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Jurisdictional Fish Life History Sample Inventory 2023

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Mixed species catch in a fish market in American Samoa. *Photo credits: NOAA Fisheries.*

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Executive 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, the Pacific Islands Fisheries Science Center’s Life History Program samples insular fish species in the U.S. Pacific jurisdictions 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 jurisdiction, and jurisdiction- 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. Prior to 2019, Non-BMUS species (typically shallow-water reef fish) were prioritized, and since 2020, BMUS have been prioritized. Starting 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 jurisdictional biological sample objectives and collection methods,
- sampling design approaches,
- Pacific Islands Fisheries Science Center (PIFSC)-species priorities,
- jurisdictional- and species-specific completed research and sample inventories.

Jurisdictional 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). LHP surveys are infrequent and often prioritize unfished areas of CNMI (Northern Mariana Islands).

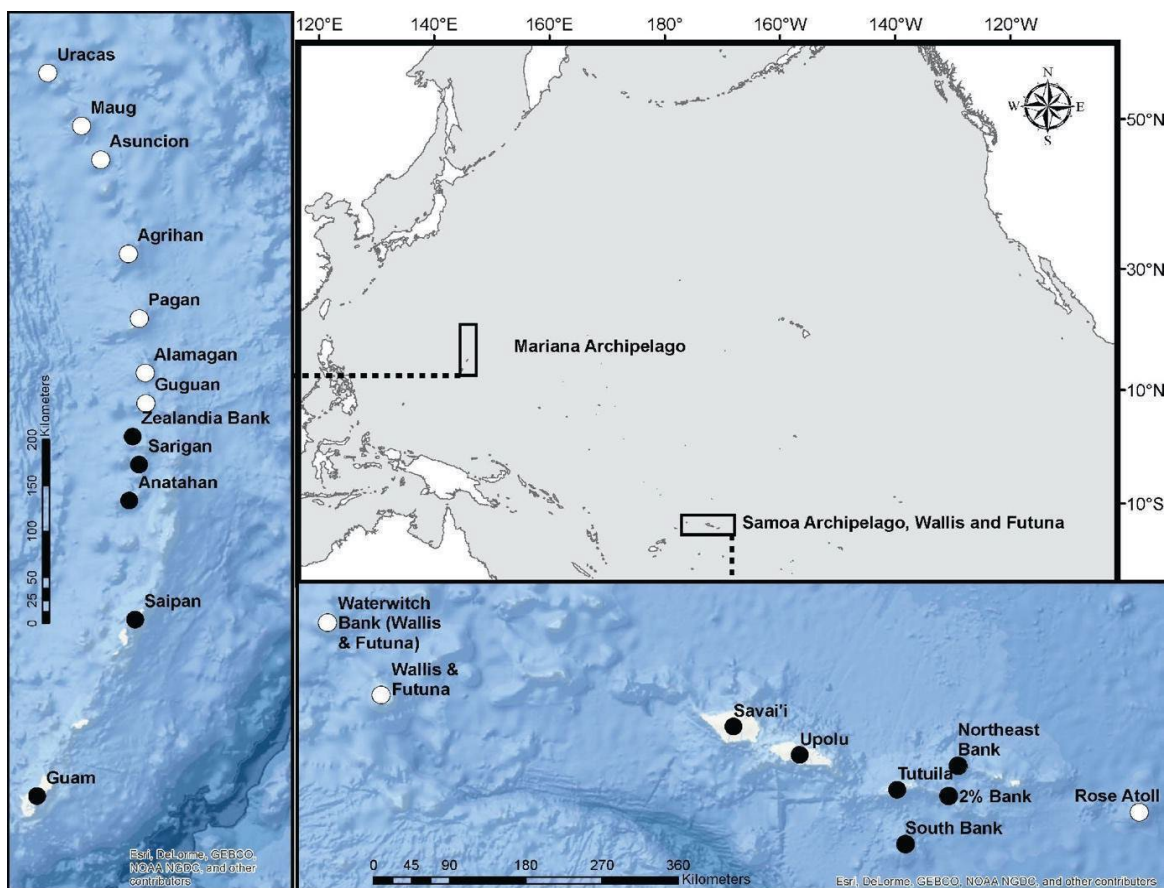


Figure 1. Jurisdictional life history sampling regions include Mariana Islands Archipelago and American Samoa. Fished areas are labeled with a black circle and lightly or non-fished areas are labeled with a white circle. Jurisdictional life history sampling is summarized as Guam (Guam and surrounding 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). Additionally, Independent Samoa, Wallis, and Futuna are shown but not included in life history summaries because the samples were collected during PIFSC LHP and the South Pacific communities (SPC) research surveys.

Commercial Fisheries Biosampling 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 jurisdictions;
5. build sample archives and reference collections to support collaborative research.

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 the fish at the tails 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 Islands Archipelago ([Table 3](#)). LHP collects samples from the entire Mariana Islands 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
<i>Aphareus rutilans</i>	Rusty jobfish	lehi/maroobw
<i>Caranx ignobilis</i>	Giant trevally	mamulan/etam
<i>Caranx lugubris</i>	Black trevally	tarakiton attelong/orong
<i>Etelis carbunculus</i> ^[1]	Ruby snapper	buninas agaga'/falaghal moroobw
<i>Etelis coruscans</i>	Flame snapper	buninas/taighulupegh
<i>Lethrinus rubrioperculatus</i>	Redgill emperor	mafute'/atigh
<i>Lutjanus kasmira</i>	Bluestripe snapper	funai/saas
<i>Pristipomoides flavipinnis</i>	Yelloweye snapper	buninas/falaghal-maroobw
<i>Pristipomoides sieboldii</i>	Von Siebold's snapper	buninas/-
<i>Pristipomoides zonatus</i>	Oblique-banded snapper	buninas rayao amiriyu /falaghal-maroobw
<i>Pristipomoides auricilla</i>	Goldflag snapper	buninas/falaghal-maroobw
<i>Pristipomoides filamentosus</i>	Pink snapper	buninas/falaghal-maroobw
<i>Variola louti</i>	Lyretail grouper	gadau matingon/bwele

^[1] *E. carbunculus* is now known to be comprised of two distinct, non-interbreeding lineages. Both species occur in the Marianas Archipelago.

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
<i>Aphareus rutilans</i>	Rusty jobfish	palu-gutusaliva
<i>Aprion virescens</i>	Green jobfish	asoama
<i>Caranx lugubris</i>	Black trevally	tafauli
<i>Etelis carbunculus</i> ^[1]	Ruby snapper	palu malau
<i>Etelis coruscans</i>	Flame snapper	palu-loa
<i>Lethrinus rubrioperculatus</i>	Redgill emperor	filoa-paomumu
<i>Lutjanus kasmira</i>	Bluestripe snapper	savane
<i>Pristipomoides flavipinnis</i>	Yelloweye snapper	palu-sina
<i>Pristipomoides zonatus</i>	Oblique-banded snapper	palu-ula, palu-sega
<i>Pristipomoides filamentosus</i>	Pink snapper	palu-'ena'ena
<i>Variola louti</i>	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 Islands 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. Additionally, water temperature 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 are generally not 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 have been collected and are in the process of being assessed from the Northern Mariana Islands for archipelago-wide climate change and fisheries research.

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

NOAA Jurisdictional Sampling Inventories

A review of the samples collected for each of the jurisdictions (2008–July 2023) is presented in [Table 4](#) (Mariana Islands BMUS), [Table 5](#) (Mariana Islands non-BMUS), [Table 6](#) (A. Samoa BMUS) and [Table 7](#) (A. Samoa non-BMUS).

Guam Jurisdictional Species Summary

BMUS 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 & Dahl 2023).

The remaining BMUS species are prioritized for continued sample collection using a POS approach.

Non-BMUS life history assessments completed for Guam:

- *Calatomus carolinus* (Taylor & Choat, 2014),
- *Cheilinus undulatus* (Andrew Kang, UOG, 2023),
- *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; Taylor et al., 2019),
- *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).

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

- *Caranx melampygus* (Erin Reed, LHP),
- *Monotaxis grandoculis* (Eric Cruz, PIFSC, UOG).

CNMI Jurisdictional Species Summary

BMUS 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 BMUS species are prioritized for continued sample collection using a POS approach.

Non-BMUS life history assessments are completed for CNMI:

- *Acanthurus lineatus* (DFW; Keena Leon Guerrero, UH 2023),
- *Lethrinus atkinsoni* (Trianni et al., 2023),
- *Lethrinus harak* (Trianni, 2016),
- *Lethrinus obsoletus* (Taylor et al., 2017),
- *Mulloidichthys flavolineatus* (Reed et al., 2020),
- *Naso unicornis* (Taylor et al., 2019),
- *Parupeneus barberinus* (Reed et al., 2020),
- *Siganus argenteus* (Taylor et al., 2016).

Non-BMUS life history assessments using CFBS samples currently in progress:

- *Acanthurus nigricauda* (John Gourley/Brett Taylor, MES-UOG),
- *Acanthurus triostegus* (John Gourley/Brett Taylor, MES-UOG),
- *Calatomus carolinus* (Cassie Pardee PFR, Brett Taylor UOG),
- *Chlorurus spilurus* (Cassie Pardee PFR, Brett Taylor UOG),
- *Caranx melampygus* (Erin Reed, LHP),
- *Mulloidichthys vanicolensis* (Cassie Pardee PFR, Brett Taylor UOG),
- *Sargocentron spiniferum* (John Gourley, MES),
- *Sargocentron tiera* (John Gourley, MES).

American Samoa Jurisdictional Species Summary

American Samoa CFBS was operational from 2010–2016. 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.

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. rubrovioaceus* (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 so species and other needed metrics cannot be assigned. See [Appendix C](#) for additional species sampling information.

For tables 4–7, the following acronyms are used: CFBS = Commercial Fisheries Biosampling, DFW = Division of Fish and Wildlife, LHP = Life History Program, PIFSC = Pacific Islands Fisheries Science Center, PFR = Poseidon Fisheries Research, UoG = University of Guam. Additionally, for tables 4–7, sample collection status is marked complete if the sample size and distribution are adequate and if blank indicates that the species is not currently being targeted for sampling. A reference is listed under research status if life history information is available for that species. If that information is not yet available, the lab and researcher working on the species are listed. A. Samoa unfished are samples collected during LHP surveys. Refer to [Figure 1](#) for fished and unfished area designation.

Table 4. BMUS summarized by Mariana Islands region.

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Aphareus rutilans</i>	CNMI	231	23–99.2	Ongoing	-
<i>Caranx ignobilis</i>	CNMI	1	94.6–94.6	Ongoing	-
<i>Caranx lugubris</i>	CNMI	183	21.3–70.9	Ongoing	-
<i>Etelis carbunculus</i>	CNMI	681	15.7–53.4	Complete	-
<i>Etelis coruscans</i>	CNMI	531	24.8–99.5	Ongoing	LHP (Reed–reproduction)
<i>Lethrinus rubrioperculatus</i>	CNMI	2	27.5–27.6	Ongoing	-
<i>Lutjanus kasmira</i>	CNMI	233	17.4–32.6	Ongoing	-
<i>Pristipomoides auricilla</i>	CNMI	536	19.6–38.9	Ongoing (small individuals only)	O’Malley et al. 2019; LHP (Schemmel reproduction)
<i>Pristipomoides filamentosus</i>	CNMI	23	26.3–60	Complete	Villagomez 2019
<i>Pristipomoides flavipinnis</i>	CNMI	307	20.7–45.2	Ongoing	-
<i>Pristipomoides sieboldii</i>	CNMI	277	19.5–36.2	Ongoing	-
<i>Pristipomoides zonatus</i>	CNMI	552	17.5–41.3	Ongoing	LHP (Schemmel)
<i>Variola louti</i>	CNMI	8	32.1–44.5	Ongoing	-
<i>Aphareus rutilans</i>	CNMI unfished	25	38.4–96.1	Ongoing	LHP (Dahl)
<i>Caranx lugubris</i>	CNMI unfished	6	29.2–56.9	Not Targeting	-
<i>Etelis carbunculus</i>	CNMI unfished	156	20.8–51.2	Ongoing	-
<i>Etelis coruscans</i>	CNMI unfished	214	47.8–92	Ongoing	-
<i>Pristipomoides auricilla</i>	CNMI unfished	213	22.5–40.3	Ongoing	O’Malley et al. 2019; LHP (Schemmel)

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Pristipomoides filamentosus</i>	CNMI unfished	133	15.1–65.3	Ongoing	-
<i>Pristipomoides flavipinnis</i>	CNMI unfished	65	30.4–53.2	Ongoing	-
<i>Pristipomoides sieboldii</i>	CNMI unfished	6	32.2–35.2	Ongoing	-
<i>Pristipomoides zonatus</i>	CNMI unfished	484	23.3–44.6	Ongoing	LHP (Schemmel)
<i>Variola louti</i>	CNMI unfished	6	25.9–41.1	Not Targeting	-
<i>Aphareus rutilans</i>	Guam	250	15.8–96.7	Ongoing	LHP (Dahl)
<i>Caranx ignobilis</i>	Guam	99	15–104.5	Ongoing	-
<i>Caranx lugubris</i>	Guam	99	10.6–76.2	Ongoing	-
<i>Etelis carbunculus</i>	Guam	385	15.9–52.1	Complete	-
<i>Etelis coruscans</i>	Guam	655	28.6–99	Complete	LHP (Reed–reproduction)
<i>Lethrinus rubrioperculatus</i>	Guam	13	18.1–44.7	Ongoing	-
<i>Lutjanus kasmira</i>	Guam	105	7.5–27.3	Ongoing	-
<i>Pristipomoides auricilla</i>	Guam	490	13.5–38.5	Complete	O’Malley et al. 2019; LHP (Schemmel–reproduction)
<i>Pristipomoides filamentosus</i>	Guam	90	22.6–65.5	Ongoing	Villagomez et al. 2019
<i>Pristipomoides flavipinnis</i>	Guam	291	16.5–67	Ongoing	-
<i>Pristipomoides sieboldii</i>	Guam	116	18.7–59.8	Ongoing	-
<i>Pristipomoides zonatus</i>	Guam	729	11.4–40.8	Targeting for eye lens	LHP (Dahl)
<i>Variola louti</i>	Guam	330	19.4–49.7	Complete	Schemmel & Dahl 2023

Table 5. Non-BMUS summarized by Mariana Island Region. Species are included if $n \geq 5$.

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Acanthurus lineatus</i>	CNMI	1,010	4.8–30	Complete	UOG (K. Leon Guerrero 2023)
<i>Acanthurus nigricauda</i>	CNMI	588	12.5–25.3	Complete	MES & UOG (Gourley & Taylor)
<i>Acanthurus triostegus</i>	CNMI	372	11.7–18.7	Complete	MES & UOG (Gourley & Taylor)
<i>Calotomus carolinus</i>	CNMI	428	17–223.8	Complete	PFR & UOG
<i>Caranx melampygus</i>	CNMI	109	2.5–68.9	Complete	LHP (Reed)
<i>Cephalopholis argus</i>	CNMI	117	16.5–41.1	Complete	LHP (Table 3)
<i>Cephalopholis igarashiensis</i>	CNMI	5	26.5–33	-	-
<i>Cheilinus trilobatus</i>	CNMI	411	16.2–34.1	Complete	-
<i>Cheilinus undulatus</i>	CNMI	306	15.5–126.2	Complete	UOG (Kang, 2023); DFW
<i>Chlorurus sordidus/ Chlorurus spilurus</i>	CNMI	723	14.5–27.1	Complete	PFR & UOG (Pardee & Taylor)
<i>Epinephelus hexagonatus</i>	CNMI	13	12.6–23.6	-	-
<i>Etelis radiosus</i>	CNMI	14	29.8–94.1	Ongoing	-
<i>Kyphosus cinerascens</i>	CNMI	297	17.5–40.1	Complete	-
<i>Lethrinus atkinsoni</i>	CNMI	930	12.4–34	Complete	(Trianni et al., 2023)
<i>Lethrinus obsoletus</i>	CNMI	1,011	14.1–29.7	Complete	(Taylor et al., 2017)
<i>Monotaxis grandoculis</i>	CNMI	249	15.8–342	Complete	PIFSC & UOG (Cruz)
<i>Mulloidichthys flavolineatus</i>	CNMI	1,226	8.5–31	Complete	(Reed et al., 2020)
<i>Mulloidichthys vanicolensis</i>	CNMI	985	8.9–28.5	Complete	PFR & UoG (Pardee & Taylor)
<i>Myripristis berndti</i>	CNMI	5	14.4–21.5	-	-
<i>Naso lituratus</i>	CNMI	1,408	7.9–29.8	Complete	-
<i>Naso unicornis</i>	CNMI	2,558	10.4–53.2	Complete	(Taylor et al., 2019)

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Parupeneus barberinus</i>	CNMI	1,246	6.7–35.5	Complete	(Reed et al., 2020)
<i>Pristipomoides argyrogrammicus</i>	CNMI	125	18–30.9	Ongoing	-
<i>Sargocentron spiniferum</i>	CNMI	944	11.5–34.2	Complete	MES (Gourley & Trianni)
<i>Sargocentron tiere</i>	CNMI	727	12.9–23.2	Complete	MES (Gourley & Trianni)
<i>Scarus ghobban</i>	CNMI	12	16.5–41.3	-	-
<i>Scarus rubroviolaceus</i>	CNMI	102	17–43.5	Complete	-
<i>Siganus argenteus</i>	CNMI	1,194	12.4–33.3	Complete	(Taylor et al., 2016)
<i>Siganus spinus</i>	CNMI	2,026	10.2–25.6	Complete	-
<i>Tarachtichthys steindachneri</i>	CNMI	44	54.4–69	-	-
<i>Zanclus cornutus</i>	CNMI	118	7.4–24.8	Complete	LHP (Table 3)
<i>Acanthurus lineatus</i>	CNMI unfished	272	6.9–23.9	-	LHP (Table 3)
<i>Aphareus furca</i>	CNMI unfished	12	22–29.7	-	-
<i>Caranx melampygus</i>	CNMI unfished	224	24.1–79	-	LHP (Reed)
<i>Cephalopholis argus</i>	CNMI unfished	223	6.5–44.9	-	LHP (Table 3)
<i>Cephalopholis igarashiensis</i>	CNMI unfished	6	33.2–41.5	-	-
<i>Cephalopholis urodeta</i>	CNMI unfished	15	13–38.5	-	-
<i>Epinephelus hexagonatus</i>	CNMI unfished	5	14.8–23.8	-	-
<i>Hyporthodus octofasciatus</i>	CNMI unfished	33	81.4–152.2	-	-
<i>Monotaxis grandoculis</i>	CNMI unfished	171	8.6–40	Complete	PIFSC & UOG (Cruz)
<i>Myripristis berndti</i>	CNMI unfished	11	19.3–23.2	-	-

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Naso lituratus</i>	CNMI unfished	274	10.5–30.4	-	LHP (Table 3)
<i>Naso unicornis</i>	CNMI unfished	178	16.5–52	Complete	(Taylor et al., 2019)
<i>Pristipomoides argyrogrammicus</i>	CNMI unfished	33	10–36	Ongoing	-
<i>Saloptia powelli</i>	CNMI unfished	16	29.9–45	-	-
<i>Scarus rubroviolaceus</i>	CNMI unfished	259	17.2–51.8	Complete	LHP (Table 3)
<i>Zanclus cornutus</i>	CNMI unfished	202	13–20.8	Complete	LHP (Table 3)
<i>Acanthurus lineatus</i>	Guam	9	15.1–19.7	-	-
<i>Aphareus furca</i>	Guam	5	22.8–35	-	-
<i>Aprion virescens</i>	Guam	22	22.8–78.9	Ongoing	-
<i>Caranx melampygus</i>	Guam	131	9.5–66.5	-	LHP (Reed)
<i>Cheilinus undulatus</i>	Guam	121	20.9–135	Complete	UOG (Kang)
<i>Chlorurus microrhinos</i>	Guam	11	18–46.7	-	-
<i>Chlorurus spilurus</i>	Guam	9	11.4–27.1	-	-
<i>Epinephelus fasciatus</i>	Guam	60	14.1–30.6	-	-
<i>Epinephelus octofasciatus</i>	Guam	6	81.9–157.5	-	-
<i>Etelis boweni</i>	Guam	7	66.7–84	Ongoing	-
<i>Etelis radiosus</i>	Guam	15	29–107.8	Ongoing	-
<i>Hipposcarus longiceps</i>	Guam	354	14.2–51.4	Complete	Taylor & Cruz 2017
<i>Lethrinus atkinsoni</i>	Guam	32	16.2–35	-	-
<i>Lethrinus erythracanthus</i>	Guam	7	23.7–68.6	-	-
<i>Lethrinus harak</i>	Guam	10	20.3–26.2	-	-
<i>Lethrinus obsoletus</i>	Guam	56	16–32.2	-	-
<i>Lethrinus olivaceus</i>	Guam	15	22–72.2	-	-

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Lethrinus xanathochilus</i>	Guam	7	32.3–57.8	-	-
<i>Lutjanus gibbus</i>	Guam	33	13.1–40.5	-	-
<i>Monotaxis grandoculis</i>	Guam	422	8.7–48.6	Complete	PIFSC & UoG (Cruz)
<i>Myripristis berndti</i>	Guam	10	12.2–23.9	-	-
<i>Naso lituratus</i>	Guam	24	11.9–28.1	-	-
<i>Naso unicornis</i>	Guam	52	13.9–55.3	-	-
<i>Plectropomus laevis</i>	Guam	9	25.3-91.6	-	-
<i>Pristipomoides argyrogrammicus</i>	Guam	12	16.1-27	-	-
<i>Siganus argenteus</i>	Guam	7	26.2-29.7	-	-
<i>Siganus punctatus</i>	Guam	88	15.8-30.1	-	-

Table 6. BMUS species for American Samoa. Species are included if $n \geq 5$.

