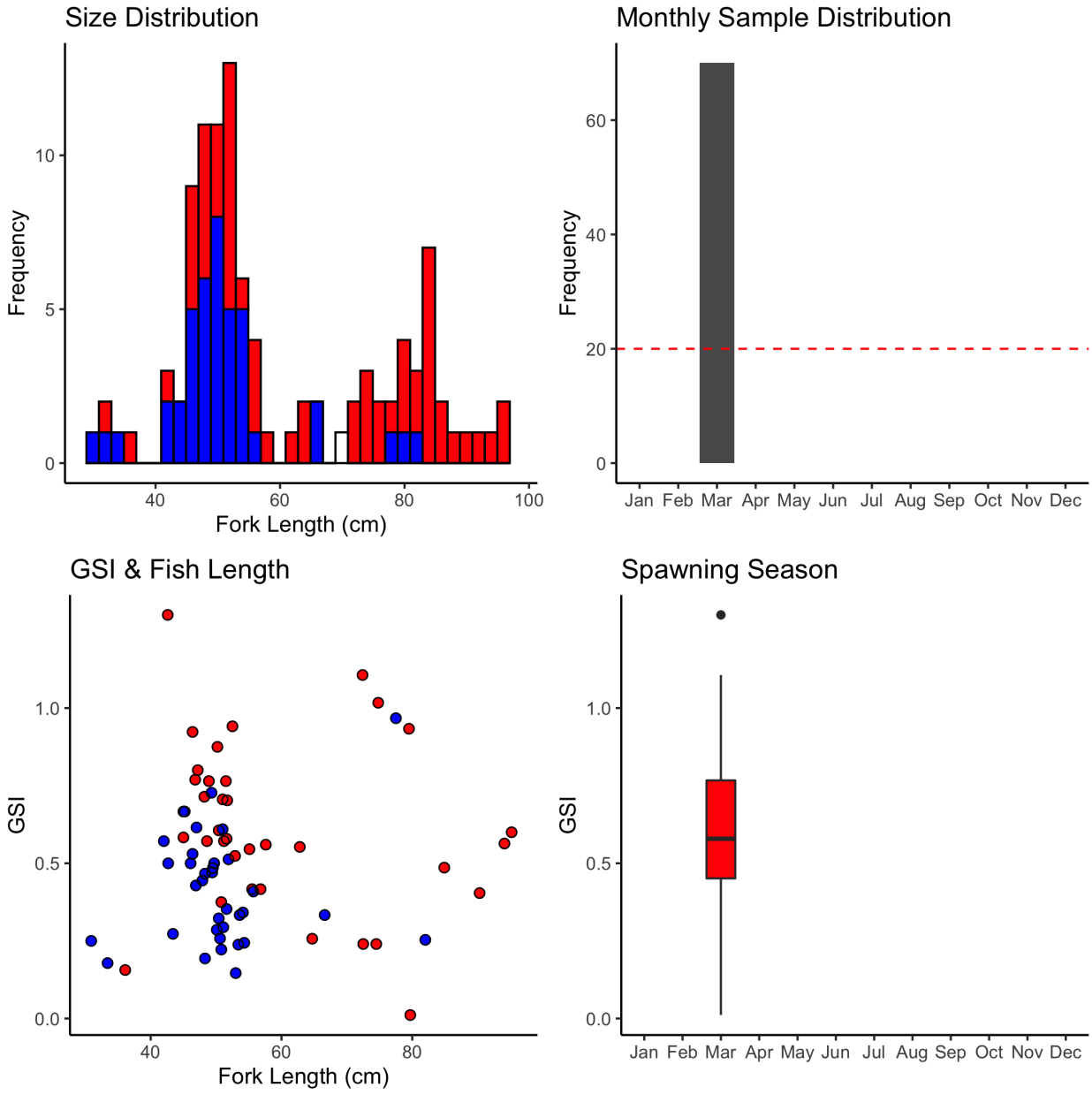

Figure C-1. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Aprion virescens

A total of 102 *Aprion virescens* samples (females=59, males=42, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 51.8 cm (min=30.9 cm, max=95.9 cm).

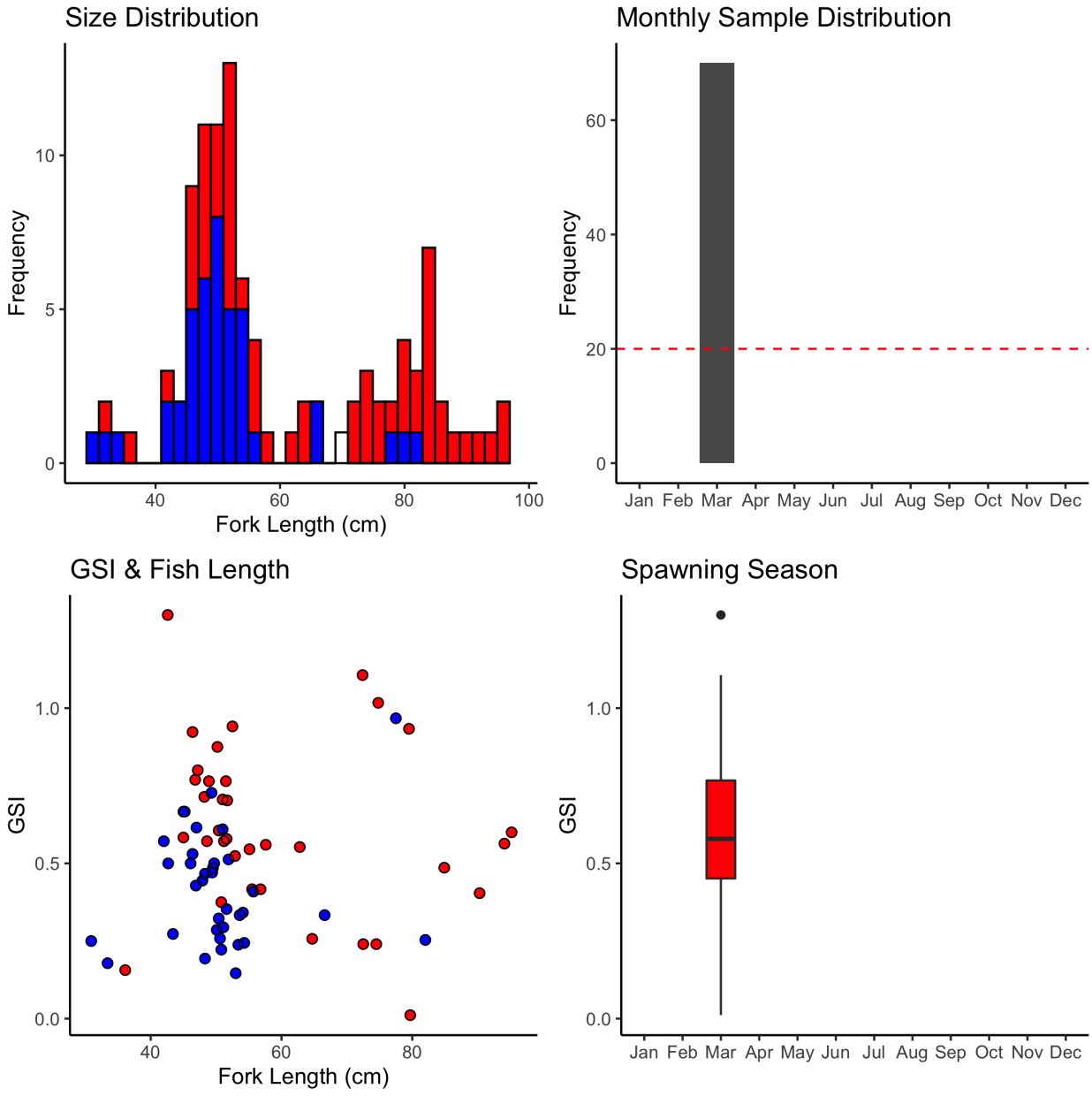

Figure C-2. *A. virescens* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx lugubris

A total of 0 *Caranx lugubris* samples (females=NA, males=NA, unknown/na=NA) have been collected to date (2022-12-02).

Etelis carbunculus

A total of 183 *Etelis carbunculus* samples (females=122, males=60, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 33.3 cm (min=23.7 cm, max=85.8 cm).

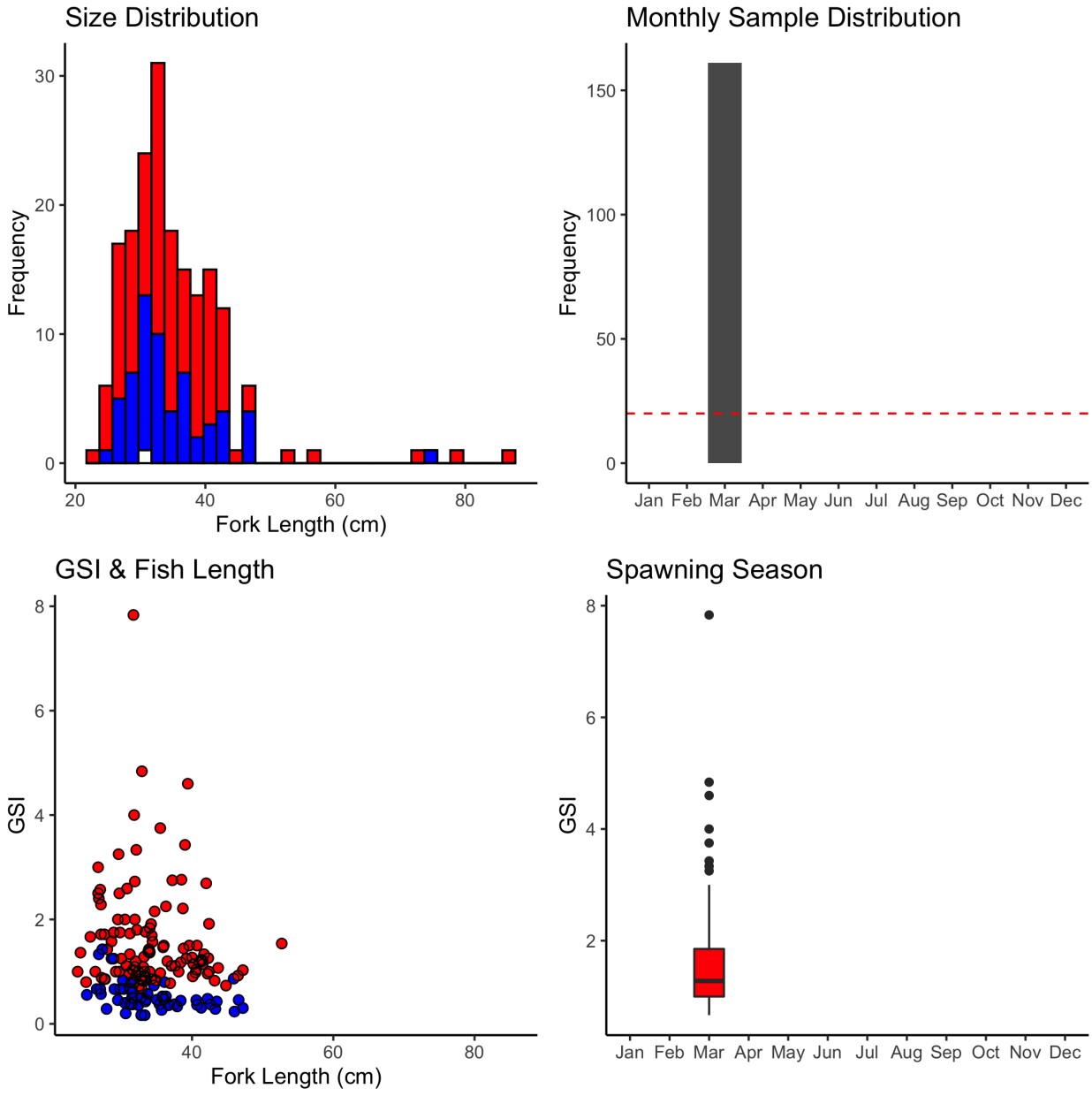

Figure C-3. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 155 *Etelis coruscans* samples (females=81, males=73, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 70.8 cm (min=45.6 cm, max=88.7 cm).

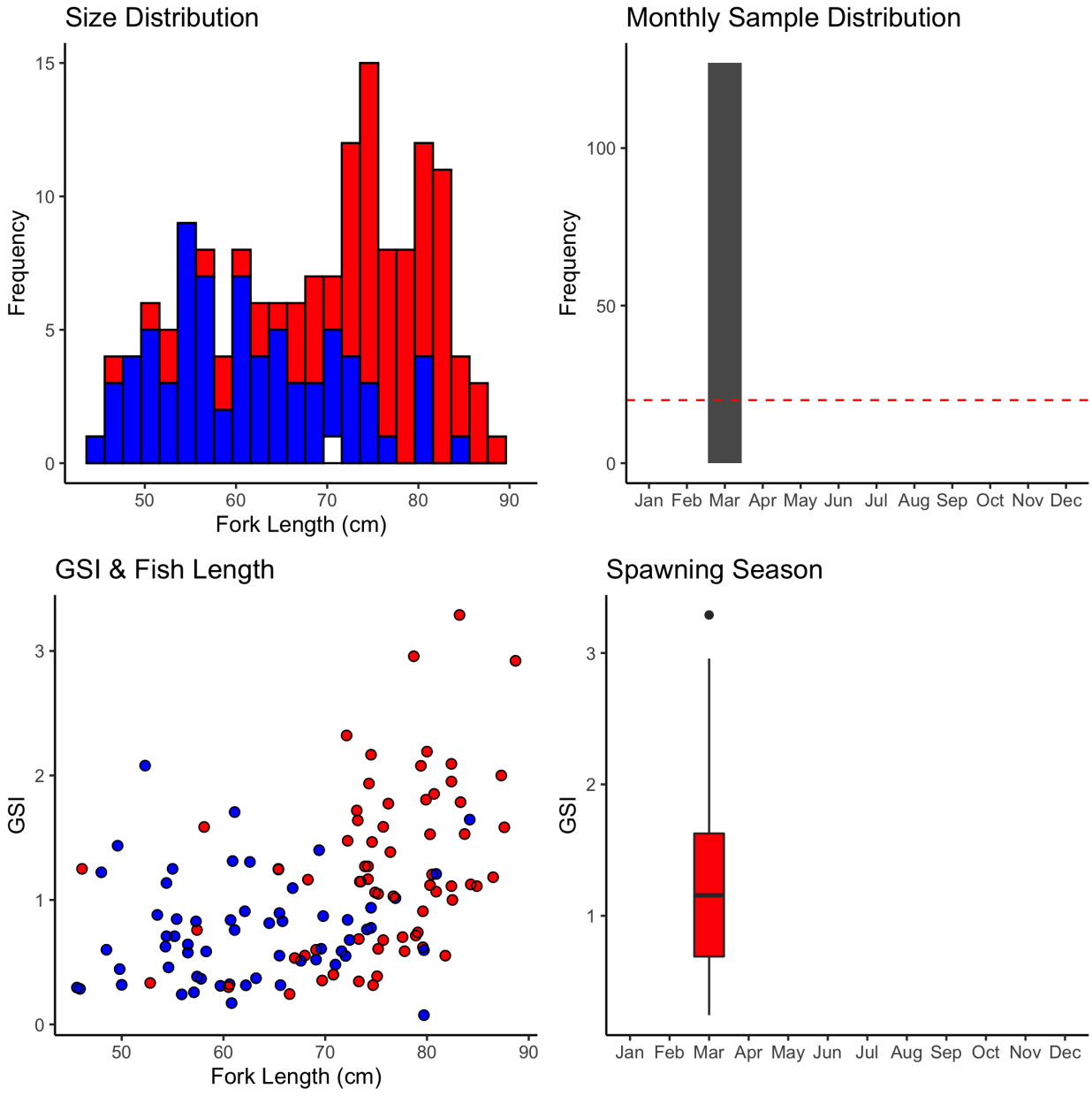

Figure C-4. *E. corcuscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus rubrioperculatus

A total of 0 *Lethrinus rubrioperculatus* samples (females=NA, males=NA, unknown/na=NA) have been collected to date (2022-12-02).