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Aphareus rutilans</i>	A. Samoa	101	30.9–95.9	Ongoing	LHP (Dahl)
<i>Aprion virescens</i>	A. Samoa	3	57.1–61.3	Ongoing	-
<i>Etelis carbunculus</i>	A. Samoa	124	23.7–57	Ongoing	-
<i>Etelis coruscans</i>	A. Samoa	129	45.6–88.7	Ongoing	-
<i>Lethrinus rubrioperculatus</i>	A. Samoa	1	32.4–32.4	Ongoing	-
<i>Lutjanus kasmira</i>	A. Samoa	5	20.5–23.4	Ongoing	-
<i>Pristipomoides filamentosus</i>	A. Samoa	65	34.1–54.4	Ongoing	-
<i>Pristipomoides flavipinnis</i>	A. Samoa	266	32.5–47.4	Age & Growth Completed	O’Malley et al. 2019
<i>Pristipomoides zonatus</i>	A. Samoa	74	23–40.2	-	-
<i>Aphareus rutilans</i>	A. Samoa unfished	1	50.1–50.1	-	LHP (Dahl)
<i>Etelis carbunculus</i>	A. Samoa unfished	55	27.2–47.2	-	-
<i>Etelis coruscans</i>	A. Samoa unfished	26	46.1–87.6	-	-
<i>Pristipomoides filamentosus</i>	A. Samoa unfished	1	46.2–46.2	-	-

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Pristipomoides flavipinnis</i>	A. Samoa unfished	8	39–42.5	-	-
<i>Pristipomoides zonatus</i>	A. Samoa unfished	9	30.2–43.7	-	-

Table 7. Non-BMUS for American Samoa.

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Cephalopholis igarashiensis</i>	A. Samoa	5	25.5–39.1	-	-
<i>Epinephelus timorensis</i>	A. Samoa	11	23.1–35.5	-	-
<i>Lethrinus xanthochilus</i>	A. Samoa	397	19–54	Complete	(Taylor et al., 2018)
<i>Lutjanus fulvus</i>	A. Samoa	26	18.2–26.6	-	-
<i>Lutjanus gibbus</i>	A. Samoa	489	14.6–49	Complete	(Taylor et al., 2018)
<i>Lutjanus rufolineatus</i>	A. Samoa	260	14.9–43.3	Complete	(Taylor et al., 2018)
<i>Myripristis amaena</i>	A. Samoa	344	12.5–21	-	Species ID issues
<i>Myripristis berndti</i>	A. Samoa	703	12.5–32.5	-	Species ID issues
<i>Myripristis murdjan</i>	A. Samoa	296	9.3–20.5	-	Species ID issues
<i>Naso unicornis</i>	A. Samoa	558	12.4–53.5	Complete	(Taylor et al., 2019)
<i>Paracaesio kusakarii</i>	A. Samoa	30	46.5–61.5	-	-
<i>Paracaesio stonei</i>	A. Samoa	8	45.2–53.9	-	-
<i>Pristipomoides argyrogrammicus</i>	A. Samoa	6	22.1–26.7	-	-
<i>Pristipomoides auricilla</i>	A. Samoa	129	22.8–48.4	-	-
<i>Saloptia powelli</i>	A. Samoa	11	30–38.2	-	-
<i>Sargocentron spiniferum</i>	A. Samoa	268	10.2–70.5	-	Species ID issues

Scientific Name	Region	<i>n</i>	Length Distribution (cm)	Sample Collection Status (Ongoing, Complete)	Research Status (Reference, Lab (name))
<i>Sargocentron tere</i>	A. Samoa	699	10.3–31.6	-	Species ID issues
<i>Scarus rubroviolaceus</i>	A. Samoa	446	17.9–91.6	Complete	(Taylor and Pardee, 2017)
<i>Pristipomoides auricilla</i>	A. Samoa unfished	13	29.5–34.8	-	-

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Appendix A: Guam Species Summaries

Updated October 2023

The following species were sampled through the Jurisdictional 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 undulates*
- *Epinephelus fasciatus*
- *Lethrinus obsoletus*
- *Siganus punctatus*

These species summaries are a guide to inform future sampling collection efforts and life history assessments. Species with completed life history assessments for the jurisdictional are excluded, unless continued sample collection is recommended for additional research to meet fisheries science and management needs. All BMUS species and Non-BMUS fish with a sample

size greater or equal to 50 are included in this appendix. There is a blank summary page if there are not any samples collected for a BMUS. 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 on occasion.

Data for each species is 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: GSI (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 GSI is plotted by month to visualize if sampling is adequate to determine spawning seasonality.

Bottomfish Management Unit Species

Aphareus rutilans

A total of 250 *Aphareus rutilans* samples (females = 96, males = 84, unknown / NA = 70) have been collected to date (October 2023). Median fork length is 46.35 cm (min=15.8 cm, max=96.7 cm).

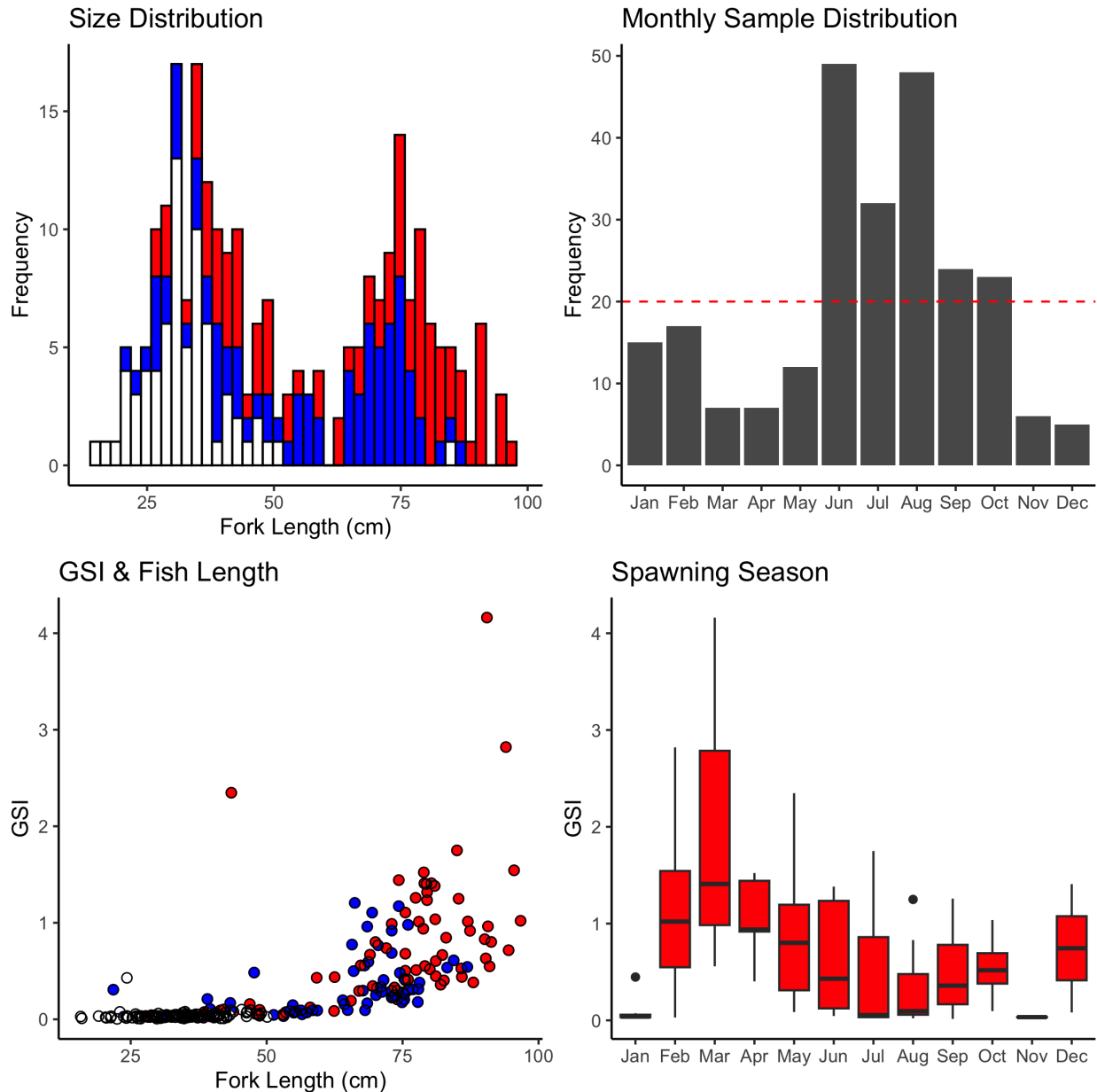


Figure A1. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx ignobilis

A total of 99 *Caranx ignobilis* samples (females = 40, males = 34, unknown/NA = 25) have been collected to date (October 2023). Median fork length is 65.6 cm (min=15 cm, max=104.5 cm).

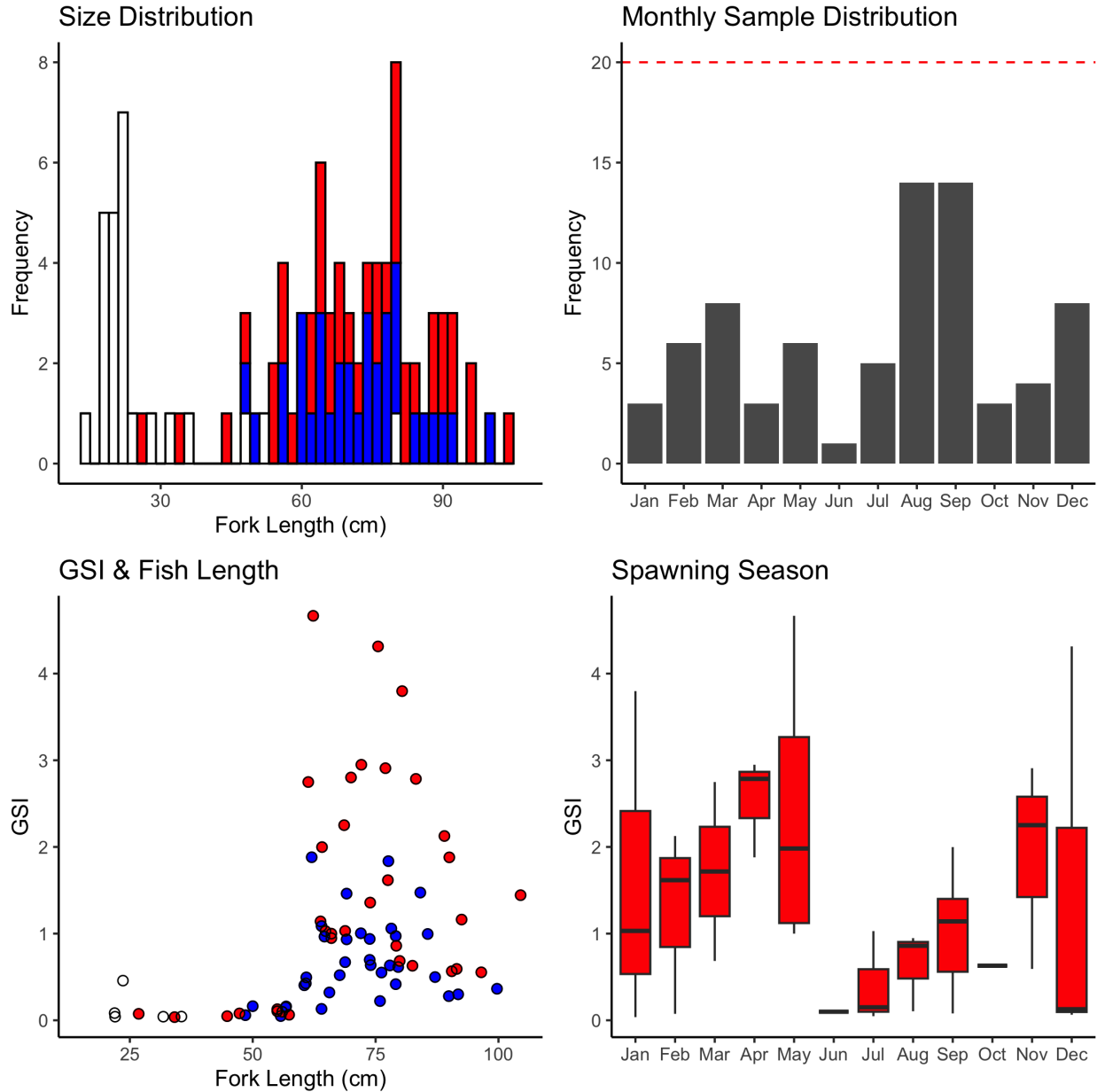


Figure A2. *C. ignobilis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx lugubris

A total of 99 *Caranx lugubris* samples (females = 43, males = 32, unknown/NA = 24) have been collected to date (October 2023). Median fork length is 38.7 cm (min=10.6 cm, max=76.2 cm).

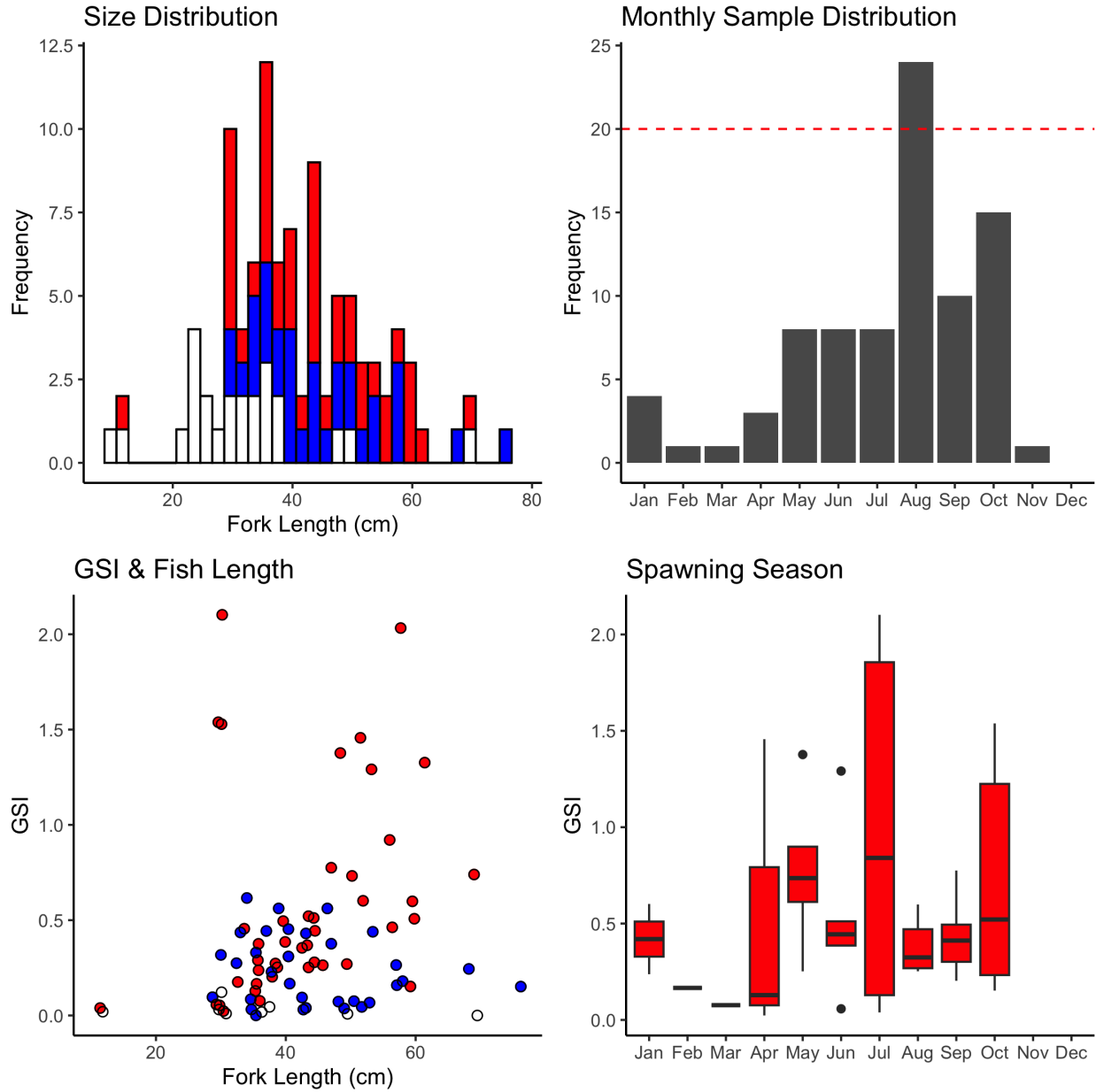


Figure A3. *C. lugubris* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis carbunculus

A total of 385 *Etelis carbunculus* samples (females = 227, males = 122, unknown/NA = 36) have been collected to date (October 2023). Median fork length is 30.3 cm (min=15.9 cm, max=52.1 cm).

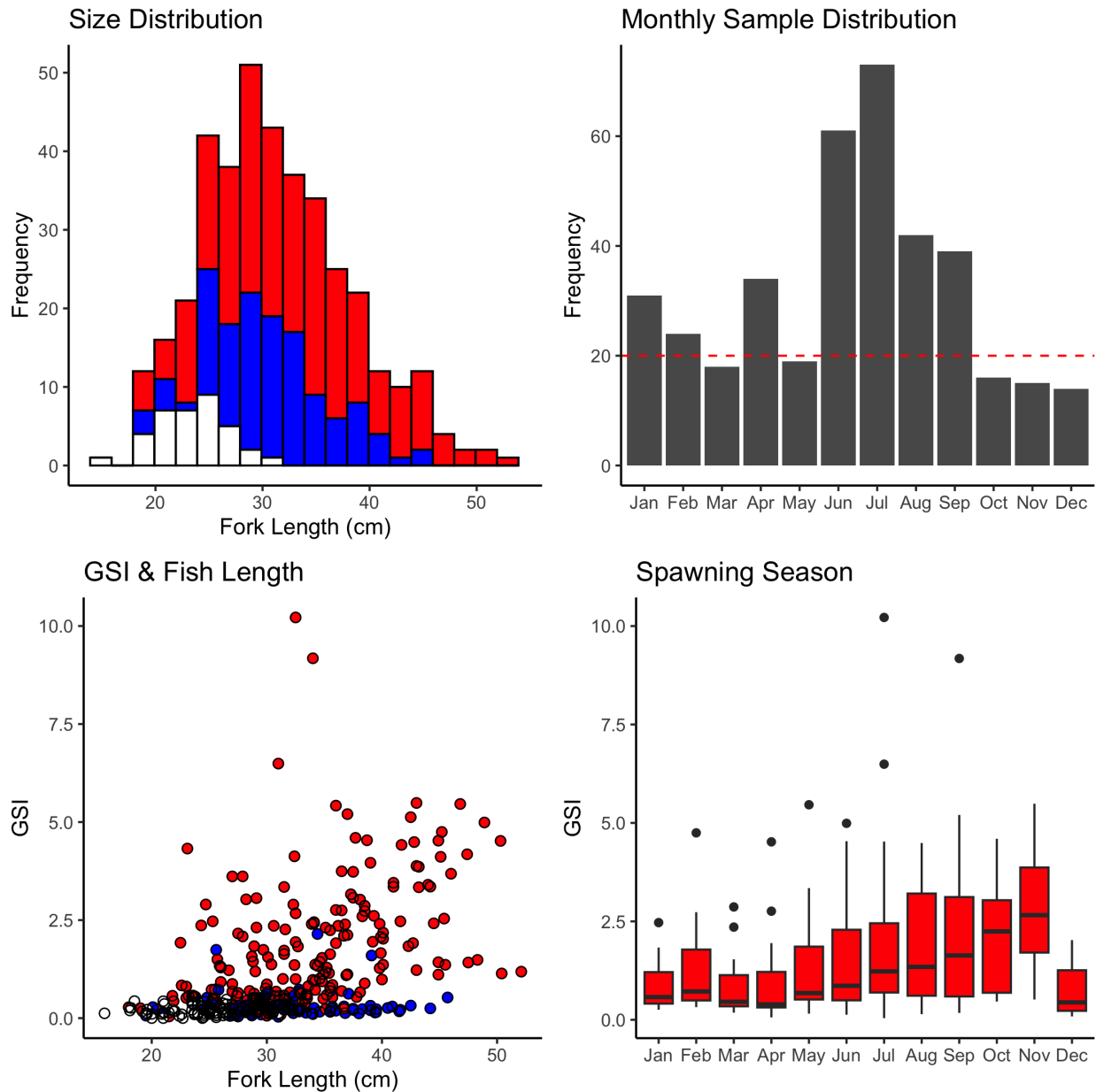


Figure A4. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 655 *Etelis coruscans* samples (females = 321, males = 292, unknown/NA = 42) have been collected to date (October 2023). Median fork length is 71 cm (min=28.6 cm, max=99 cm).