Lutjanus kasmira

A total of 155 *Lutjanus kasmira* samples (females=81, males=73, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 70.8 cm (min=45.6 cm, max=88.7 cm).

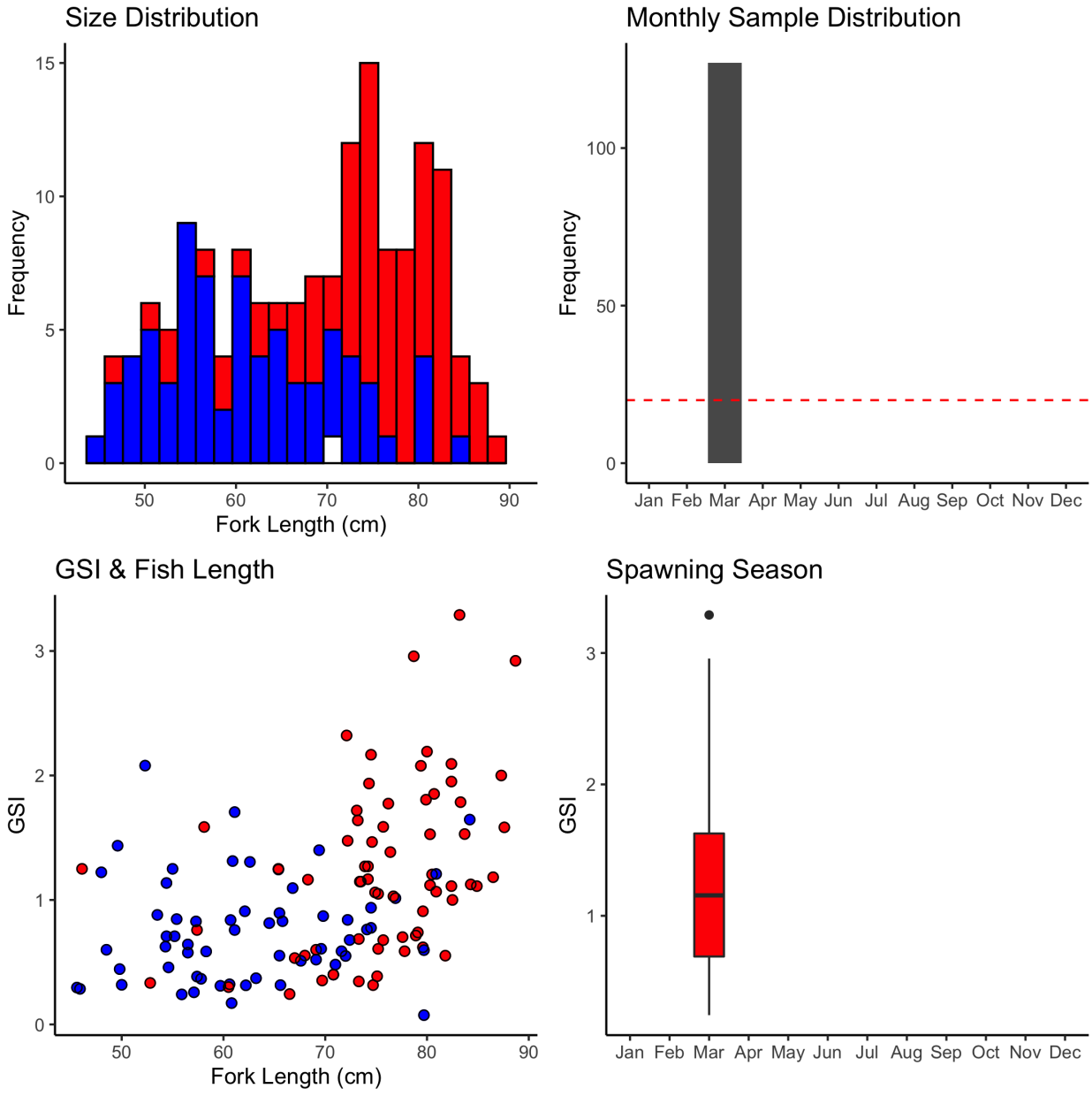

Figure C-5. *L. kasmira* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides filamentosus

A total of 66 *Pristipomoides filamentosus* samples (females=24, males=42, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 40.85 cm (min=34.1 cm, max=54.4 cm).