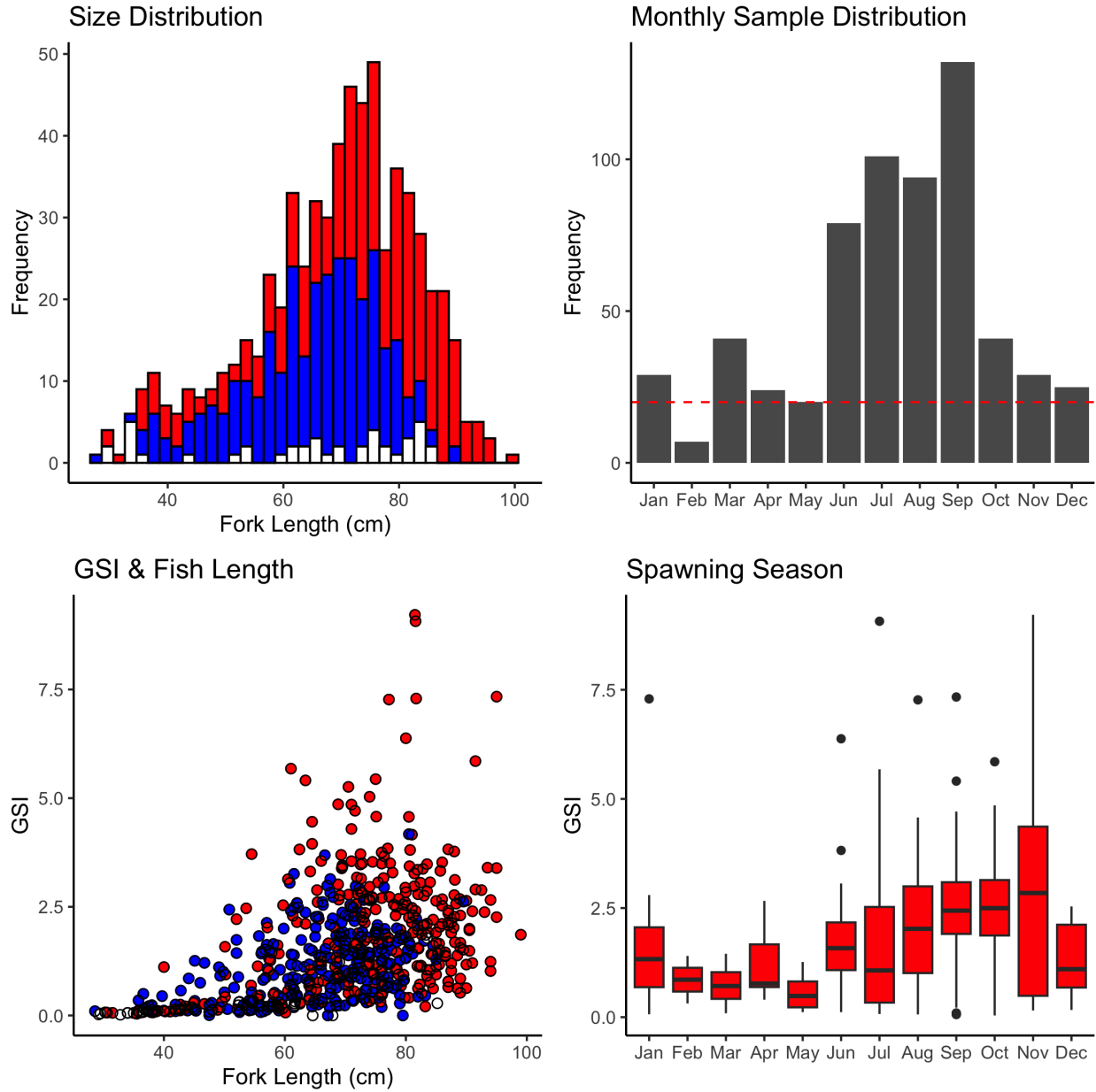


Figure A5. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus rubrioperculatus

A total of 13 *Lethrinus rubrioperculatus* samples (females = 8, males = 3, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 22.9 cm (min=18.1 cm, max=44.7 cm).

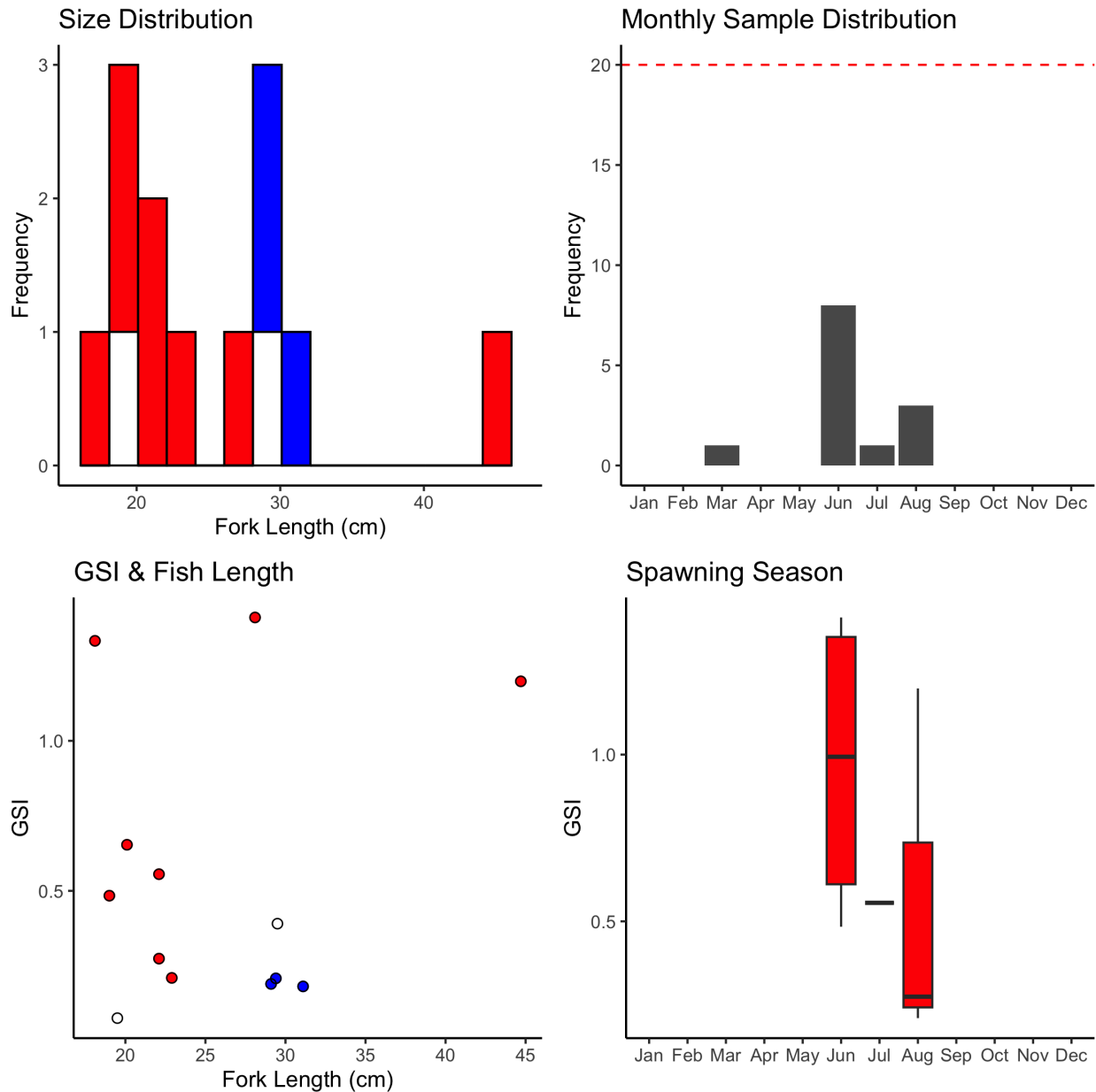


Figure A6. *L. rubrioperculatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lutjanus kasmira

A total of 105 *Lutjanus kasmira* samples (females = 23, males = 28, unknown/NA = 54) have been collected to date (October 2023). Median fork length is 19.5 cm (min=7.5 cm, max=27.3 cm).

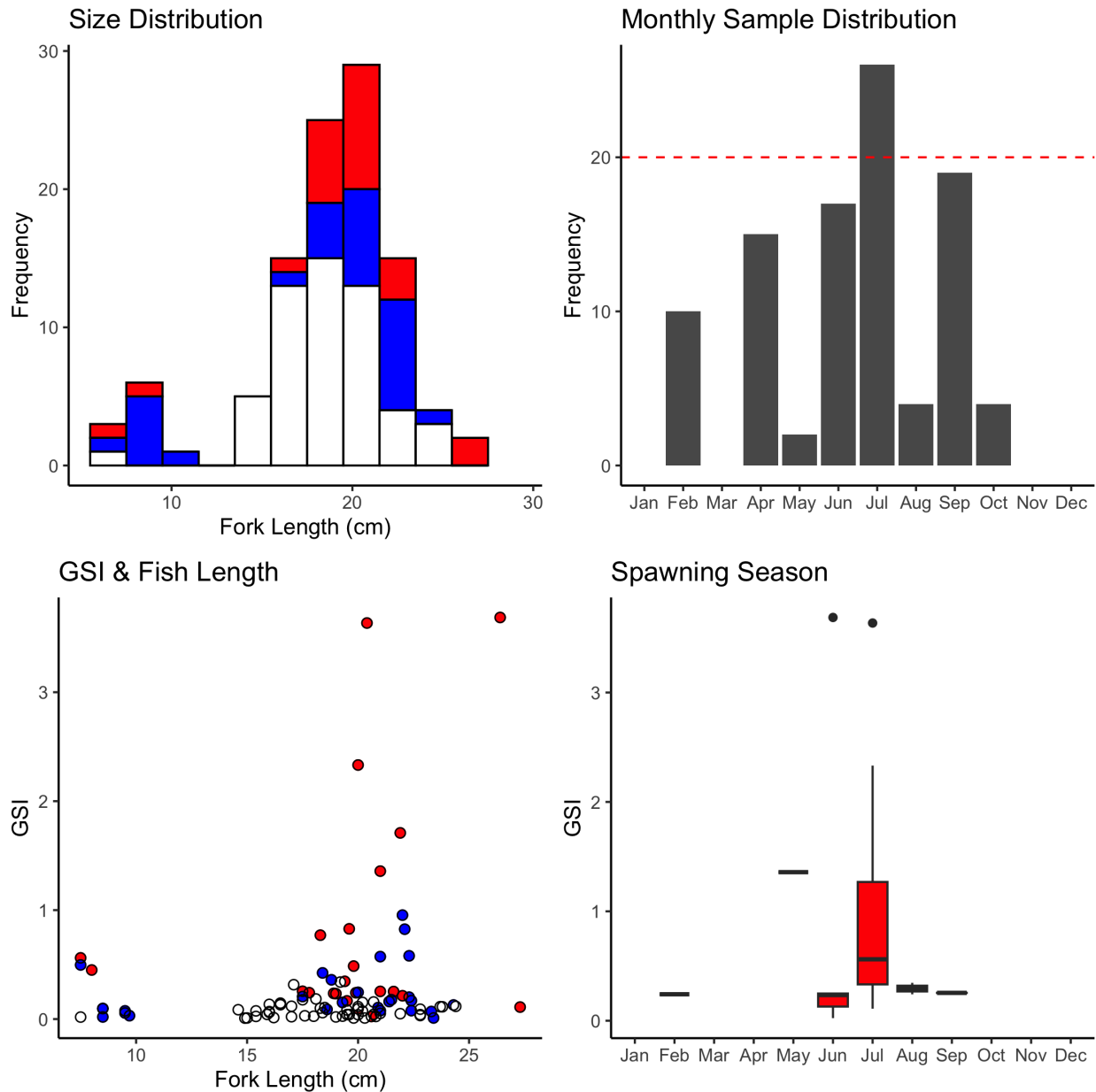


Figure A7. *L. kasmira* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides auricilla

A total of 490 *Pristipomoides auricilla* samples (females = 190, males = 154, unknown/NA = 146) have been collected to date (October 2023). Median fork length is 26.9 cm (min=13.5 cm, max=38.5 cm).

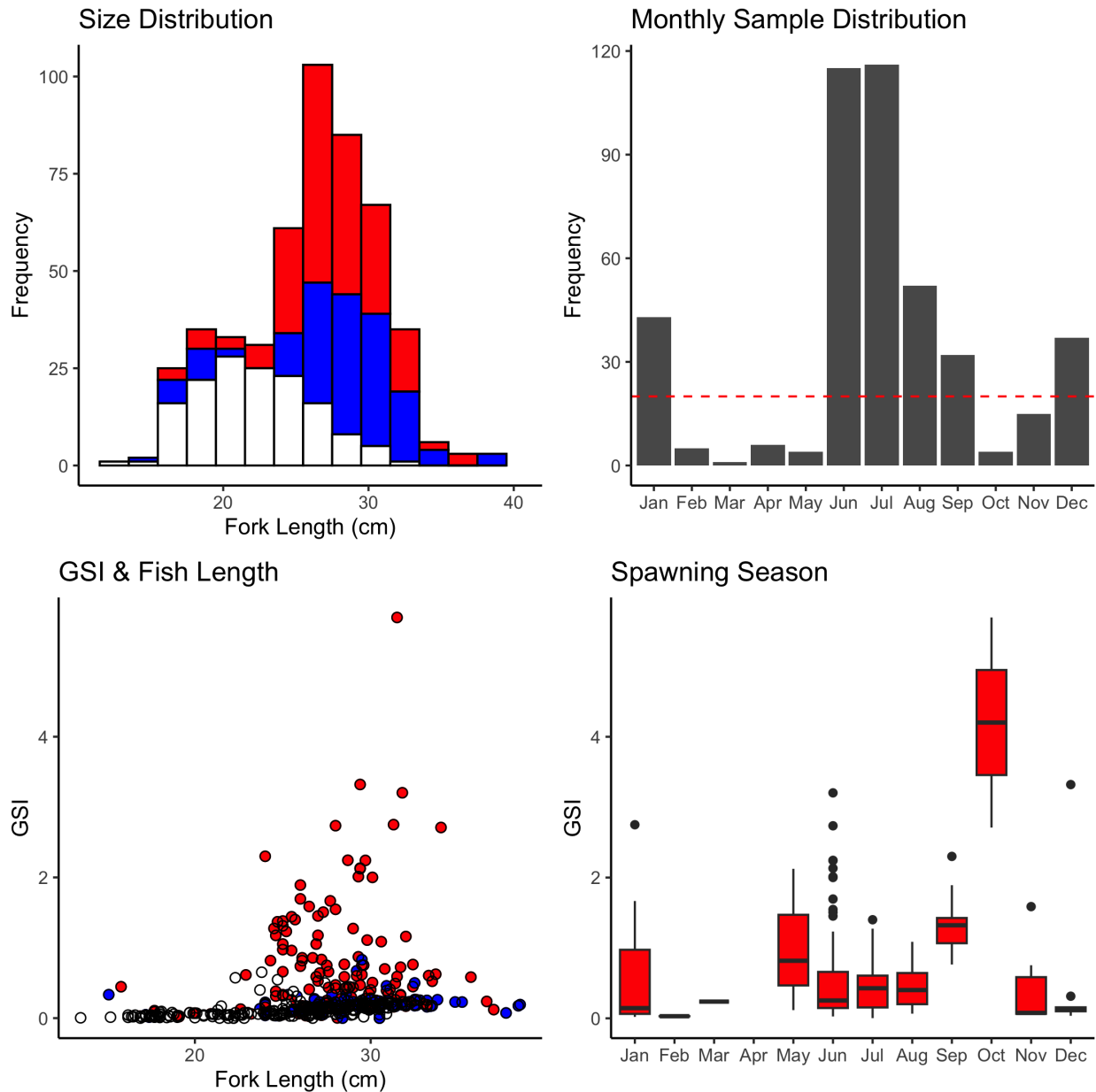


Figure A8. *P. auricilla* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides filamentosus

A total of 90 *Pristipomoides filamentosus* samples (females = 34, males = 21, unknown/NA = 35) have been collected to date (October 2023). Median fork length is 33.05 cm (min=22.6 cm, max=65.5 cm).

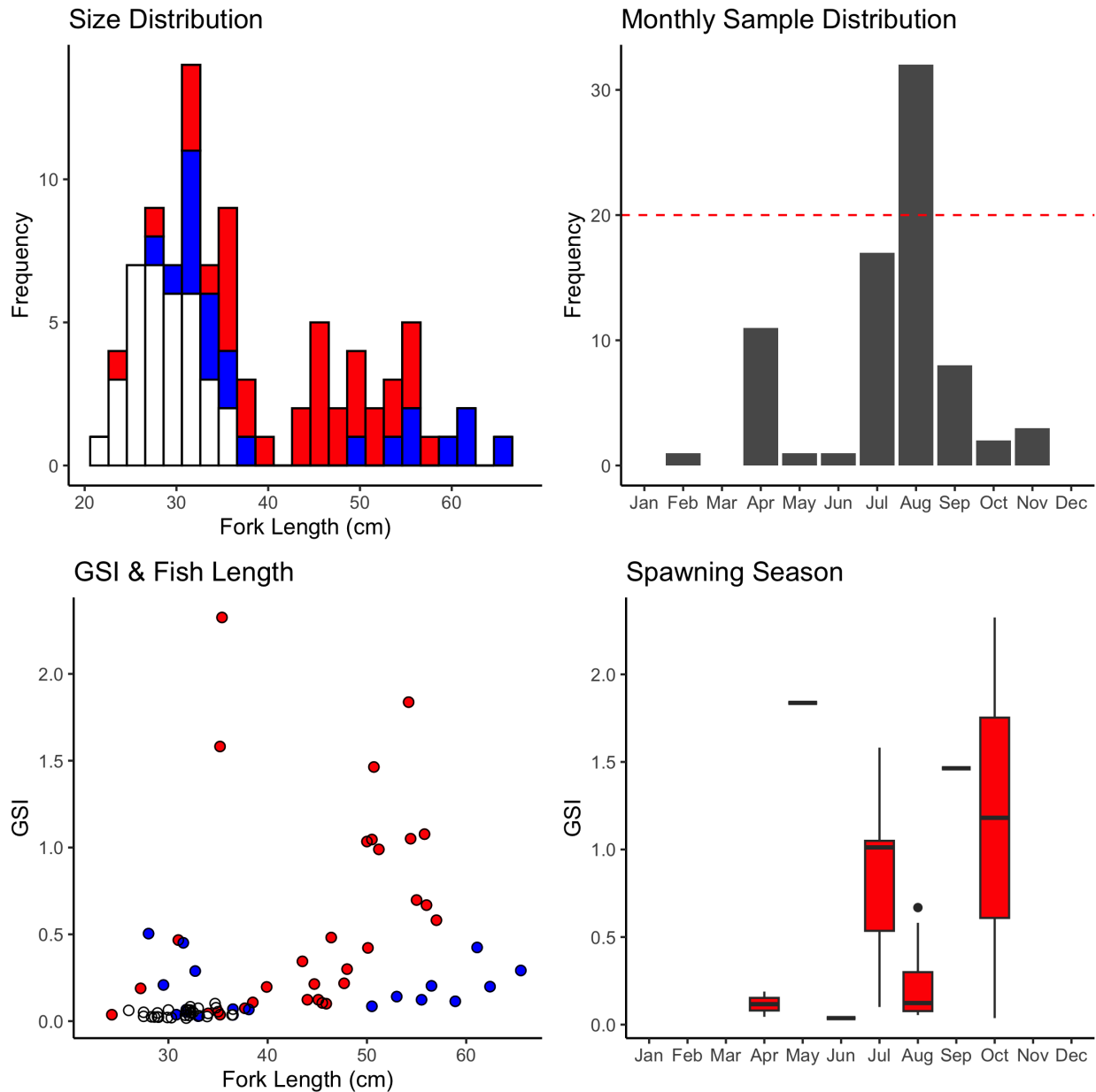


Figure A9. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides flavipinnis

A total of 291 *Pristipomoides flavipinnis* samples (females = 106, males = 97, unknown/NA = 88) have been collected to date (October 2023). Median fork length is 29.5 cm (min=16.5 cm, max=67 cm).

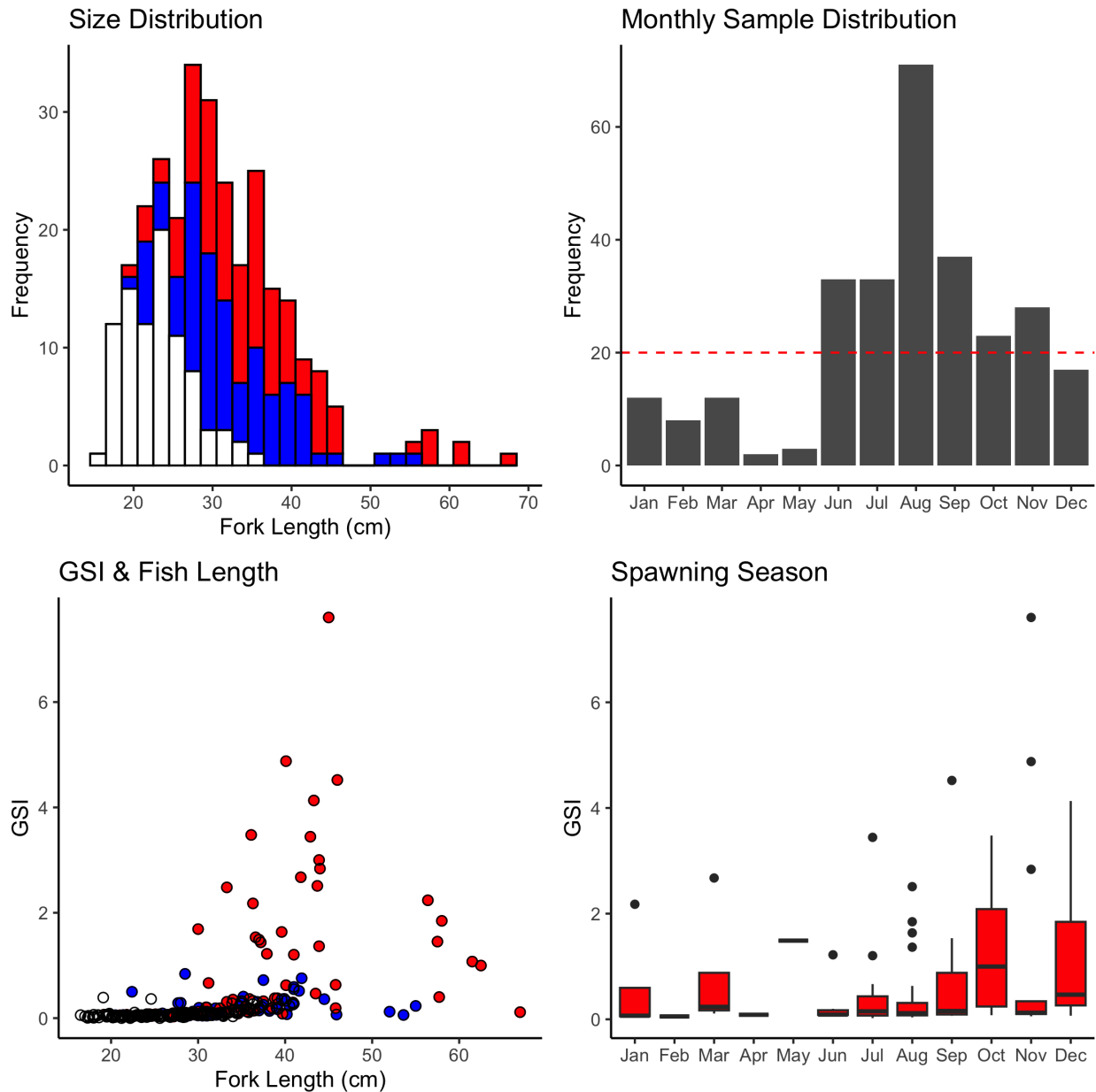


Figure A10. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides sieboldii

A total of 116 *Pristipomoides sieboldii* samples (females = 59, males = 50, unknown/NA = 7) have been collected to date (October 2023). Median fork length is 30.9 cm (min=18.7 cm, max=59.8 cm).

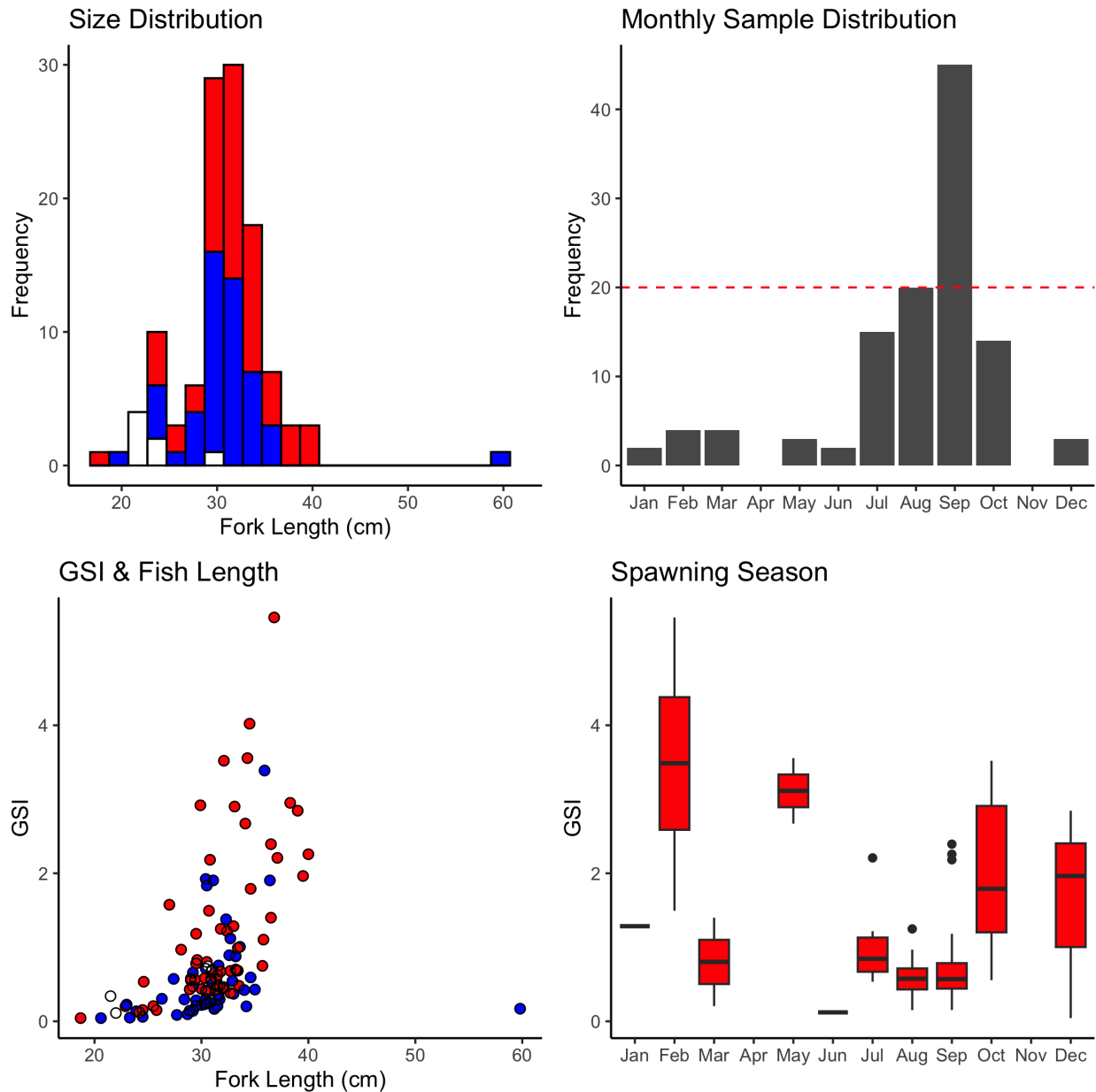


Figure A11. *P. sieboldii* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides zonatus

A total of 729 *Pristipomoides zonatus* samples (females = 343, males = 68, unknown/NA = 318) have been collected to date (October 2023). Median fork length is 26.2 cm (min=11.4 cm, max=40.8 cm).

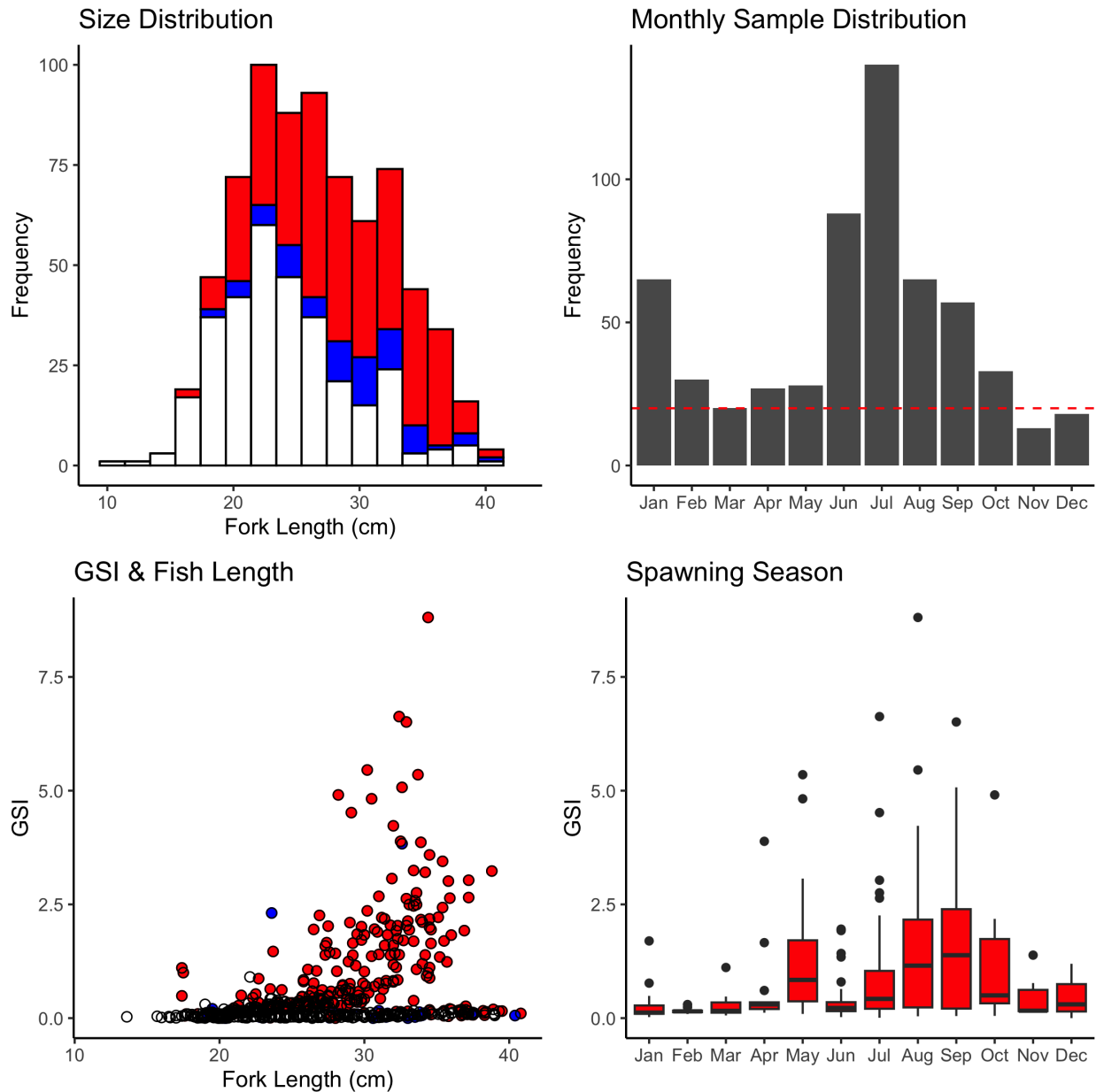


Figure A12. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Variola louti

A total of 330 *Variola louti* samples (females = 158, males = 64, unknown/NA = 108) have been collected to date (October 2023). Median fork length is 33.7 cm (min=19.4 cm, max=49.7 cm).

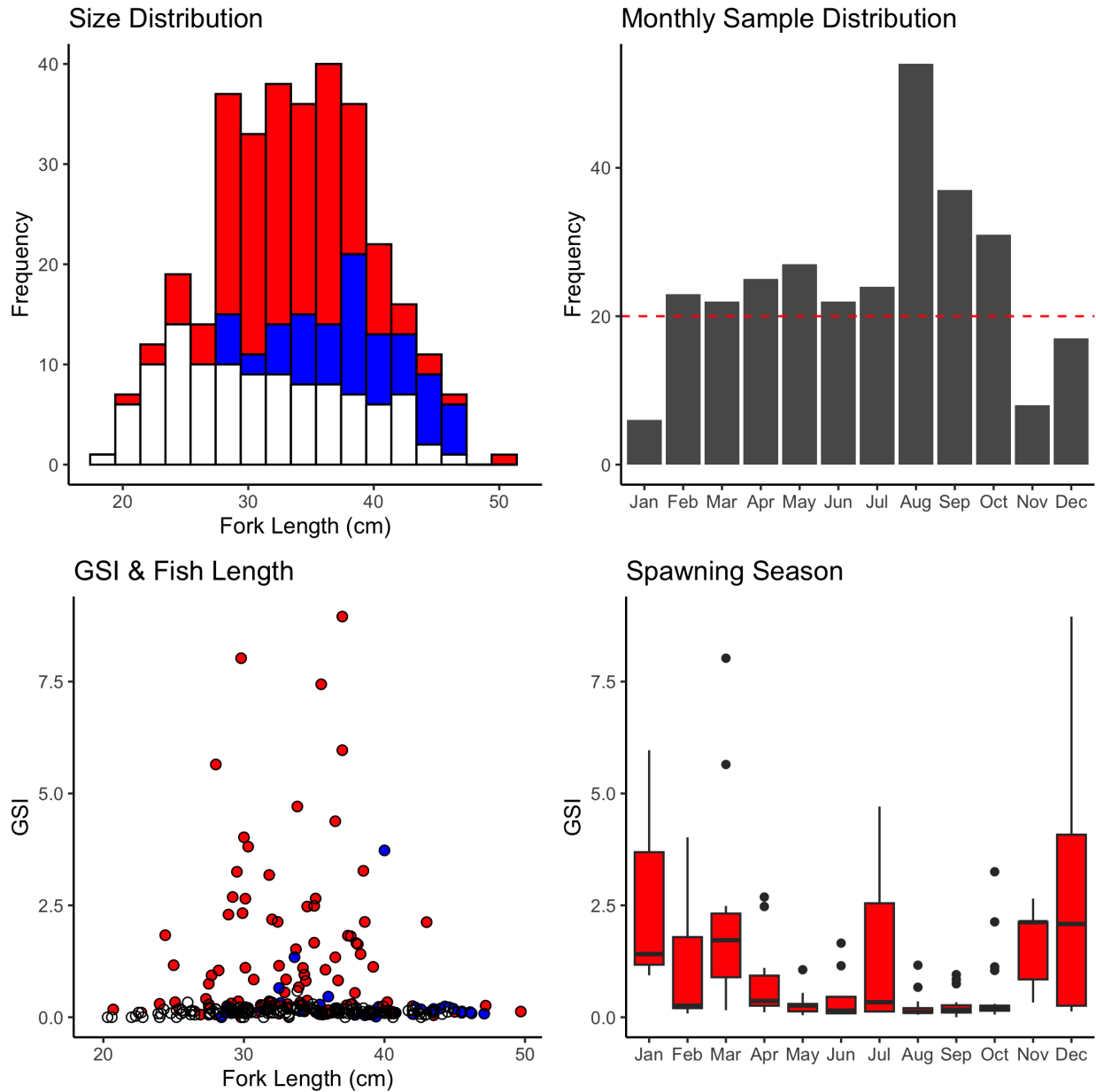


Figure A13. *V. louti* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Non-BMUS

Caranx melampygus

A total of 131 *Caranx melampygus* samples (females = 54, males = 43, unknown/NA = 34) have been collected to date (October 2023). Median fork length is 34.4 cm (min=9.5 cm, max=66.5 cm).

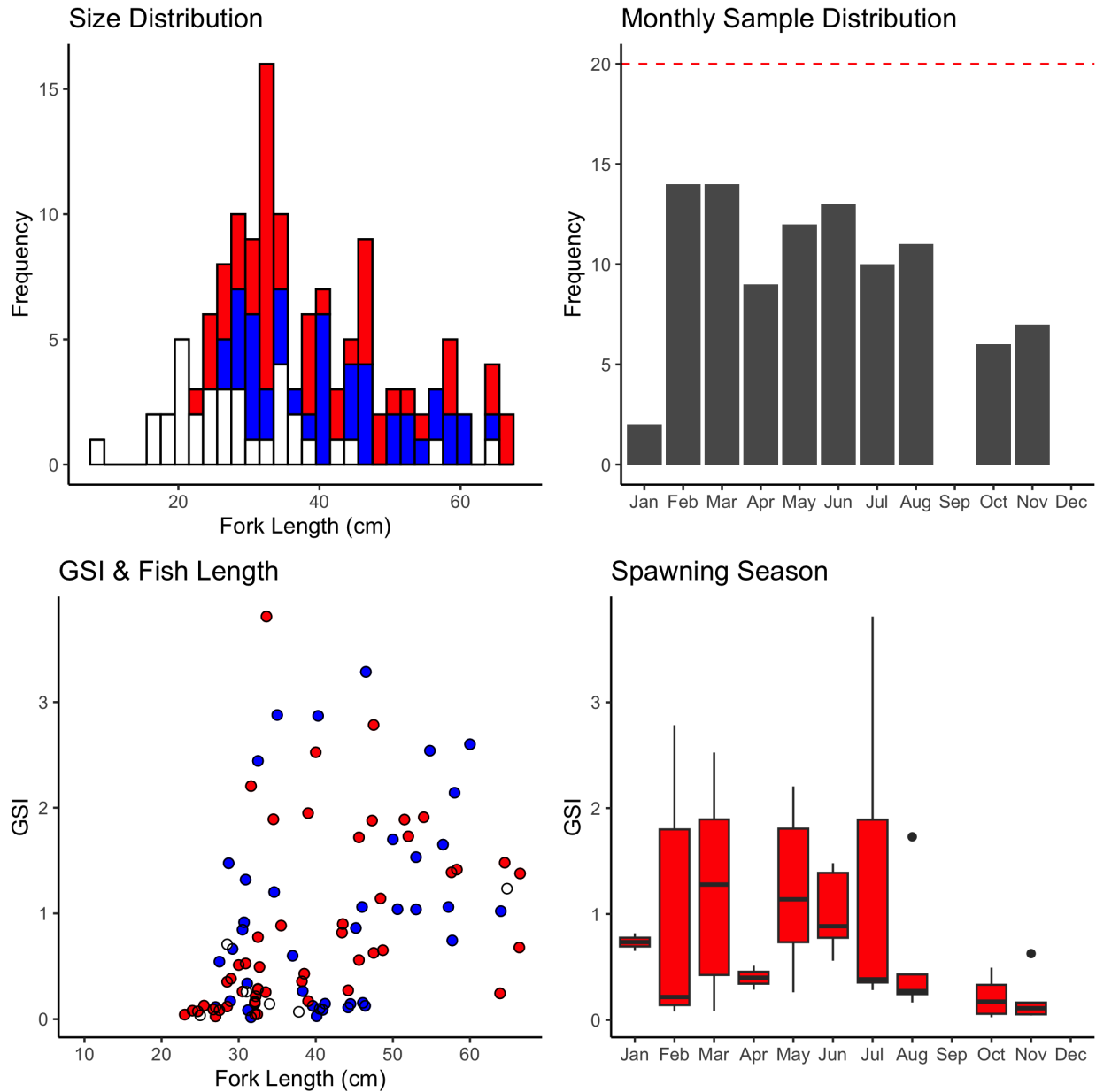


Figure A14. *C. melampygus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cheilinus undulatus

A total of 121 *Cheilinus undulatus* samples (females = 78, males = 6, unknown/NA = 37) have been collected to date (2023–10). Median fork length is 70.1 cm (min=20.9 cm, max=135 cm).

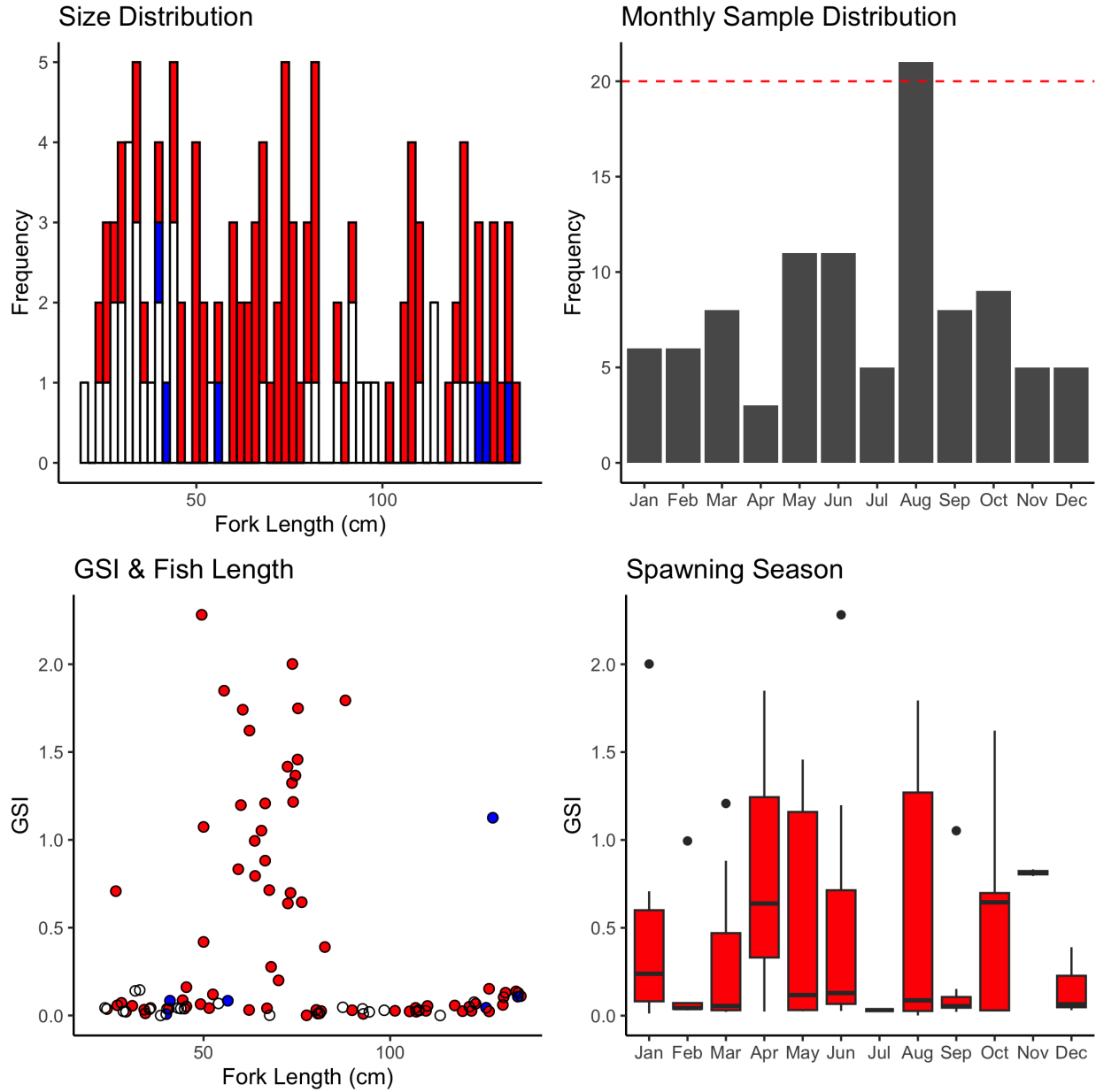


Figure A15. *C. undulatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Epinephelus fasciatus

A total of 60 *Epinephelus fasciatus* samples (females = 24, males = 4, unknown/NA = 32) have been collected to date (October 2023). Median fork length is 21.3 cm (min=14.1 cm, max=30.6 cm).