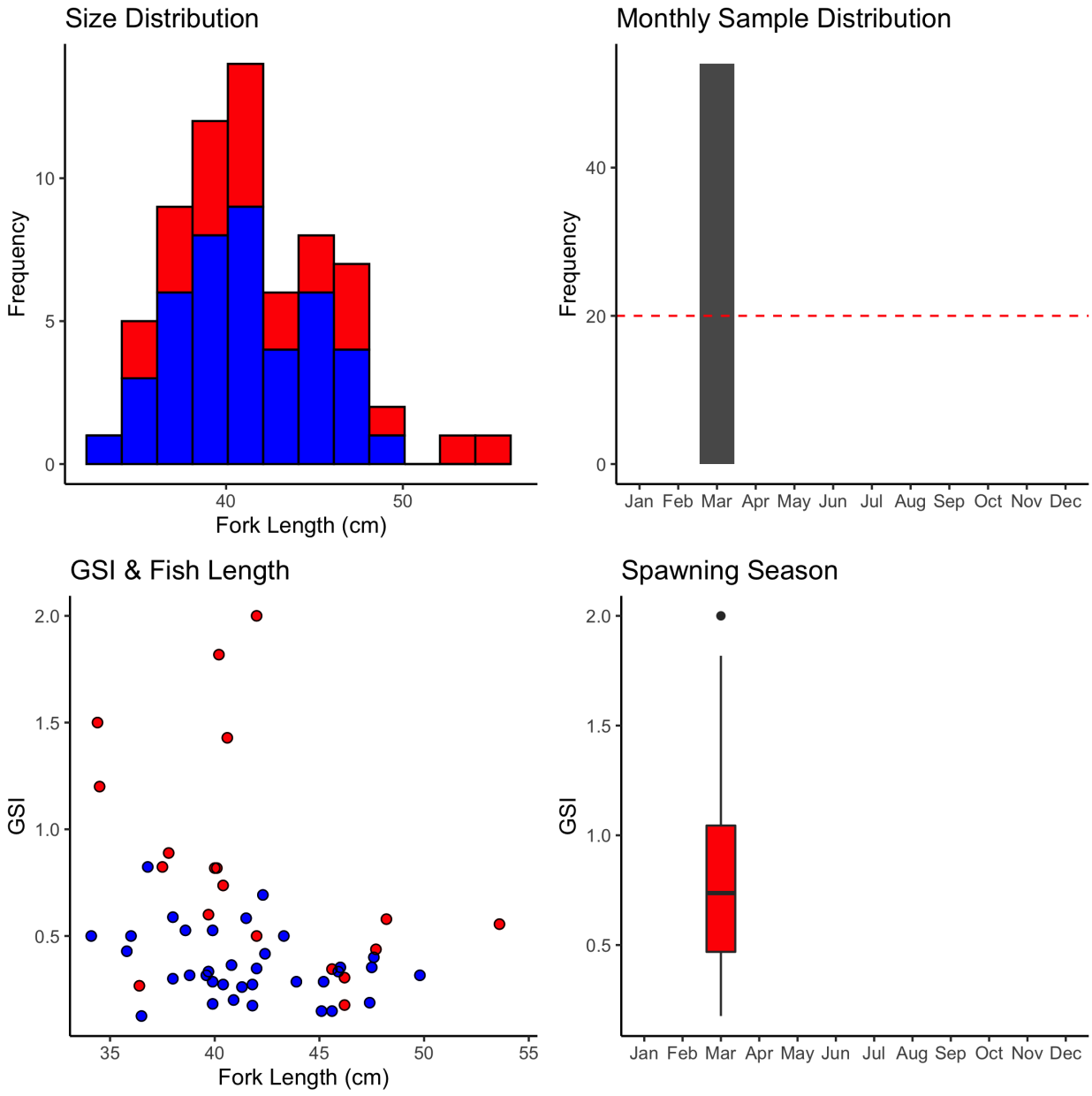

Figure C-6. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides flavipinnis

A total of 274 *Pristipomoides flavipinnis* samples (females=124, males=148, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 39.7 cm (min=32.5 cm, max=47.4 cm).

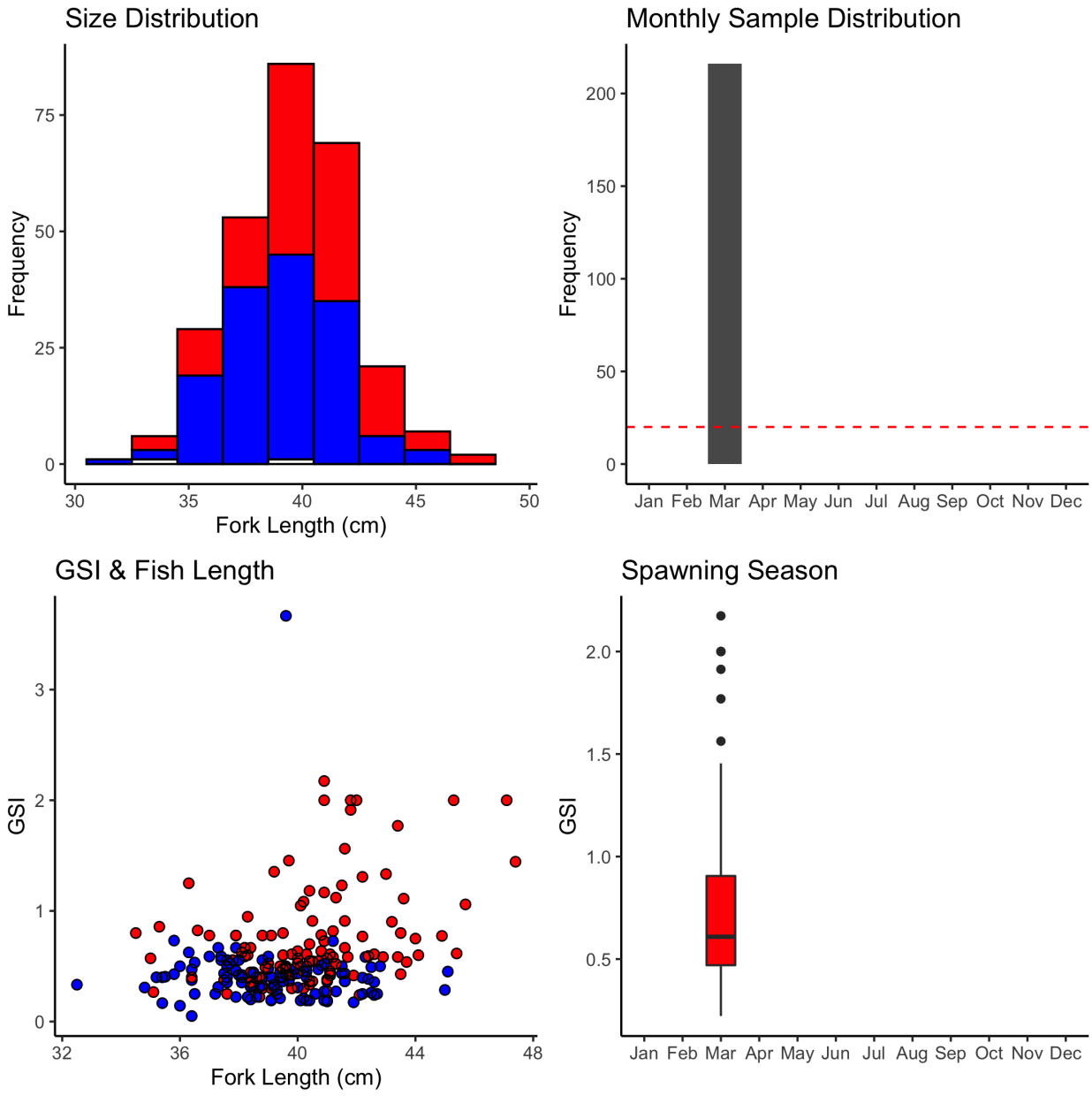

Figure C-7. *P. flavipinnus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides zonatus

A total of 83 *Pristipomoides zonatus* samples (females=56, males=17, unknown/na=10) have been collected to date (2022-12-02). Median fork length is 33 cm (min=23 cm, max=43.7 cm).