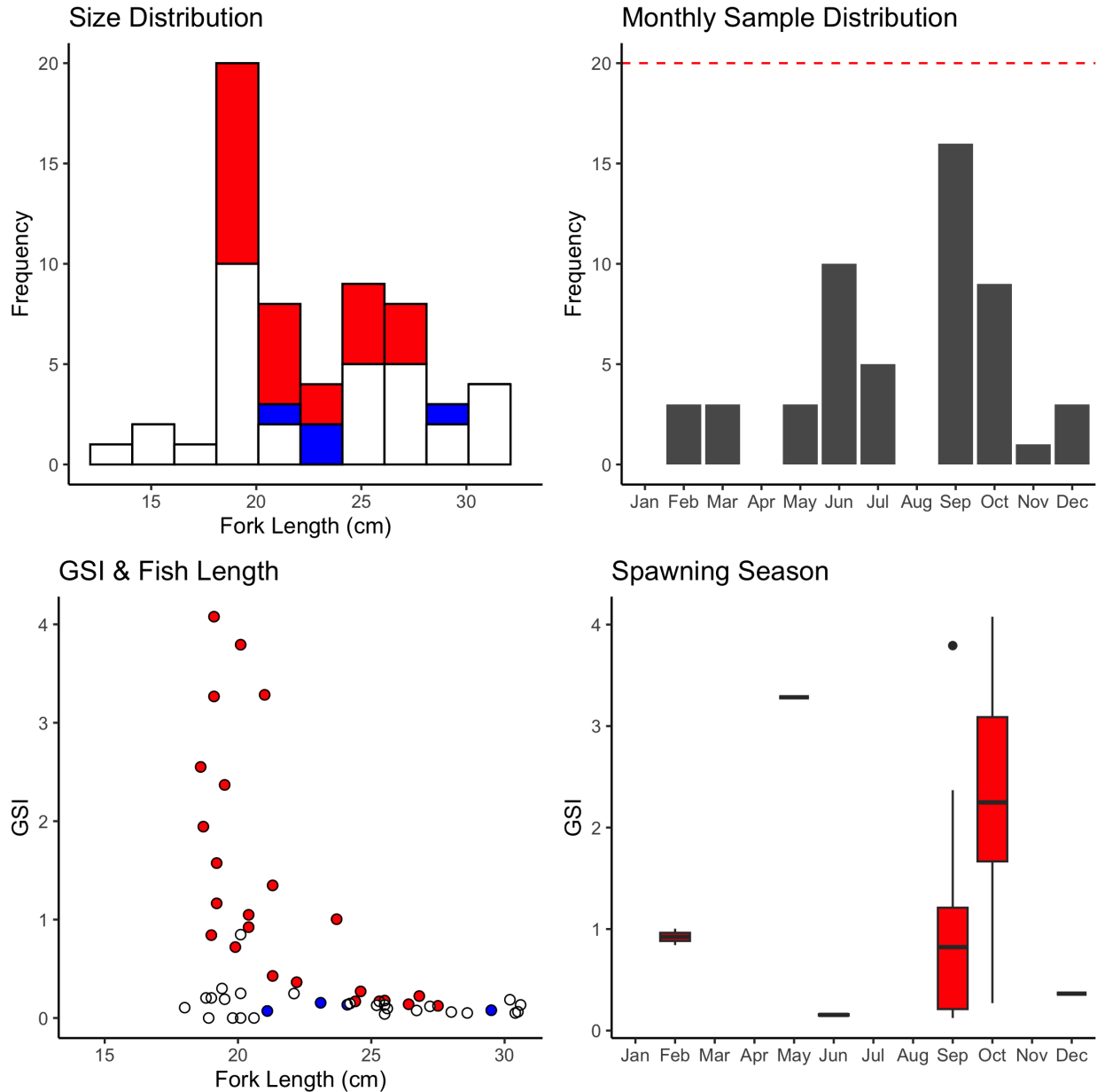


Figure A16. *E. fasciatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus obsoletus

A total of 56 *Lethrinus obsoletus* samples (females = 14, males = 35, unknown/NA = 7) have been collected to date (October 2023). Median fork length is 22.2 cm (min=16 cm, max=32 cm).

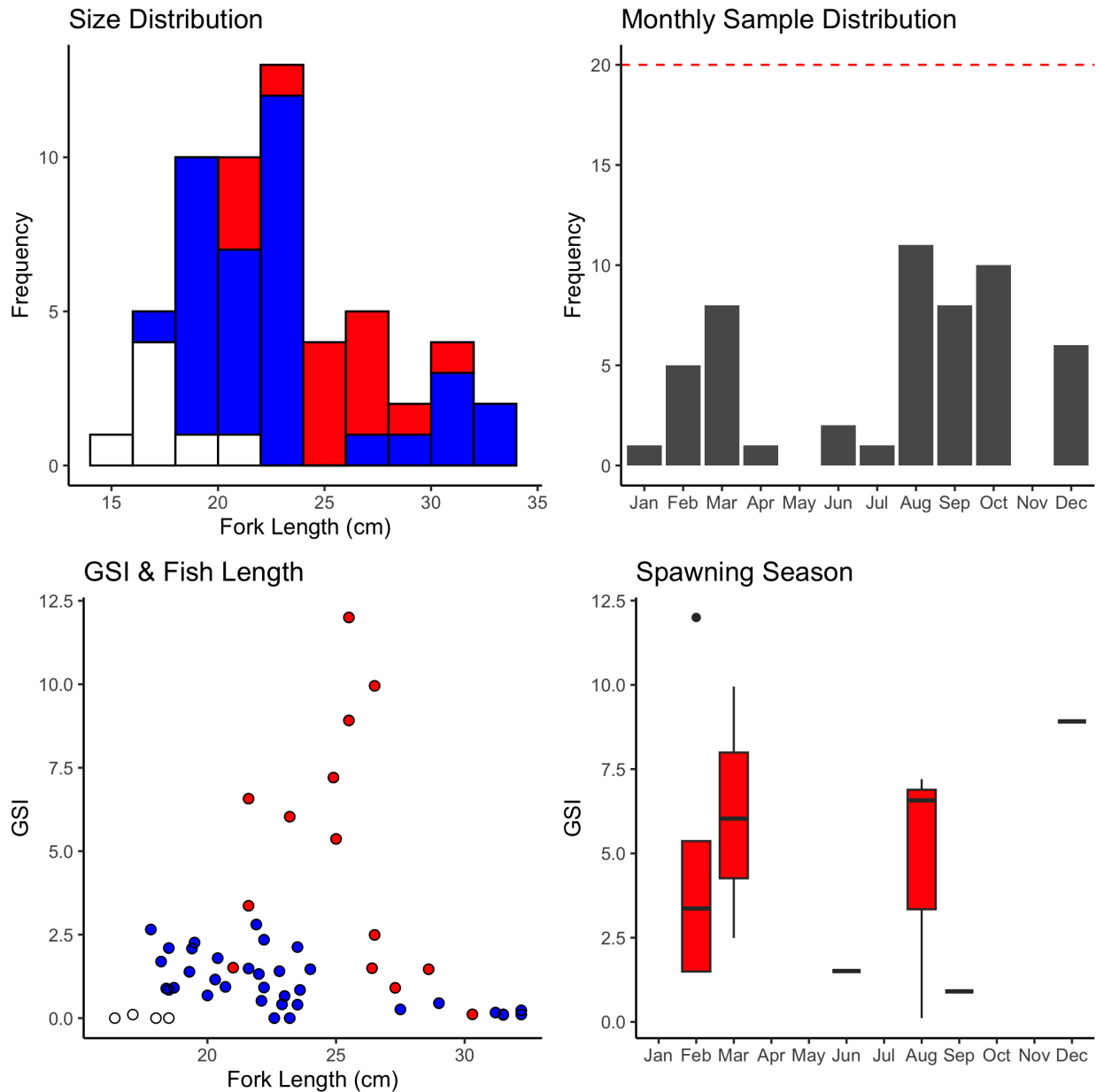


Figure A17. *L. obsoletus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Monotaxis grandoculis

A total of 422 *Monotaxis grandoculis* samples (females = 133, males = 82, unknown/NA = 207) have been collected to date (October 2023). Median fork length is 26.8 cm (min=8.7 cm, max=48.6 cm).

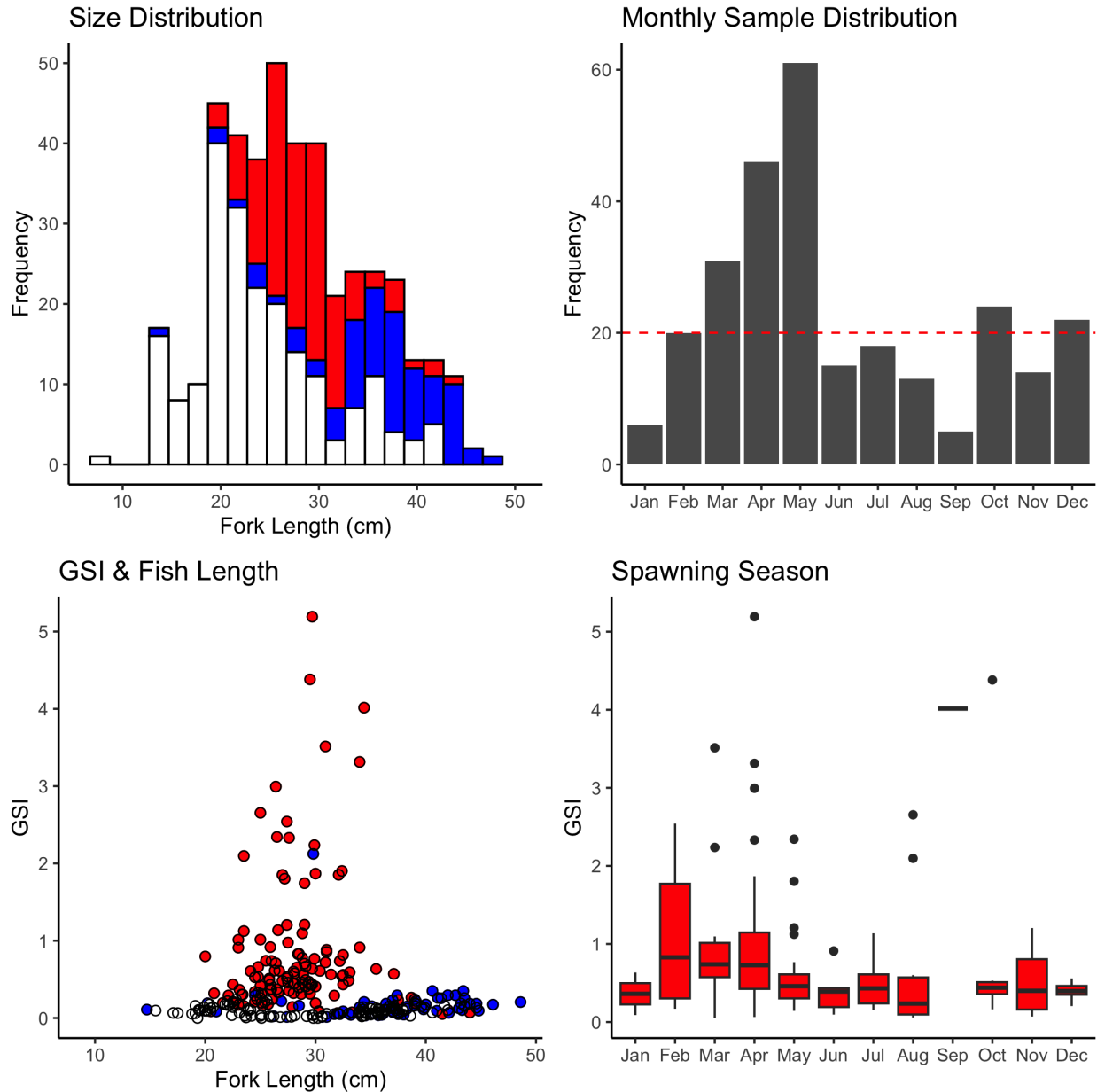


Figure A18. *M. grandoculis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Siganus punctatus

A total of 88 *Siganus punctatus* samples (females = 26, males = 13, unknown/NA = 49) have been collected to date (October 2023). Median fork length is 22.45 cm (min=15.8 cm, max=30.1 cm).

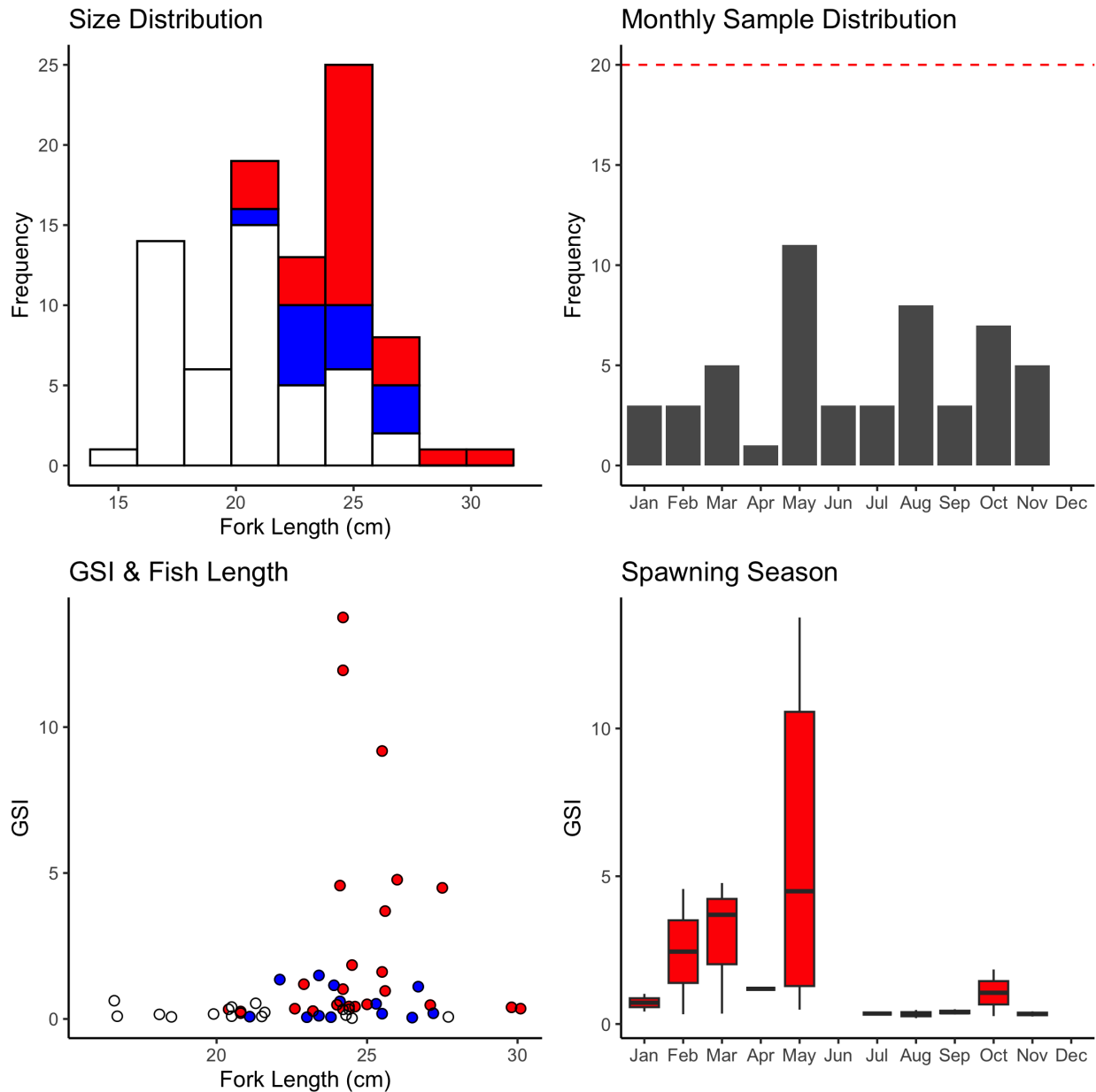


Figure A19. *S. punctatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Appendix B: CNMI Species Summaries

CNMI Fished Species

Updated October 2023

The following species were sampled through the Jurisdictional 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:

- *Acanthurus lineatus*
- *Acanthurus nigricauda*
- *Acanthurus triostegus*
- *Calotomus carolinus*
- *Caranx melampygus*
- *Cephalopholis argus*

- *Cheilinus trilobatus*
- *Cheilinus undulates*
- *Chlorurus sordidus*
- *Kyphosus cinerascens*
- *Lethrinus obsoletus*
- *Monotaxis grandoculis*
- *Mulloidichthus vanicolensis*
- *Naso lituratus*
- *Naso unicornis*
- *Sargocentron spiniferum*
- *Sargocentron tiere*
- *Scarus rubroviolaceus*
- *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 jurisdiction 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. There is a blank summary page if there are not any samples collected for a BMUS. 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 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: GSI (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 GSI is plotted by month to visualize if sampling is adequate to determine spawning seasonality.

Bottomfish Management Unit Species

Aphareus rutilans

A total of 231 *Aphareus rutilans* samples (females = 108, males = 104, unknown/NA = 19) have been collected to date (September 2023). Median fork length is 52.8 cm (min=23 cm, max=99.2 cm).

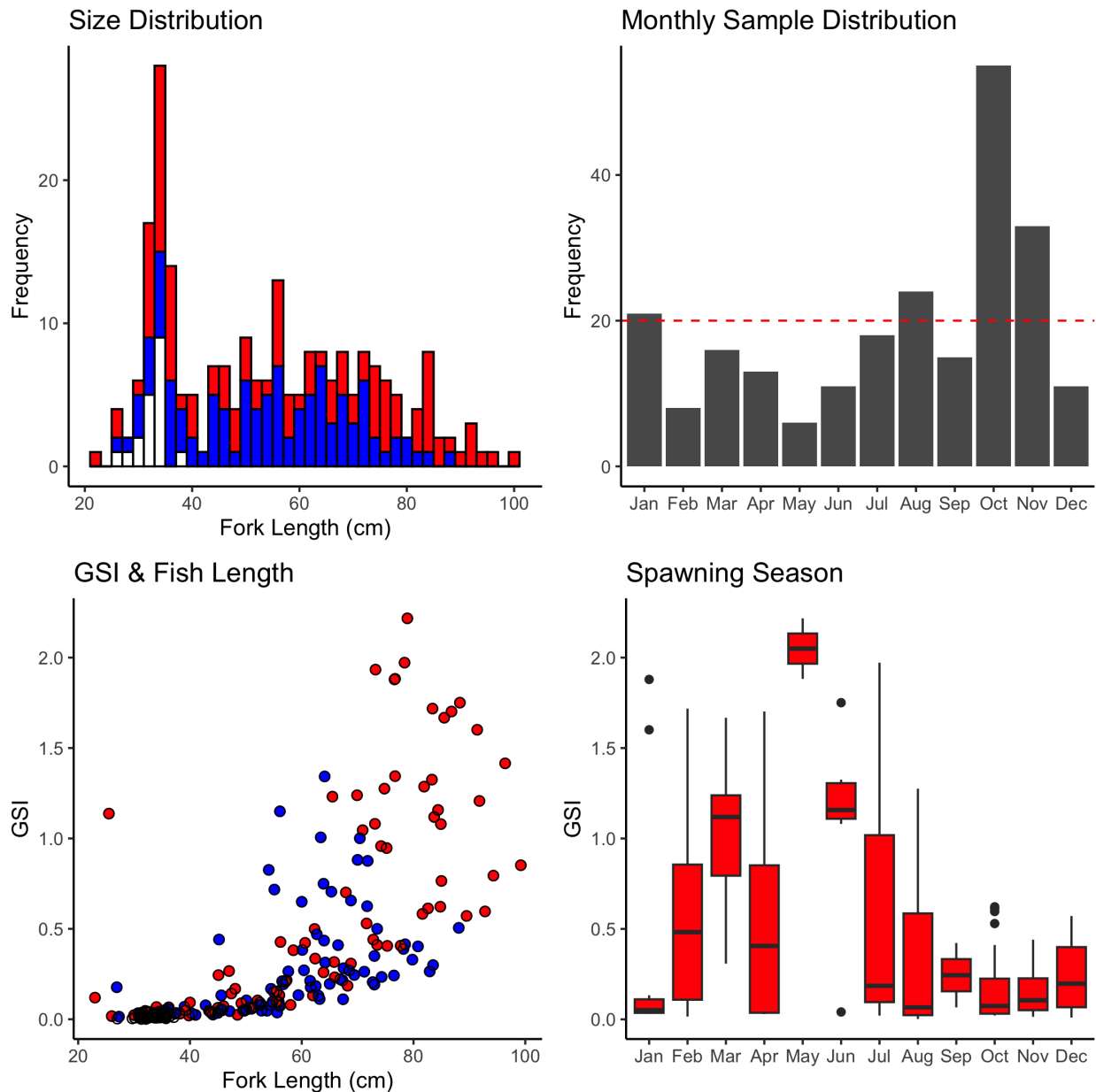


Figure B1. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Caranx ignobilis

A total of 1 *Caranx ignobilis* samples (females = 1, males = NA, unknown/NA = NA) have been collected to date (September 2023). Median fork length is 94.6 cm (min=94.6 cm, max=94.6 cm).

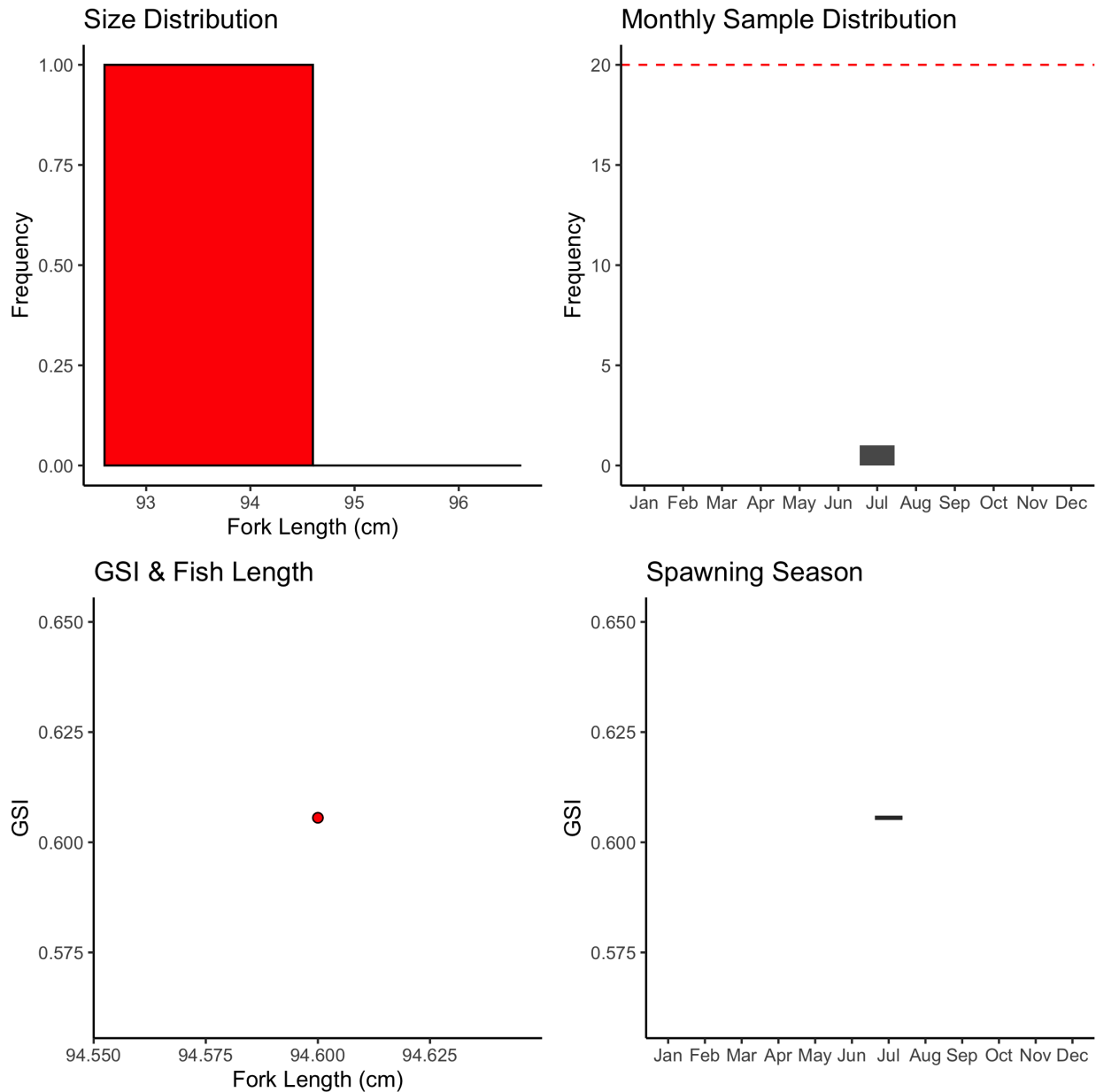


Figure B2. *C. ignobilis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Caranx lugubris

A total of 183 *Caranx lugubris* samples (females = 72, males = 59, unknown/NA = 52) have been collected to date (September 2023). Median fork length is 38 cm (min=21.3 cm, max=70.9 cm).

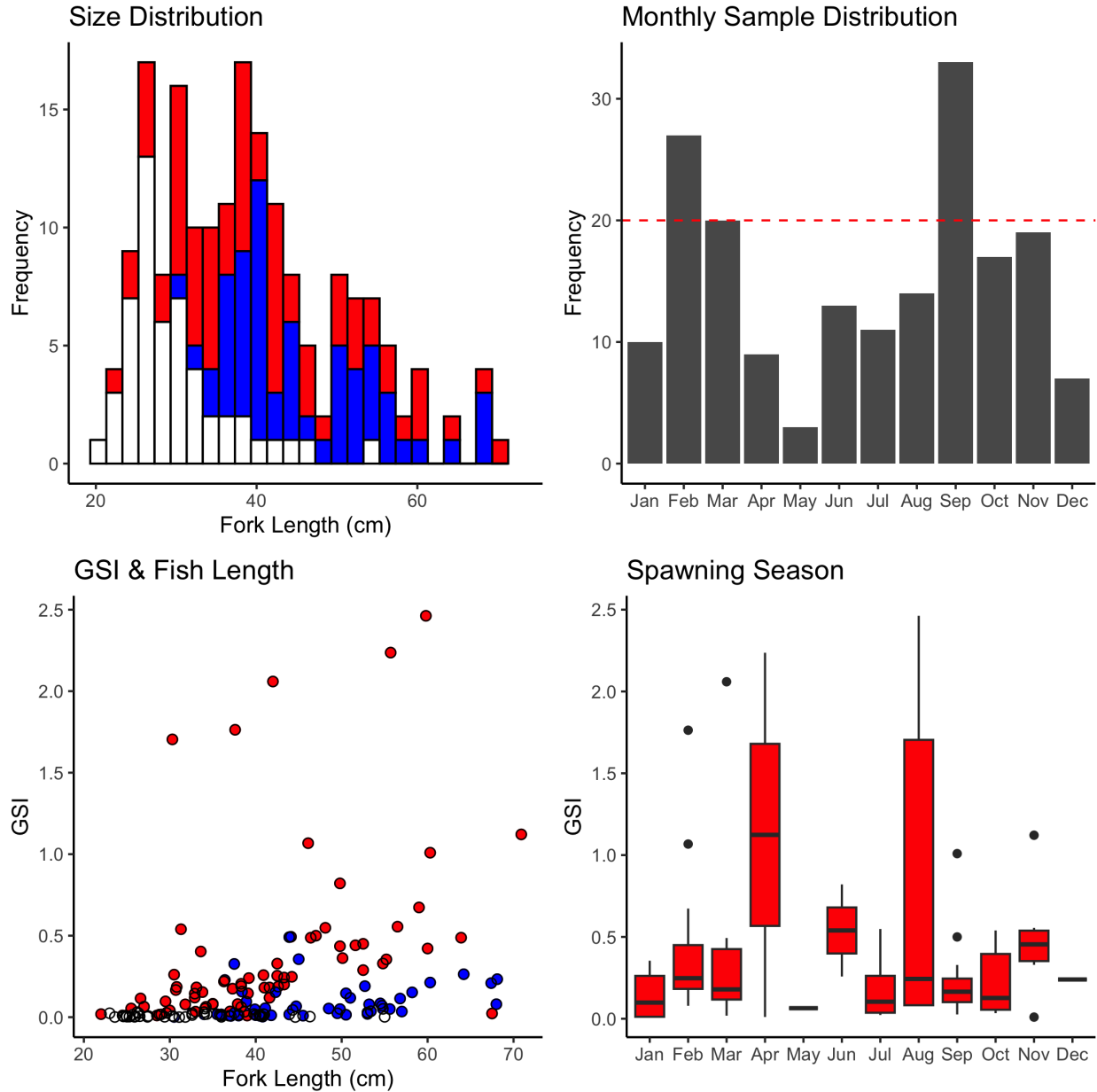


Figure B3. *C. lugubris* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Etelis carbunculus

A total of 681 *Etelis carbunculus* samples (females = 447, males = 228, unknown/NA = 6) have been collected to date (September 2023). Median fork length is 30.7 cm (min=15.7 cm, max=53.4 cm).

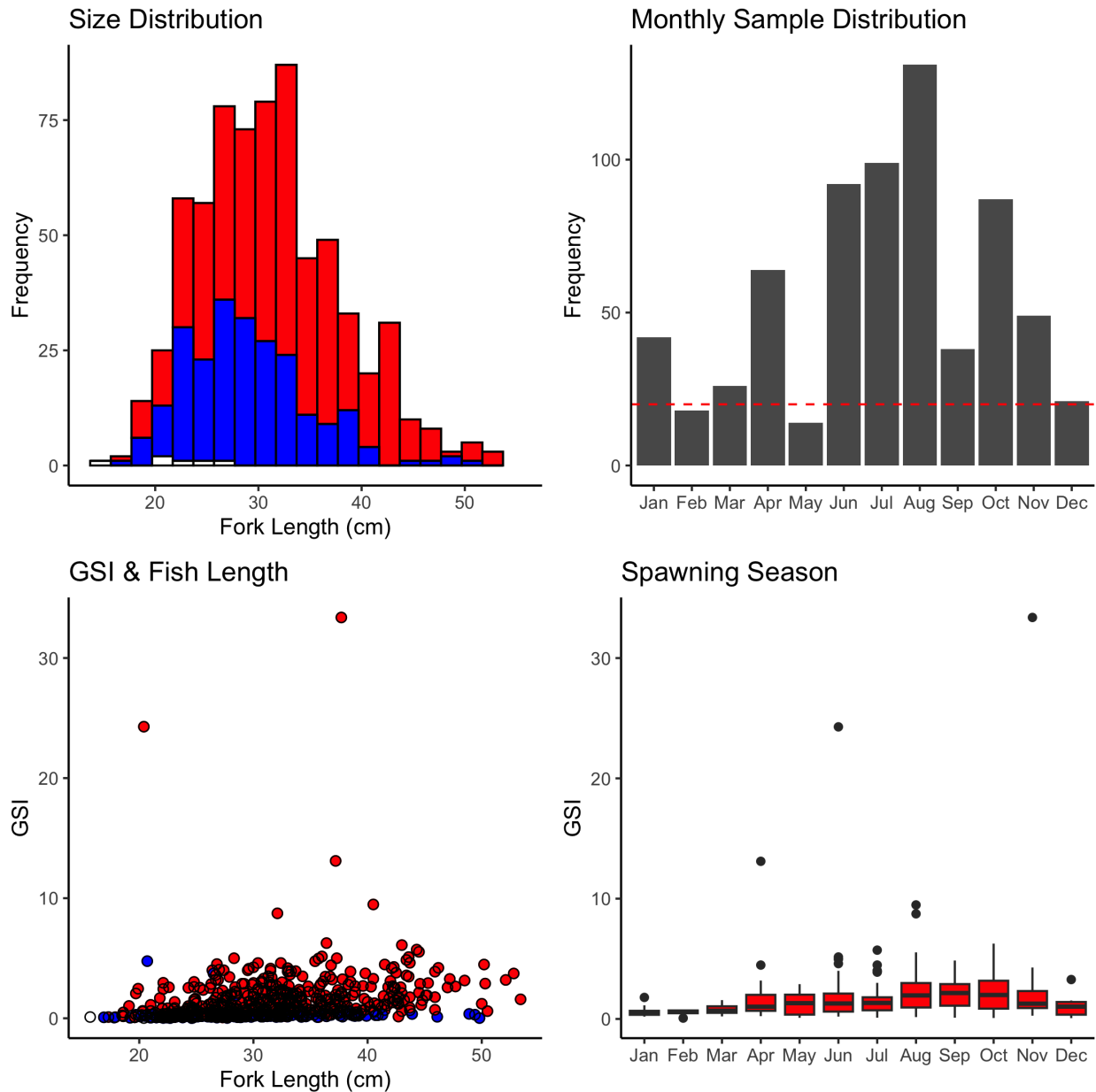


Figure B4. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Etelis coruscans

A total of 531 *Etelis coruscans* samples (females = 260, males = 265, unknown/NA = 6) have been collected to date (September 2023). Median fork length is 70.3 cm (min=24.8 cm, max=99.5 cm).

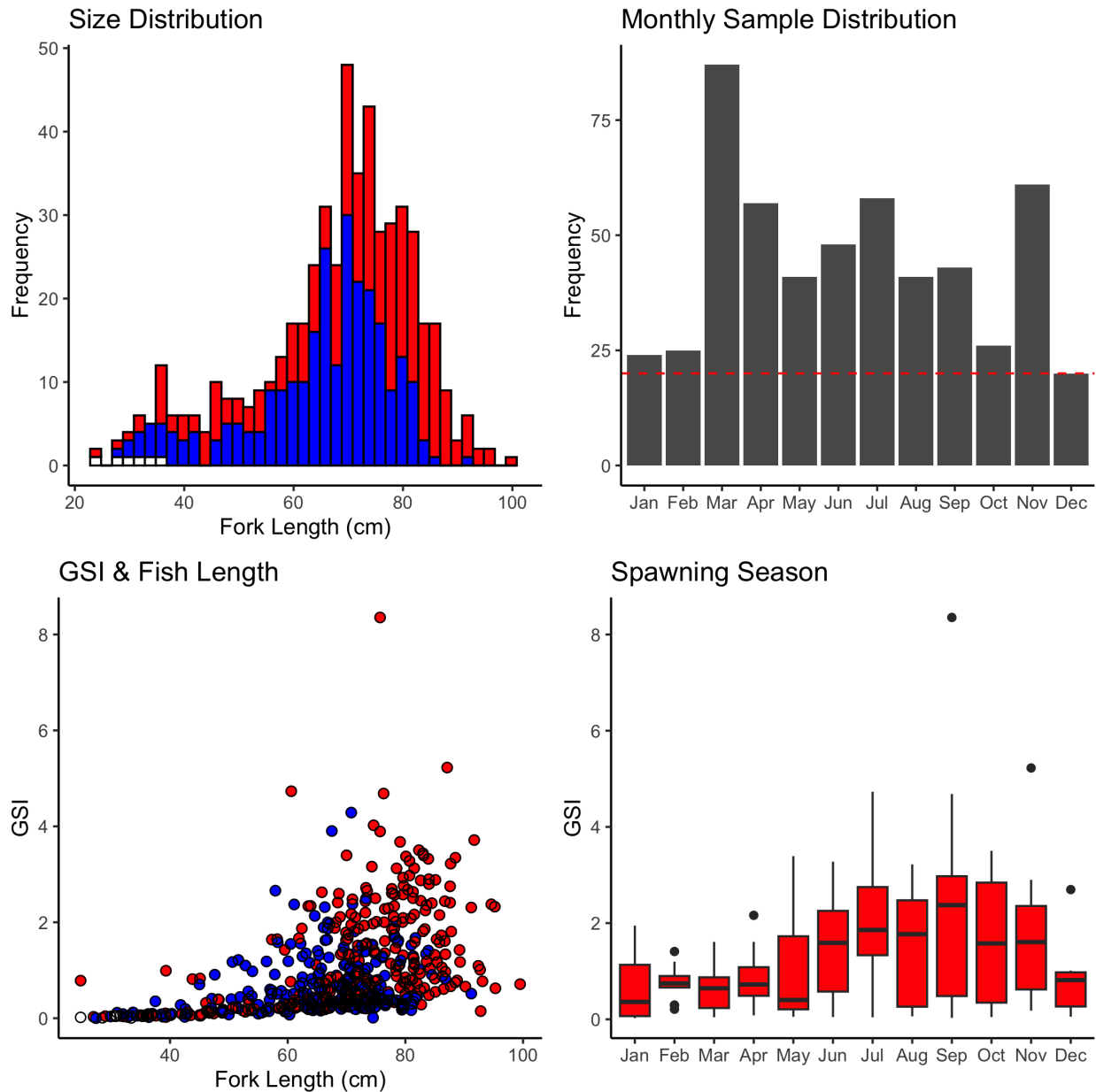


Figure B5. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Lethrinus rubrioperculatus

A total of 2 *Lethrinus rubrioperculatus* samples (females = 1, males = 1, unknown/NA = NA) have been collected to date (September 2023). Median fork length is 27.55 cm (min=27.5 cm, max=27.6 cm).

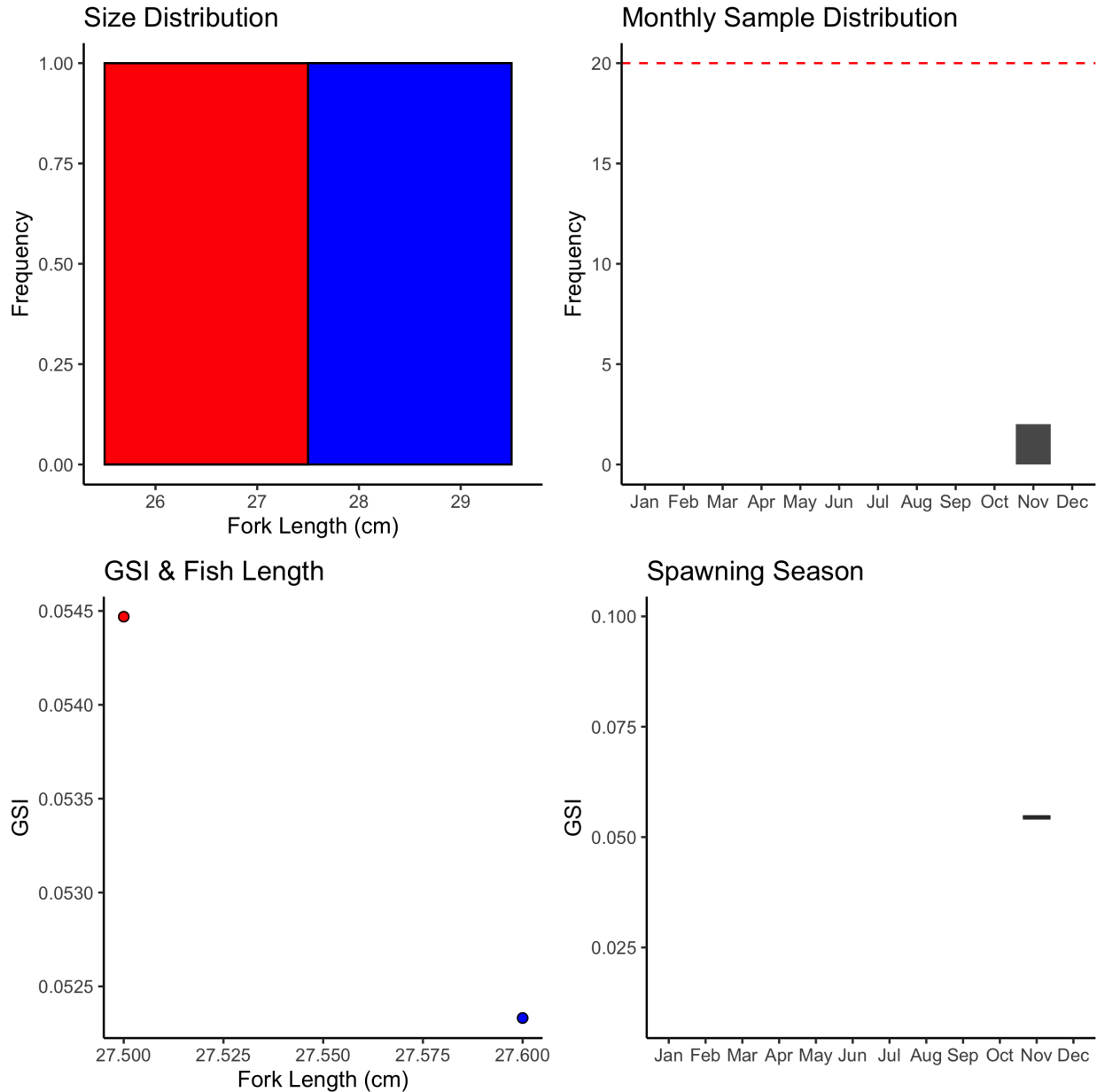


Figure B6. *L. rubrioperculatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Lutjanus kasmira

A total of 233 *Lutjanus kasmira* samples (females = 90, males = 131, unknown/NA = 12) have been collected to date (September 2023). Median fork length is 23.1 cm (min=17.4 cm, max=32.6 cm).