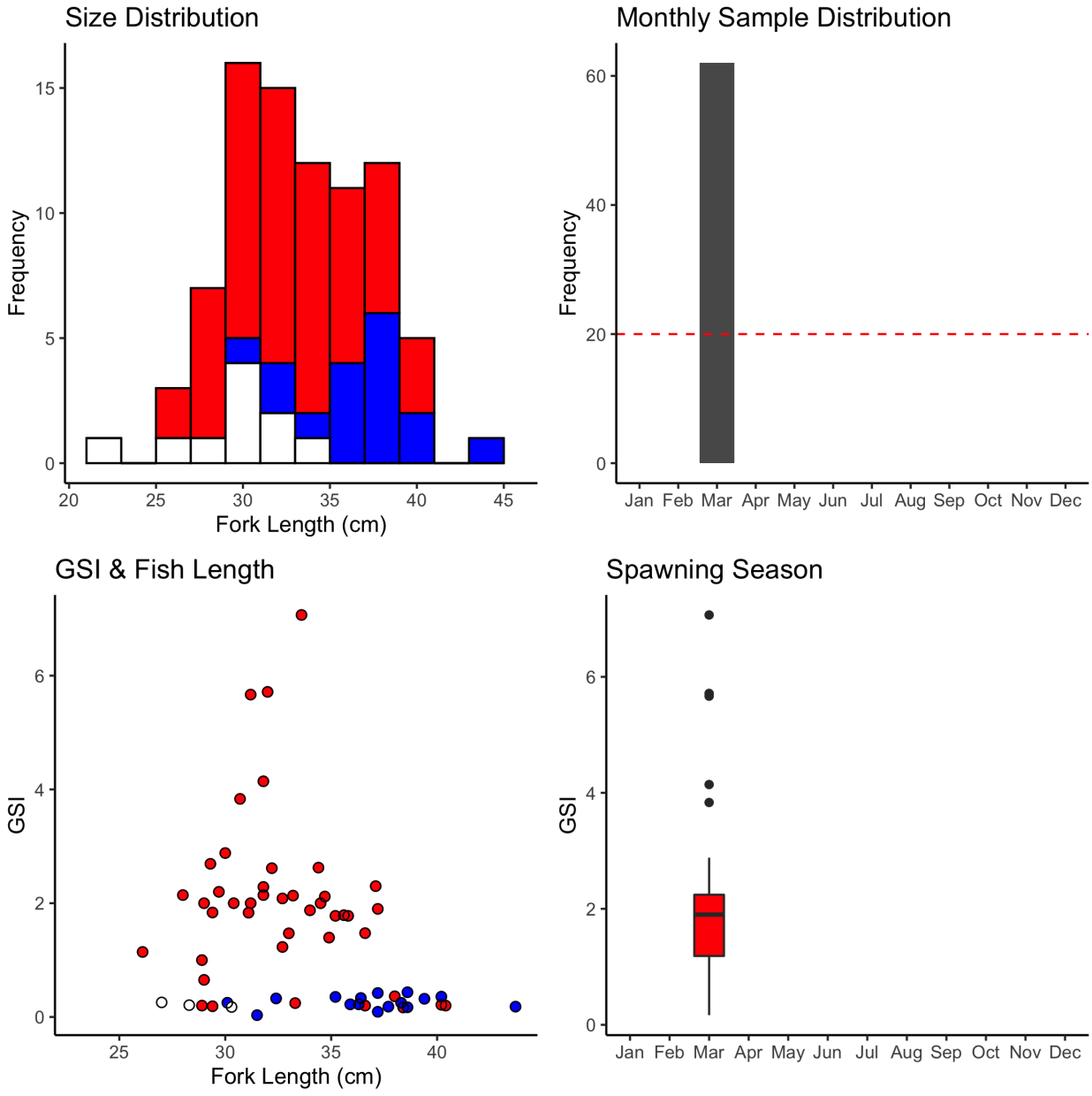

Figure C-8. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Variola louti

A total of 0 *Variola louti* samples (females=NA, males=NA, unknown/na=NA) have been collected to date (2022-12-02).

Non-BMUS

Lethrinus xanthochilus

A total of 397 *Lethrinus xanthochilus* samples (females=222, males=174, unknown/na=1) have been collected to date (2022-12-02). Median fork length is 37.2 cm (min=19 cm, max=54 cm).

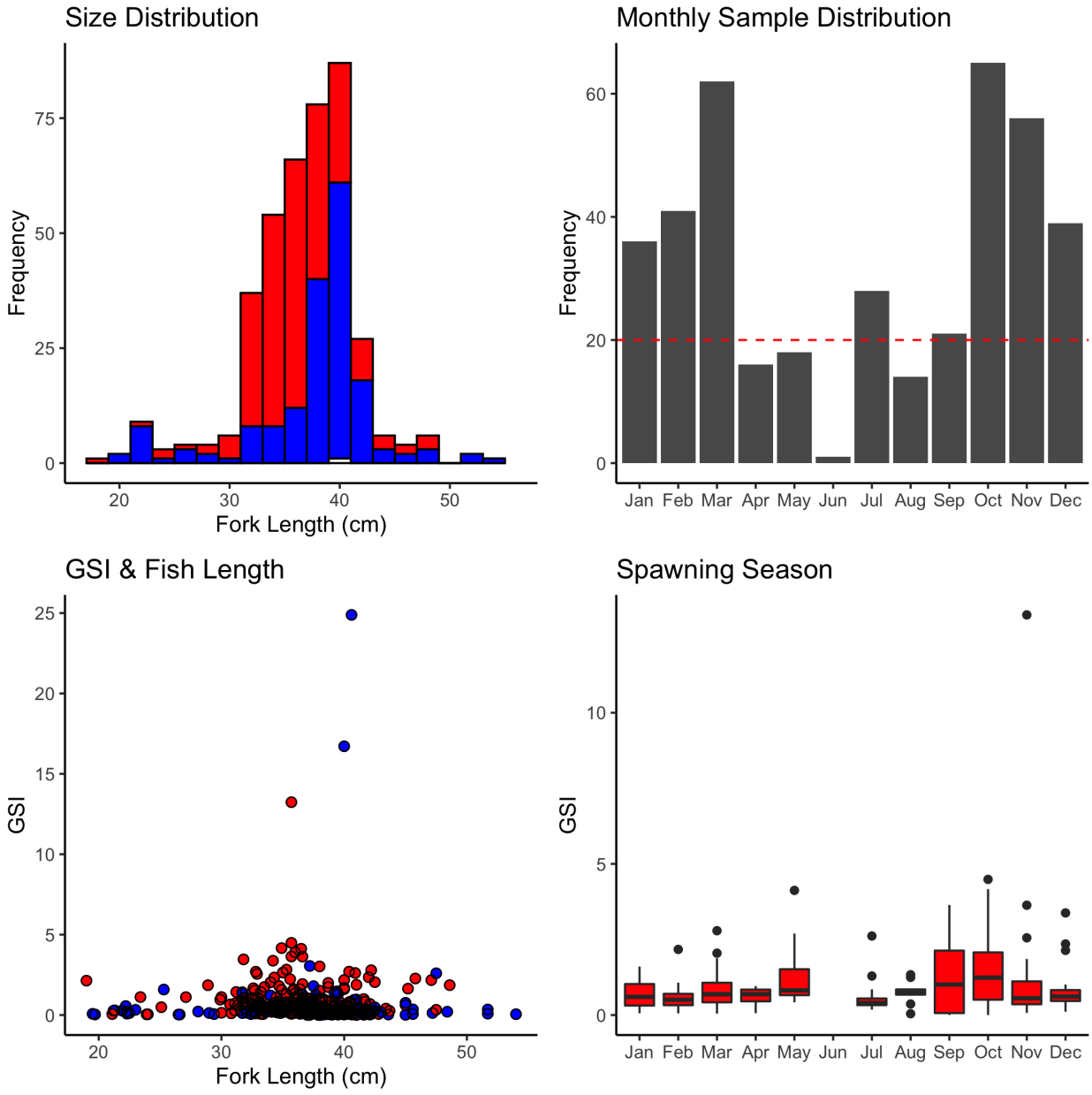

Figure C-9. *L. xanthochilus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lutjanus rufolineatus

A total of 260 *Lutjanus rufolineatus* samples (females=64, males=194, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 22 cm (min=14.9 cm, max=43.3 cm).