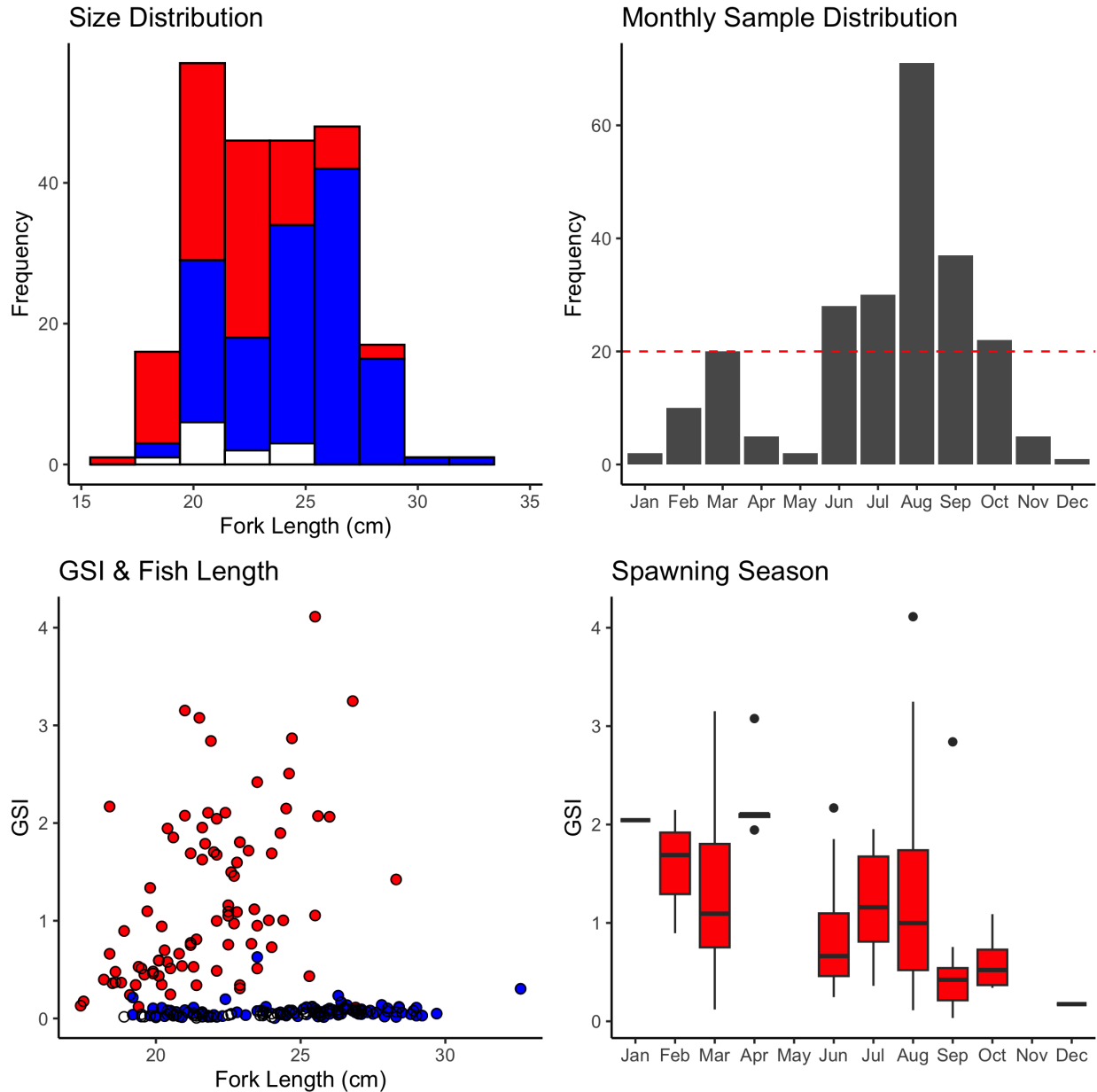


Figure B7. *L. kasmira* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides auricilla

A total of 536 *Pristipomoides auricilla* samples (females = 262, males = 255, unknown/NA = 19) have been collected to date (September 2023). Median fork length is 28.6 cm (min=19.6 cm, max=38.9 cm).

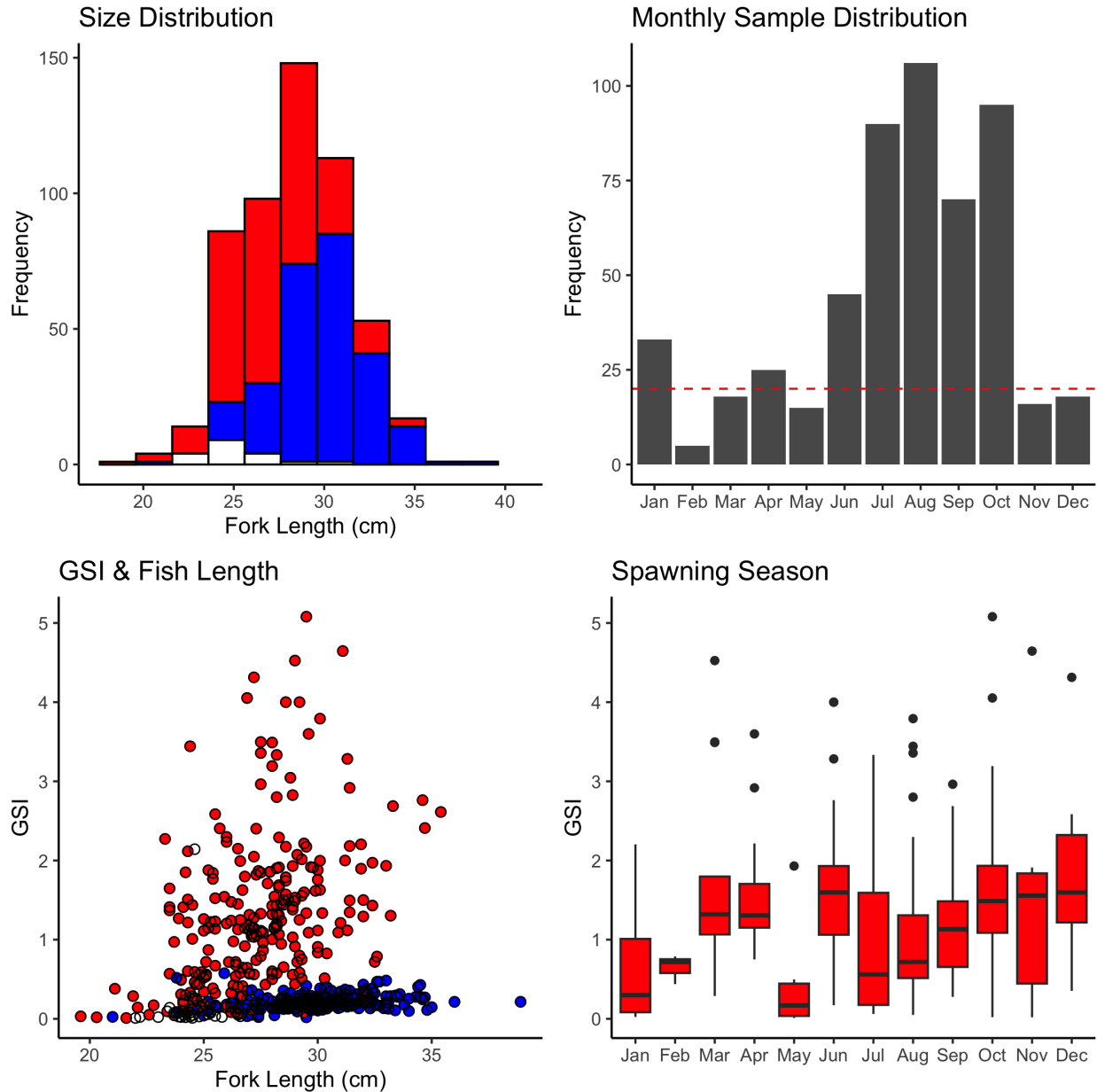


Figure B8. *P. auricilla* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides filamentosus

A total of 23 *Pristipomoides filamentosus* samples (females = 9, males = 14, unknown/NA = NA) have been collected to date (September 2023). Median fork length is 49.1 cm (min=26.3 cm, max=60 cm).

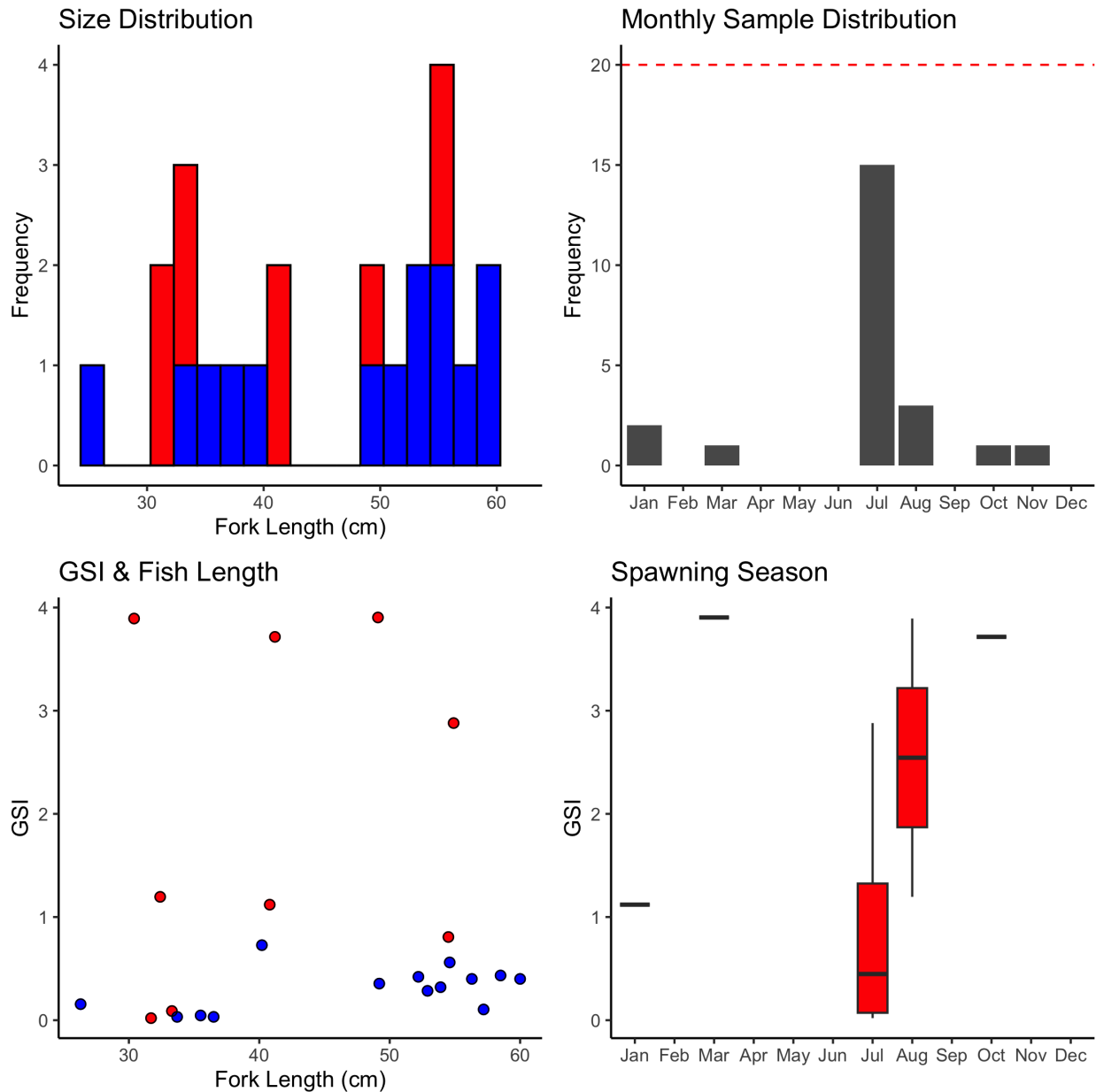


Figure B9. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides flavipinnis

A total of 307 *Pristipomoides flavipinnis* samples (females = 151, males = 154, unknown/NA = 2) have been collected to date (September 2023). Median fork length is 34.4 cm (min=20.7 cm, max=45.2 cm).

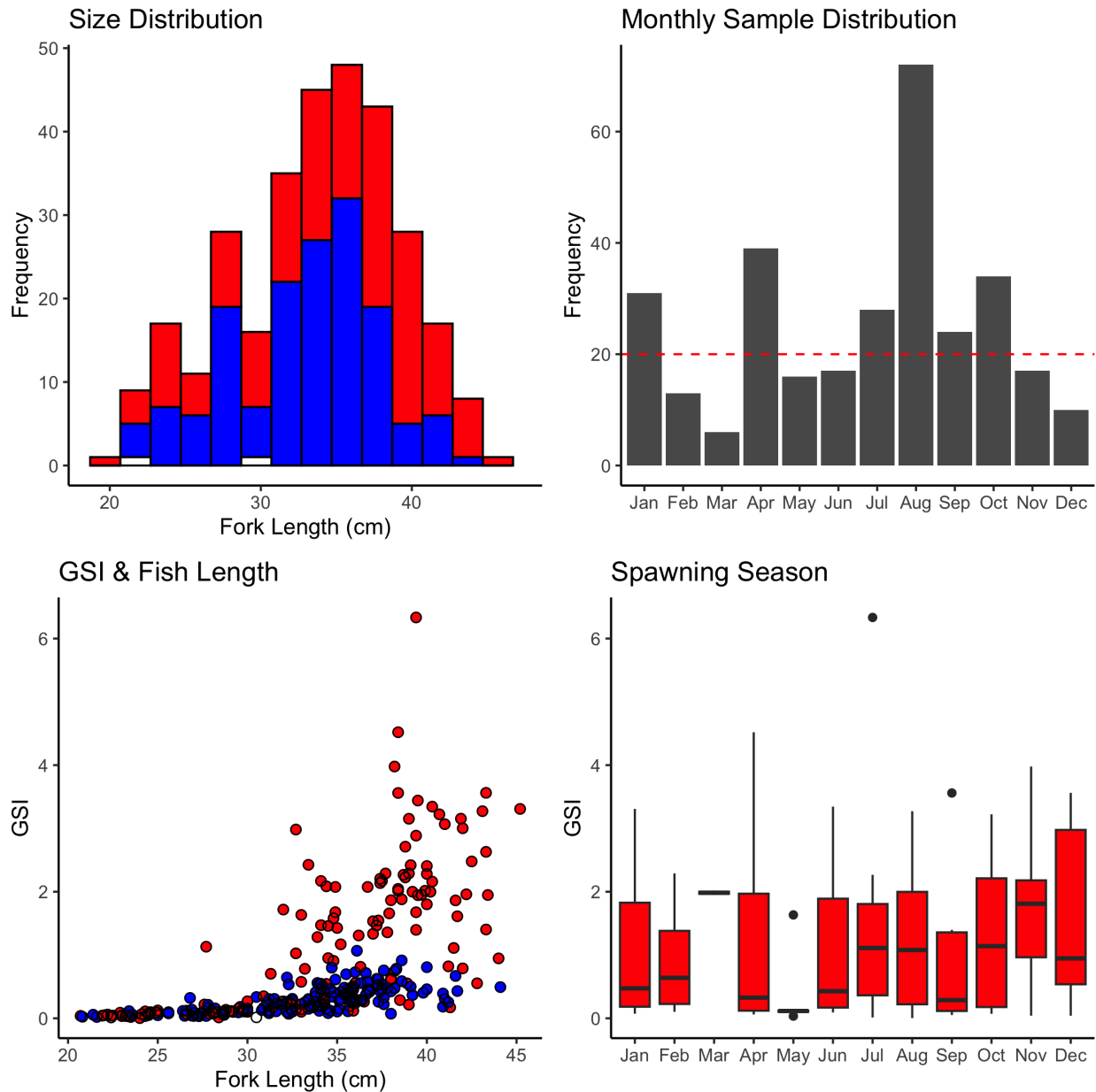


Figure B10. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides sieboldii

A total of 277 *Pristipomoides sieboldii* samples (females = 129, males = 137, unknown/NA = 11) have been collected to date (September 2023). Median fork length is 30.1 cm (min=19.5 cm, max=36.2 cm).

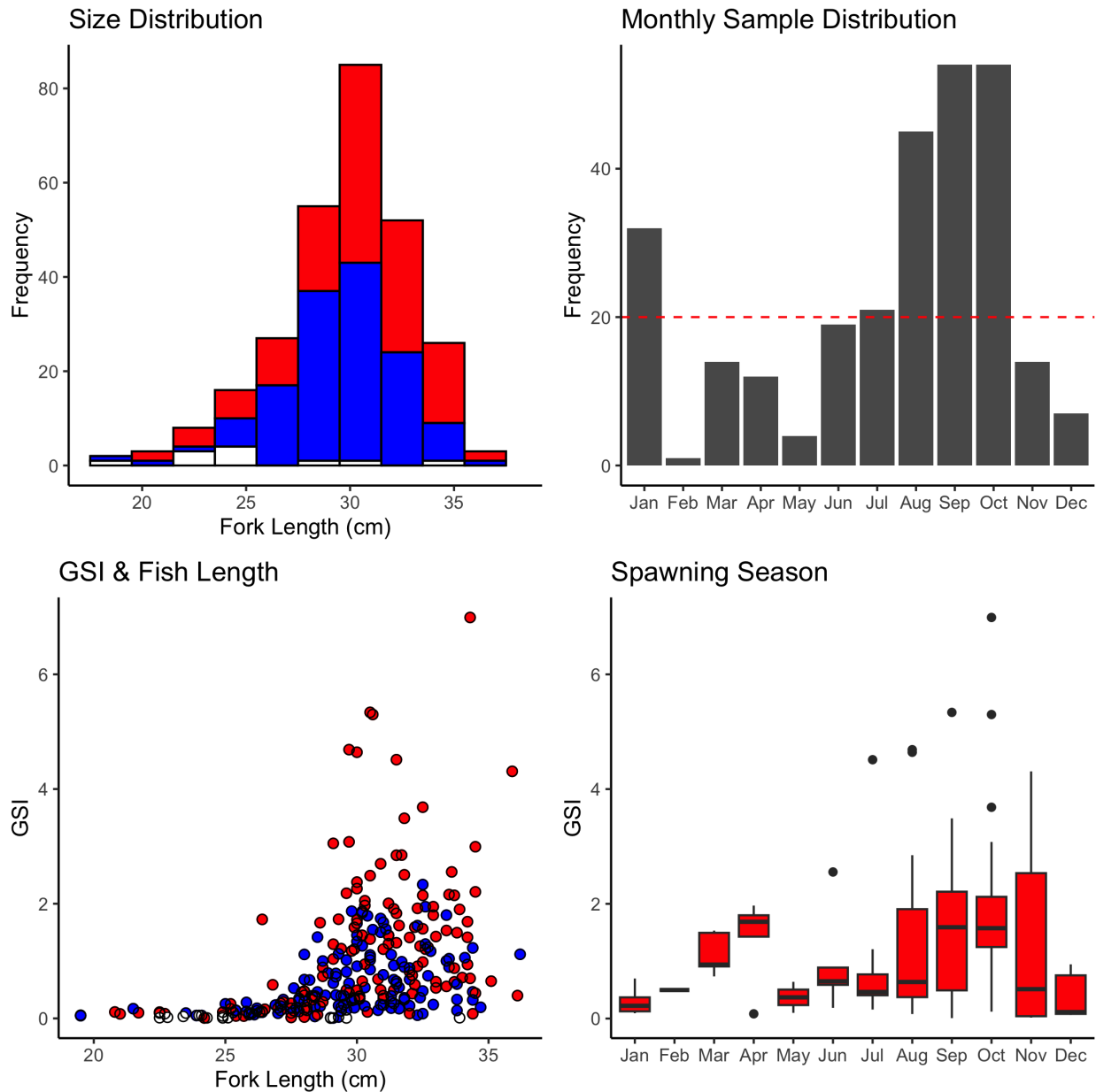


Figure B11. *P. sieboldii* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides zonatus

A total of 552 *Pristipomoides zonatus* samples (females = 332, males = 148, unknown/NA = 72) have been collected to date (September 2023). Median fork length is 32.5 cm (min=17.5 cm, max=41.3 cm).

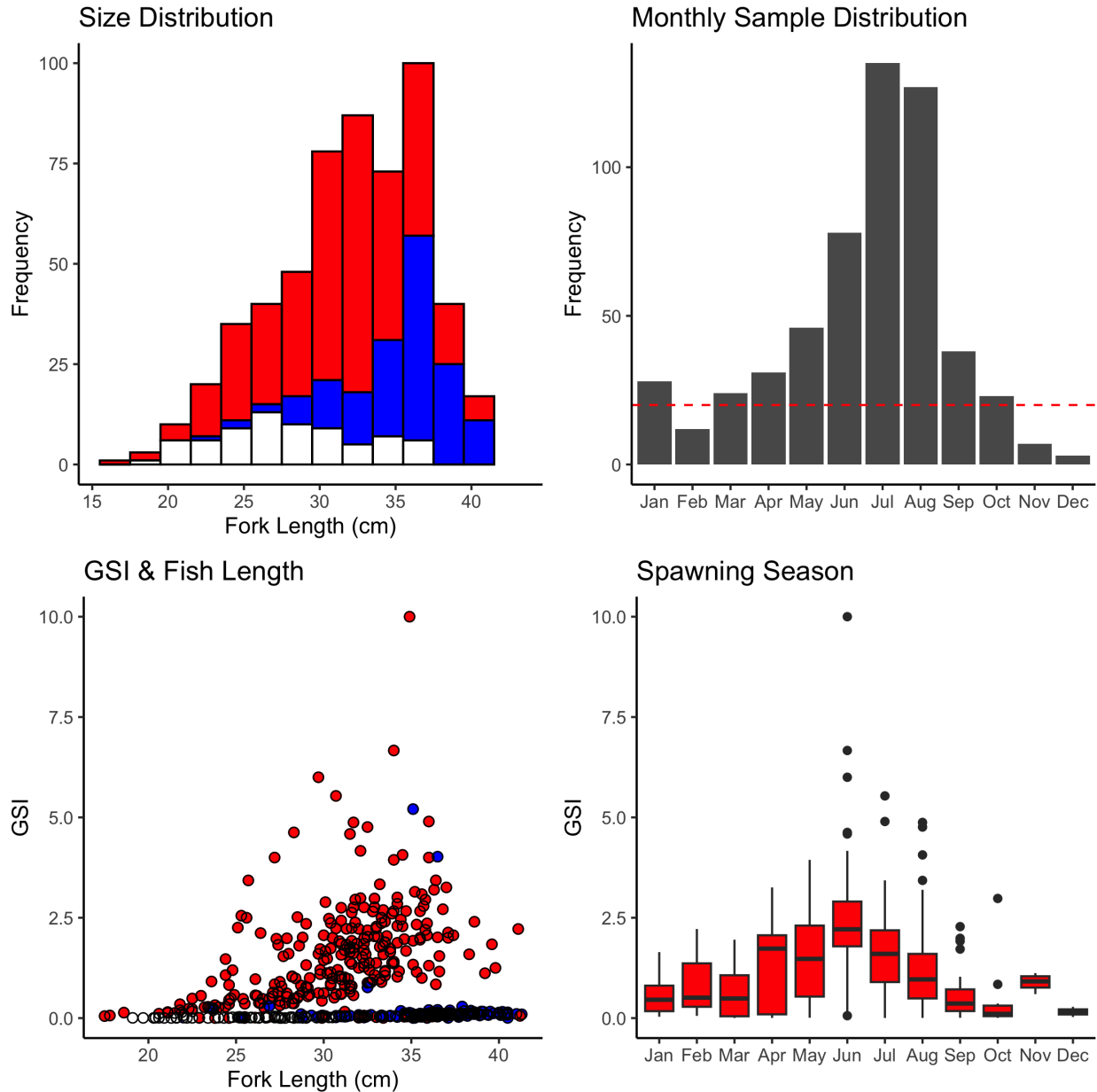


Figure B12. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Variola louti

A total of 8 *Variola louti* samples (females = 5, males = 1, unknown/NA = 2) have been collected to date (2023_09). Median fork length is 36.2 cm (min=32.1 cm, max=44.5 cm).