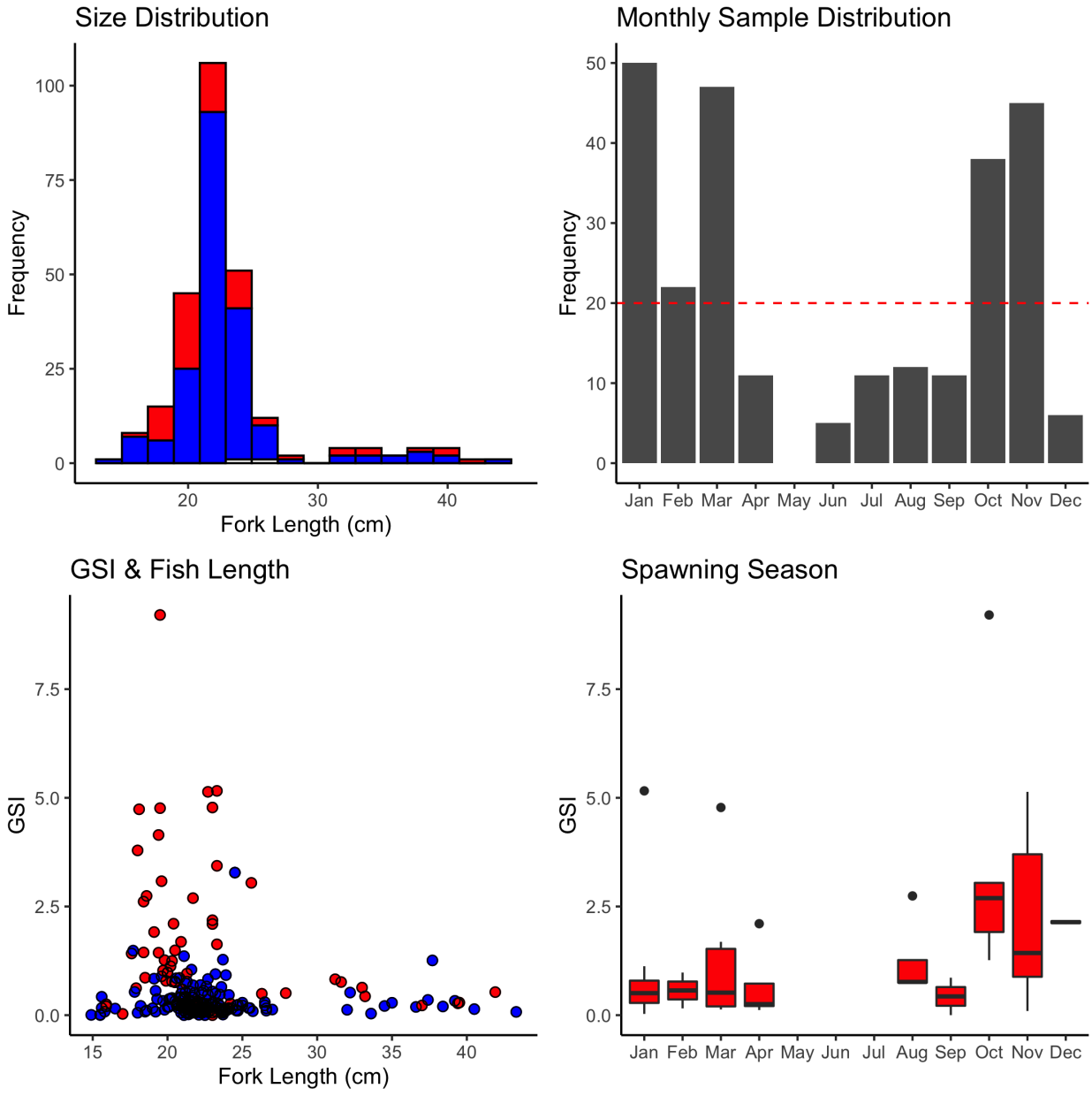

Figure C-10. *L. rufolineatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Myripristis amaena

A total of 344 *Myripristis amaena* samples (females=130, males=214, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 17.2 cm (min=12.5 cm, max=21 cm).

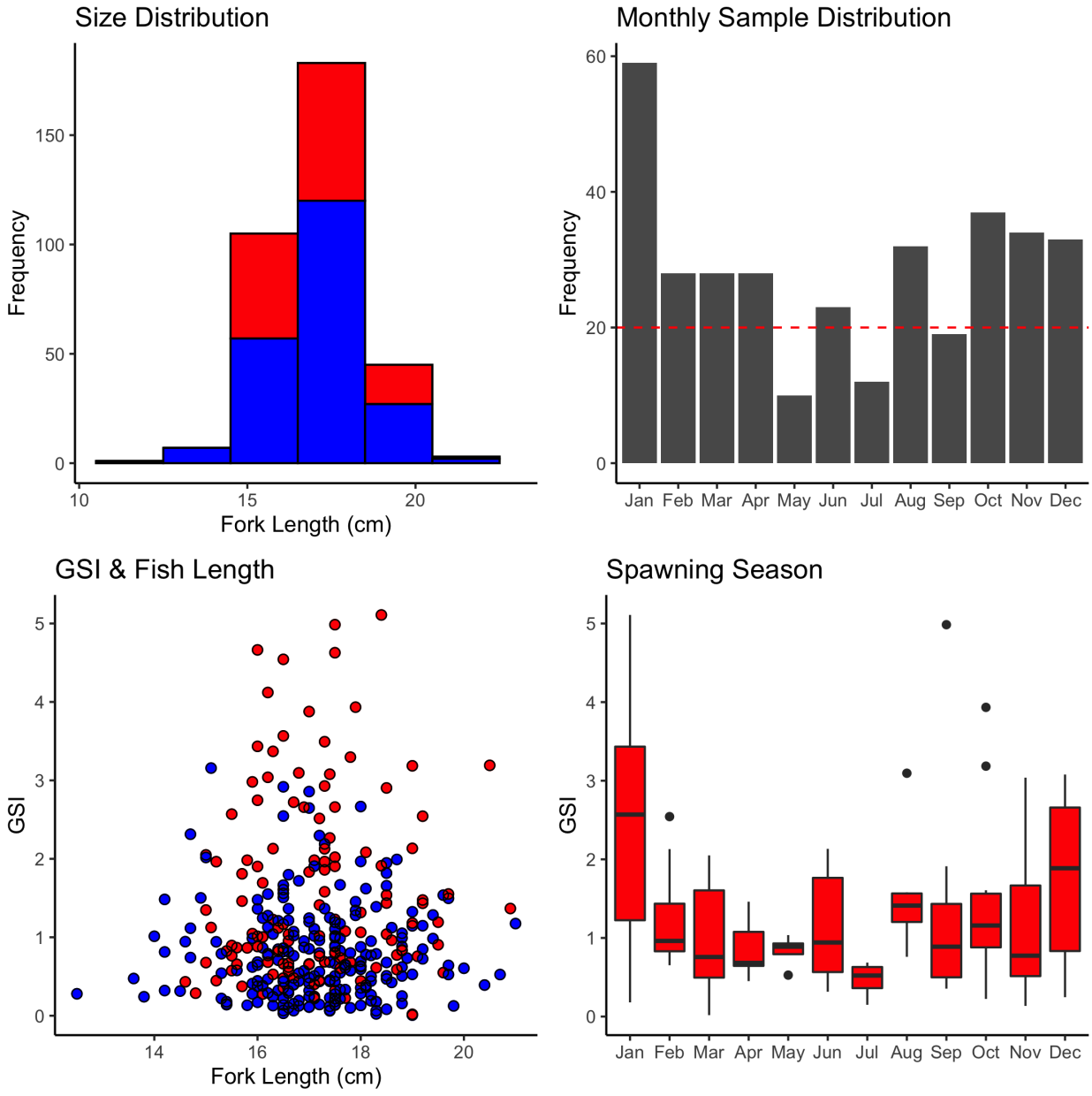

Figure C-11. *M. amaena* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Myripristis berndti

A total of 703 *Myripristis berndti* samples (females=292, males=409, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 18 cm (min=12.5 cm, max=32.5 cm).

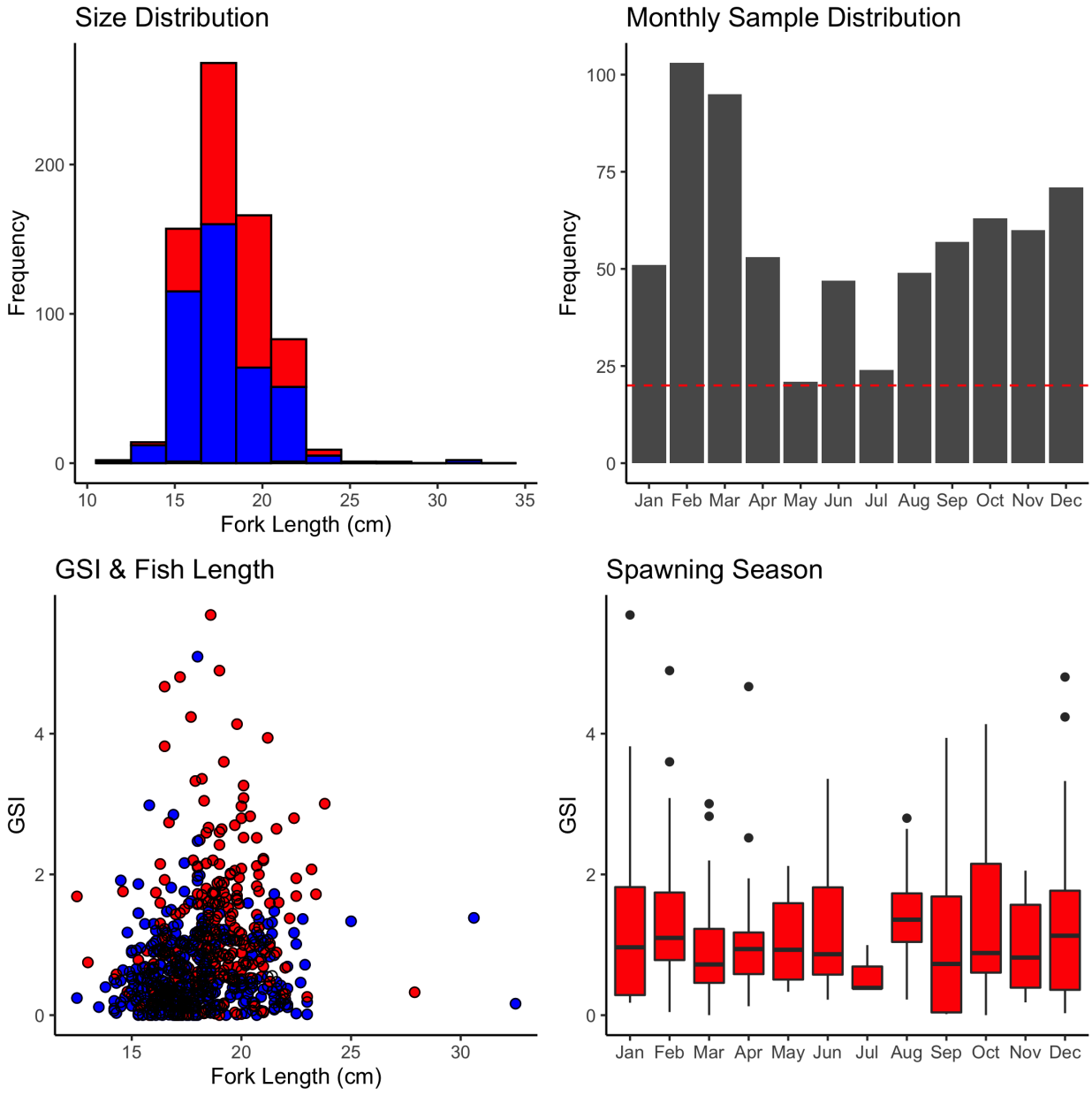

Figure C-12. *M. berndti* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Myripristis murdjan

A total of 296 *Myripristis murdjan* samples (females=123, males=171, unknown/na=2) have been collected to date (2022-12-02). Median fork length is 16.35 cm (min=9.3 cm, max=20.5 cm).

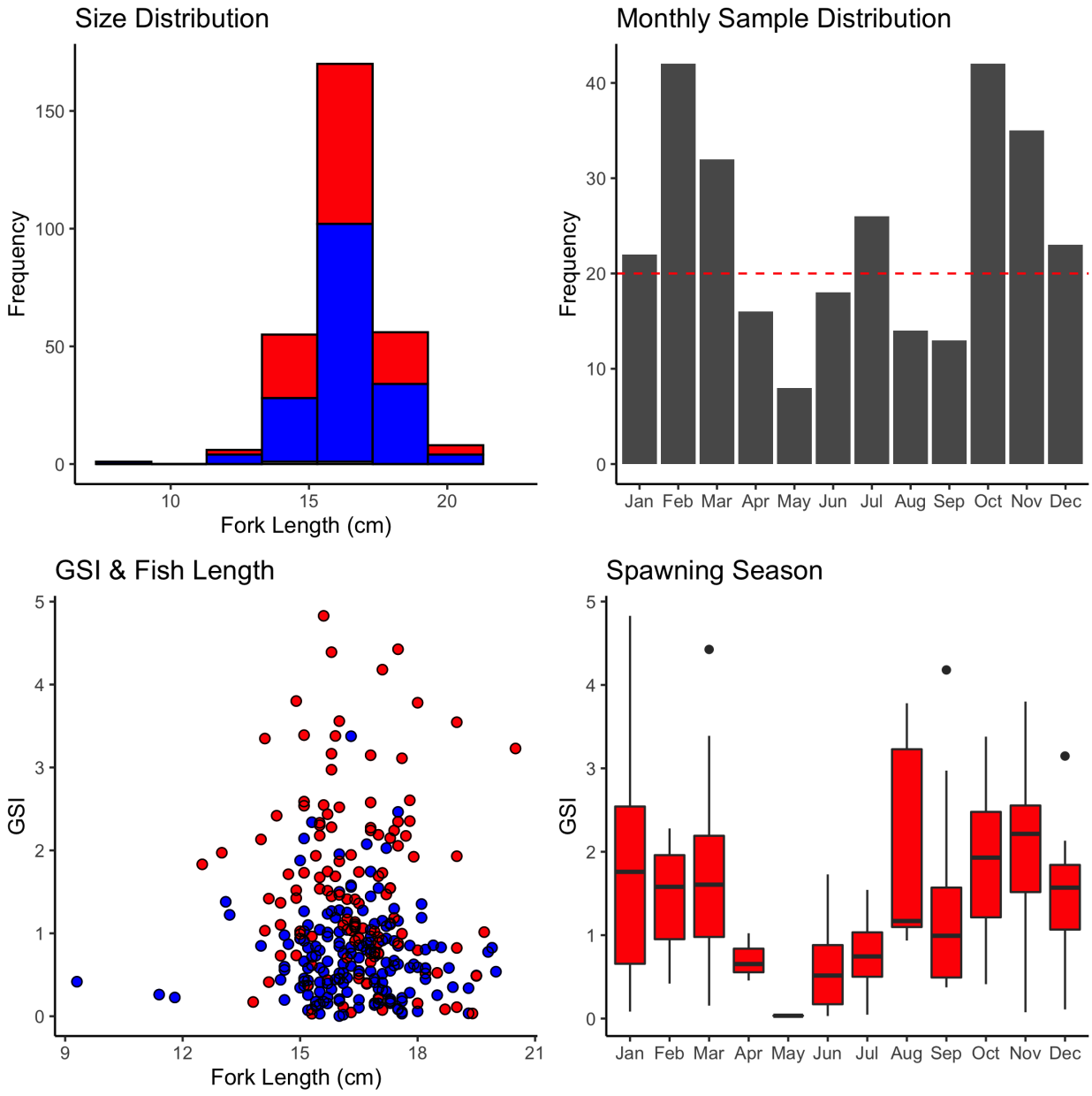

Figure C-13. *M. murdjan* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso unicornis

A total of 558 *Naso unicornis* samples (females=262, males=292, unknown/na=4) have been collected to date (2022-12-02). Median fork length is 29.3 cm (min=12.4 cm, max=53.5 cm).

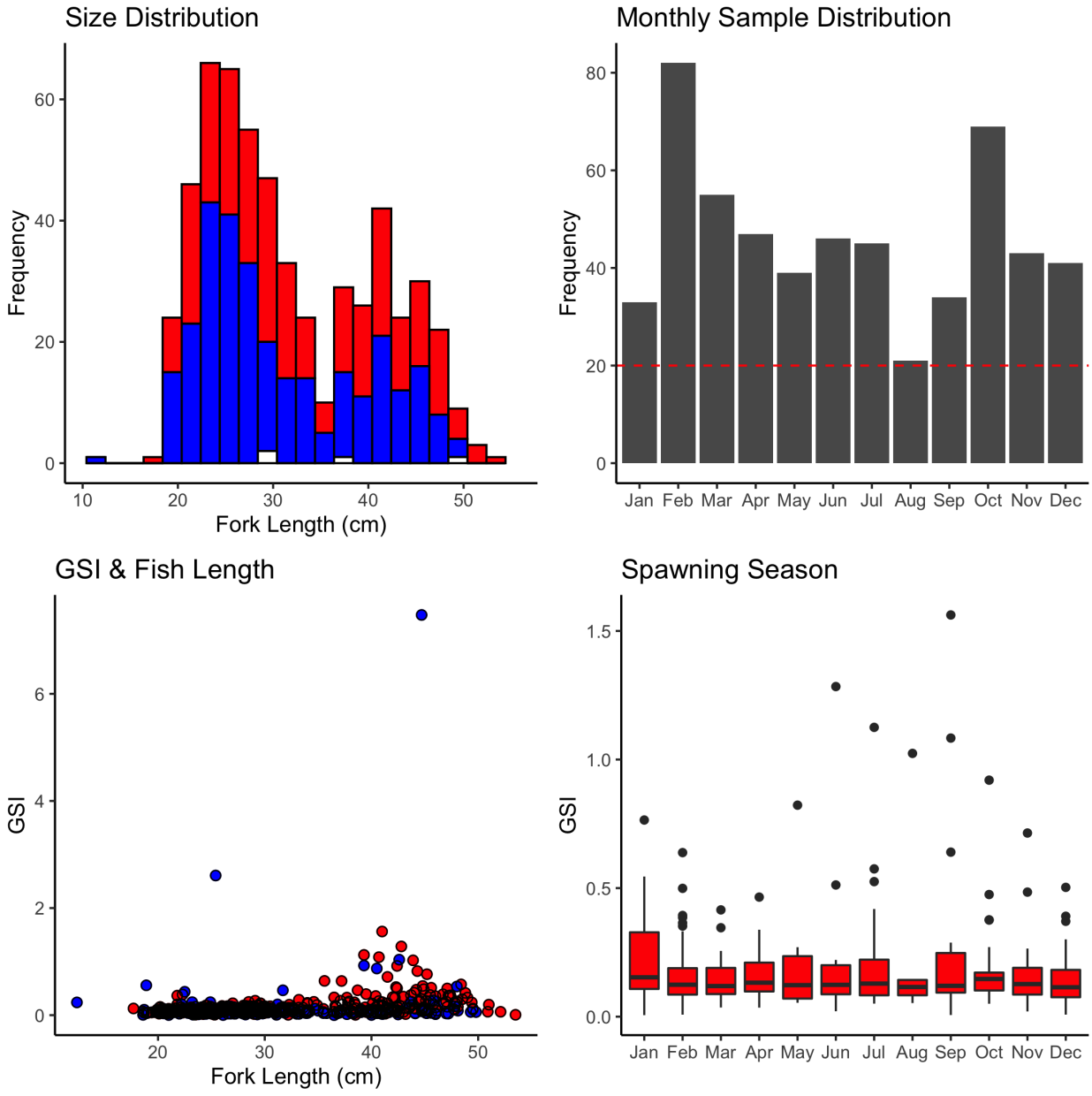

Figure C-14. *N. unicornis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Sargocentron tiere

A total of 699 *Sargocentron tiere* samples (females=278, males=387, unknown/na=34) have been collected to date (2022-12-02). Median fork length is 17.9 cm (min=10.3 cm, max=31.6 cm).

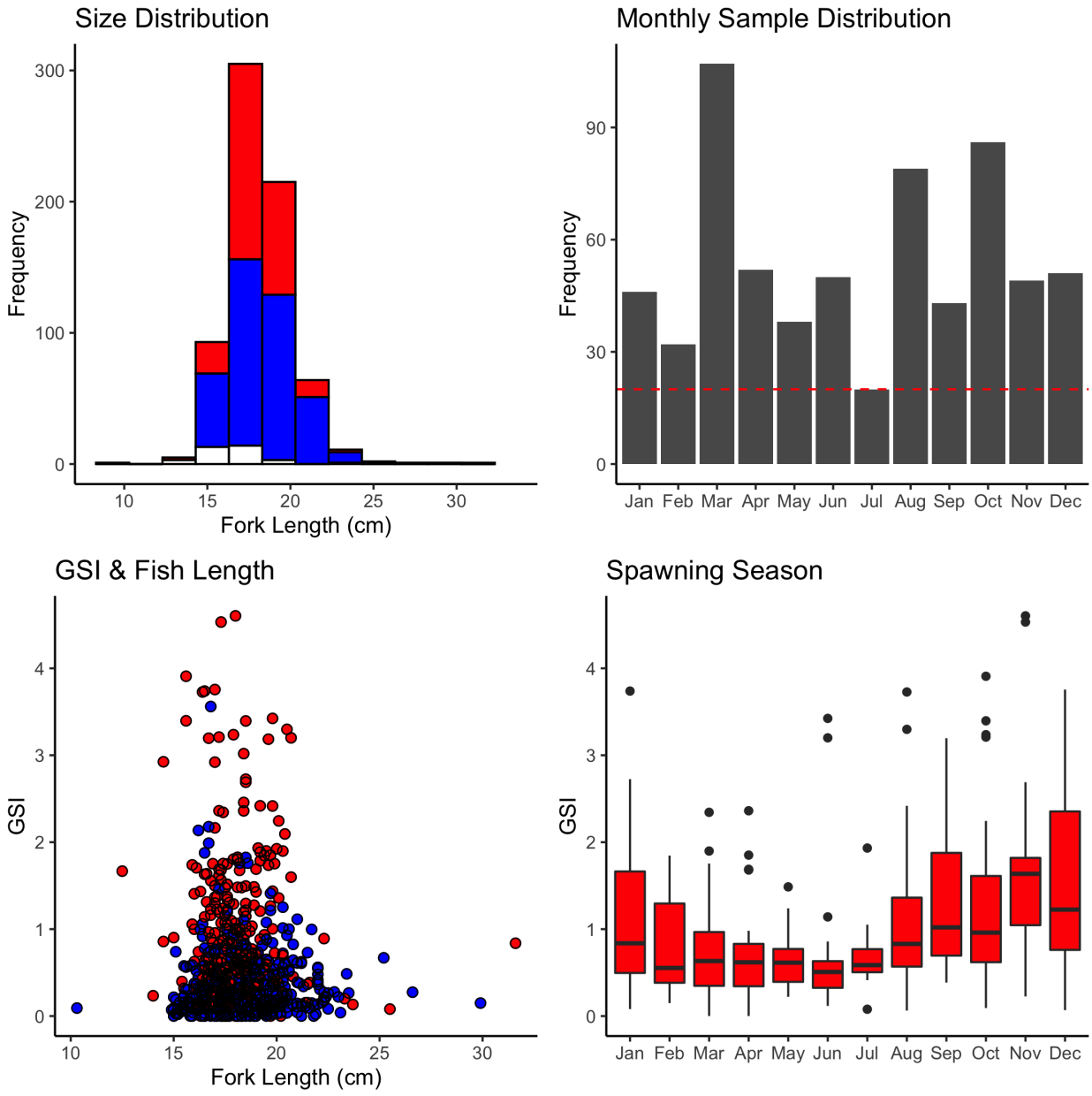

Figure C-15. *S. tiere* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.