Non-BMUS

Acanthurus lineatus

A total of 1010 *Acanthurus lineatus* samples (females = 426, males = 429, unknown/NA = 155) have been collected to date (September 2023). Median fork length is 17.7 cm (min=4.8 cm, max=30 cm).

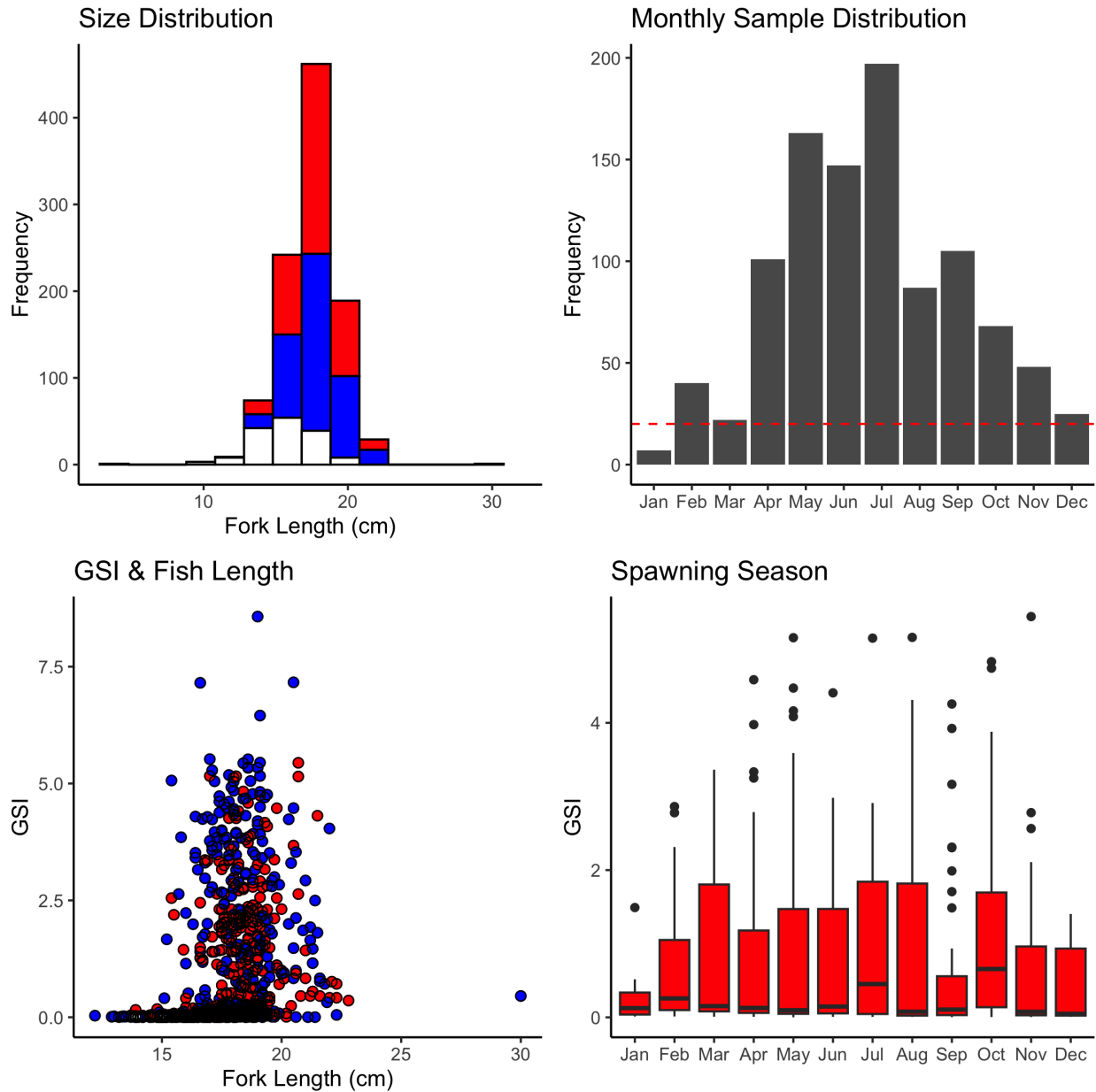


Figure B13. *A. lineatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Acanthurus nigricauda

A total of 588 *Acanthurus nigricauda* samples (females = 200, males = 197, unknown/NA = 191) have been collected to date (September 2023). Median fork length is 18.45 cm (min=12.5 cm, max=25.3 cm).

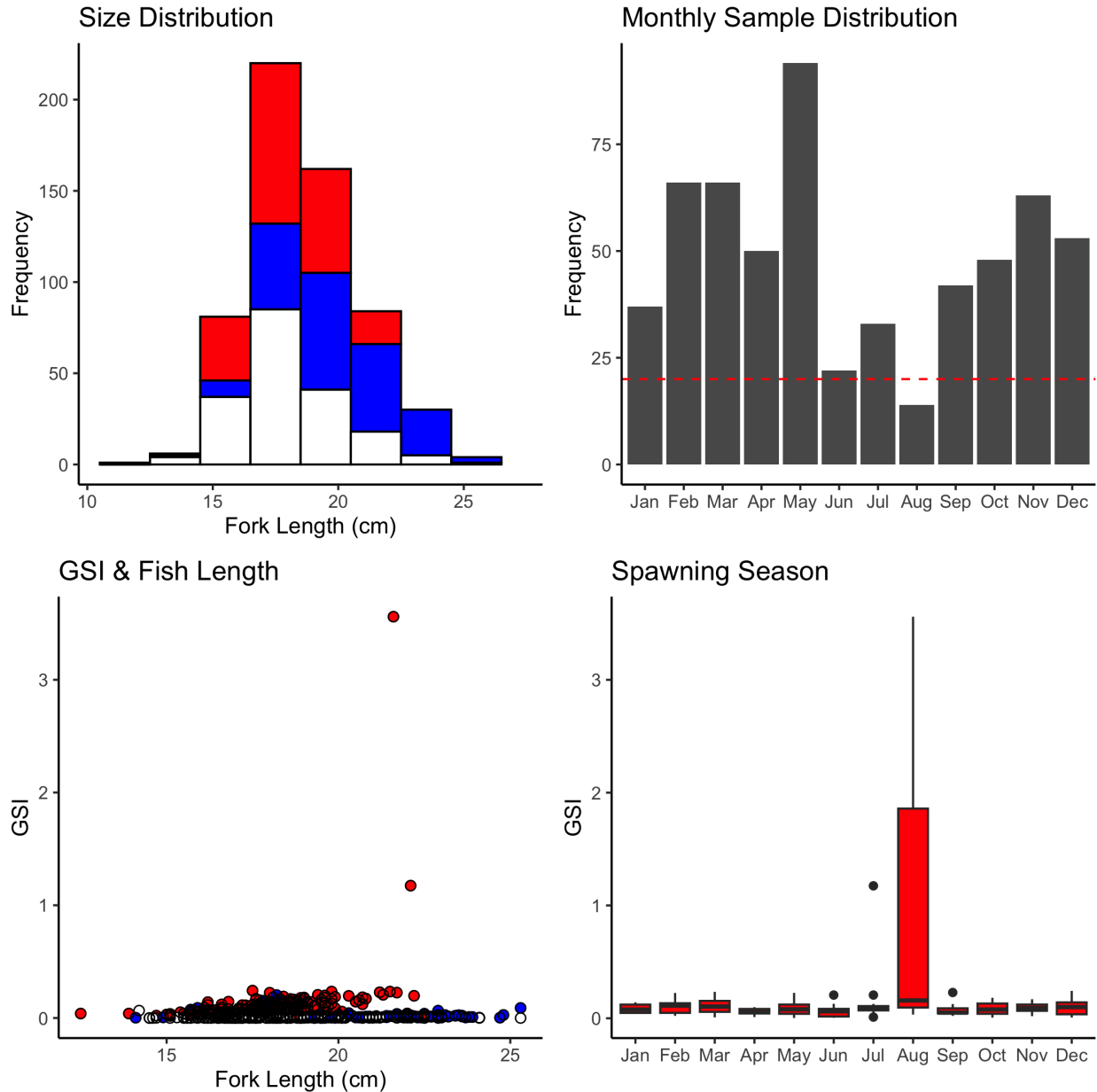


Figure B14. *A. nigricauda* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Acanthurus triostegus

A total of 372 *Acanthurus triostegus* samples (females = 195, males = 175, unknown/NA = 2) have been collected to date (September 2023). Median fork length is 15.3 cm (min=11.7 cm, max=18.7 cm).

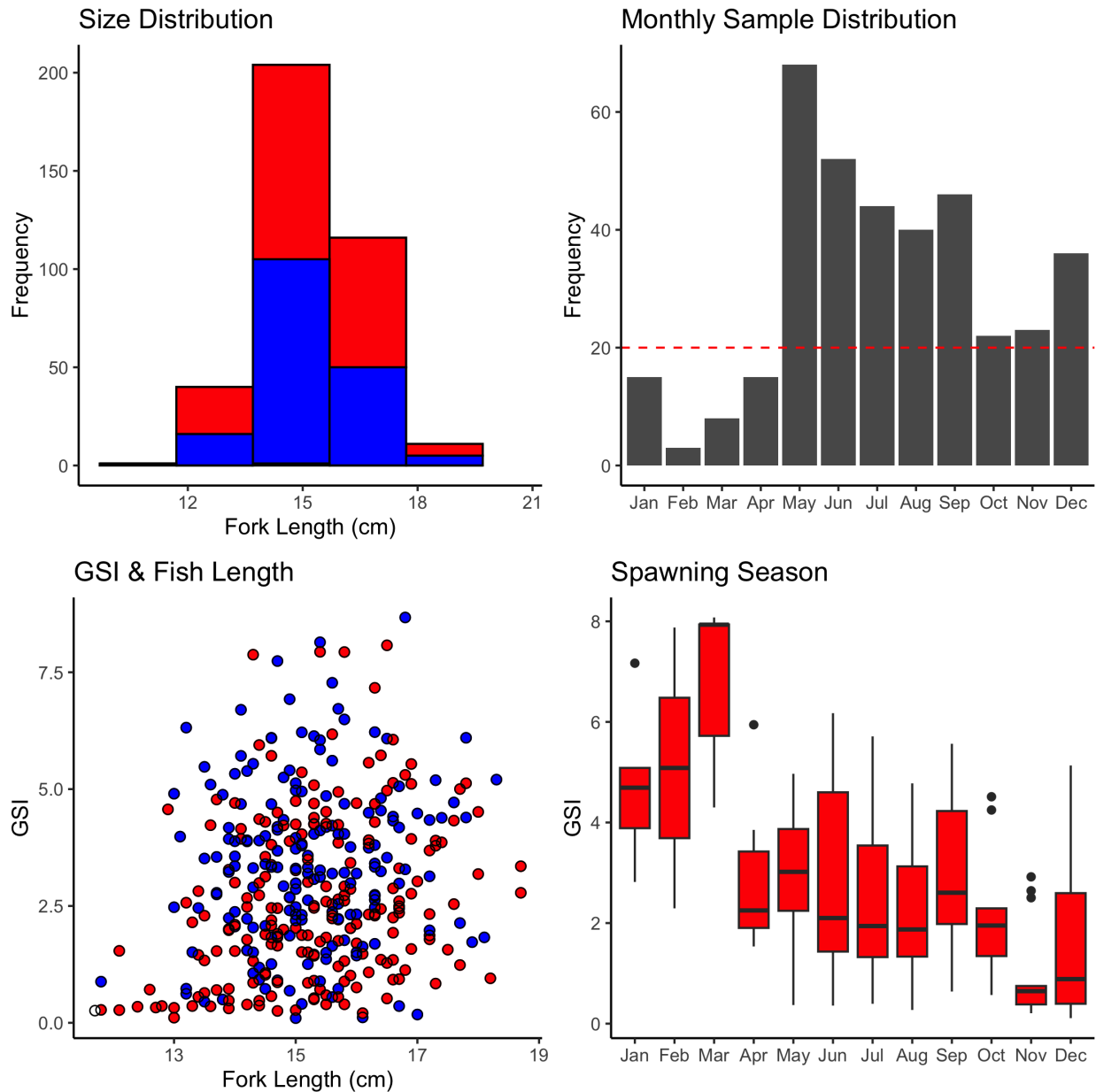


Figure B15. *L. rubioperculatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Calotomus carolinus

A total of 427 *Calotomus carolinus* samples (females = 278, males = 147, unknown/NA = 2) have been collected to date (September 2023). Median fork length is 24.6 cm (min=17 cm, max=32.2 cm).

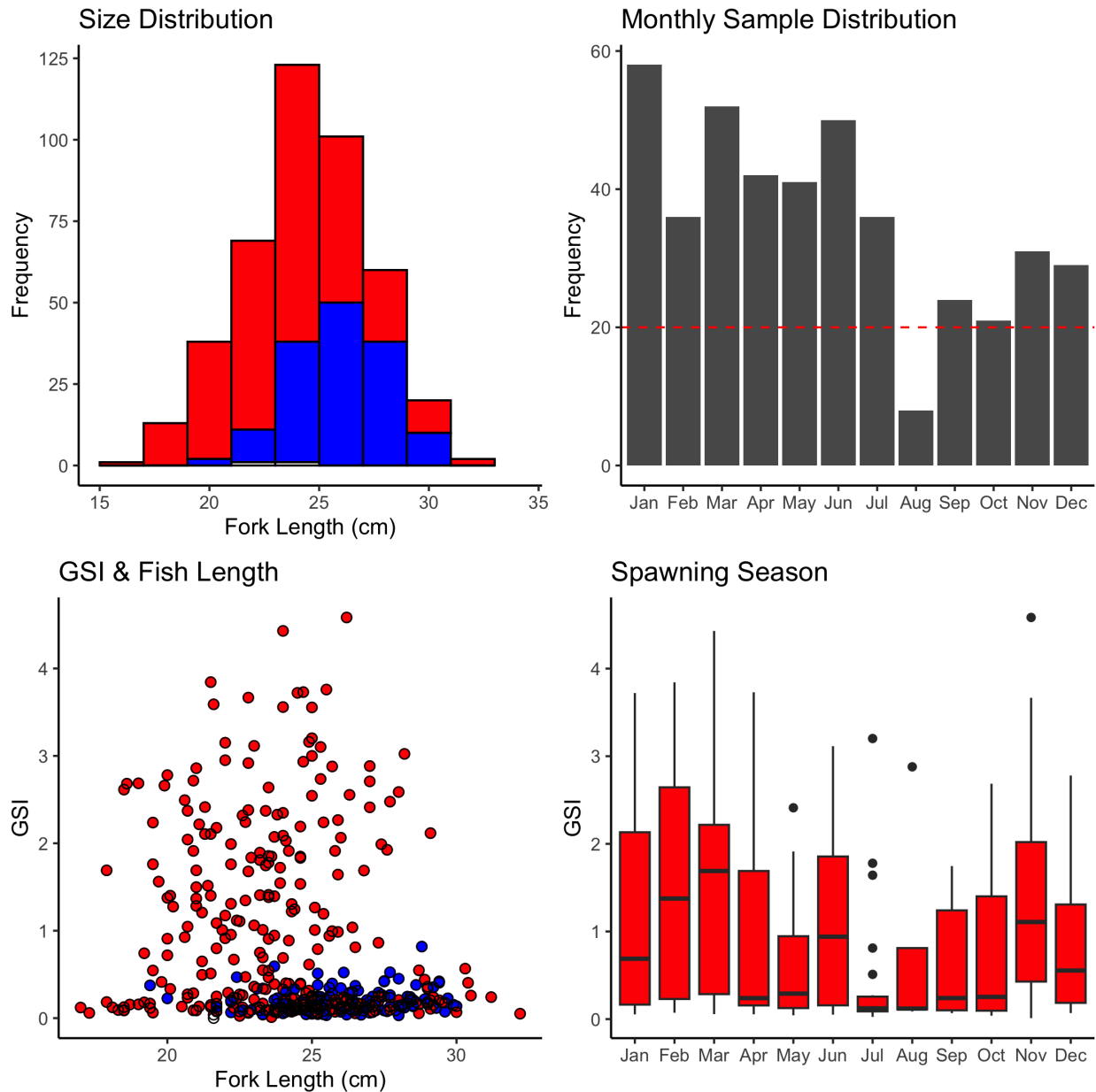


Figure B16. *C. carolinus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Caranx melampygus

A total of 108 *Caranx melampygus* samples (females = 53, males = 49, unknown/NA = 6) have been collected to date (October 2023). Median fork length is 39.6 cm (min=24.9 cm, max=68.9 cm).

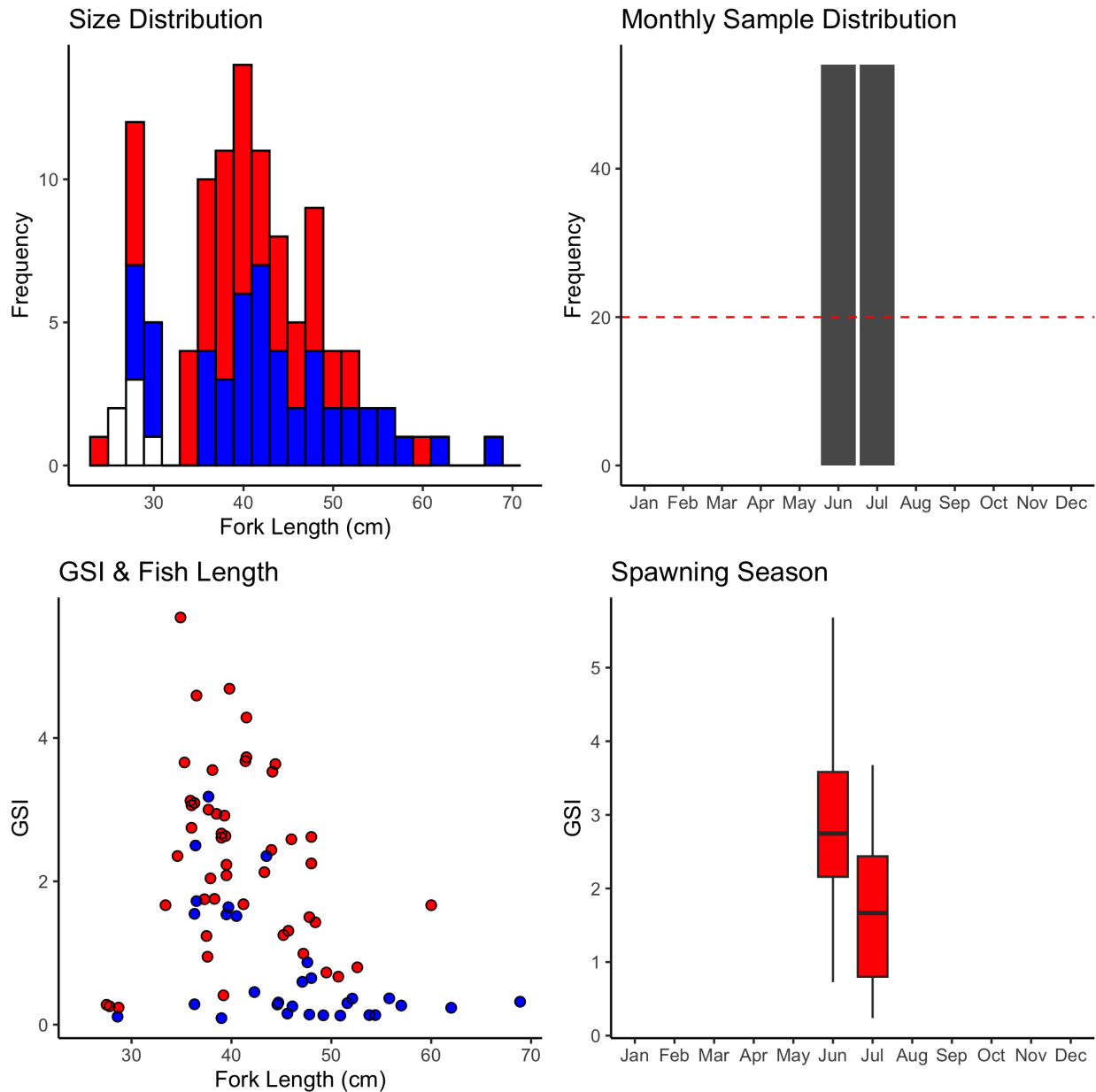


Figure B17. *C. melampygus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Cephalopholis argus

A total of 117 *Cephalopholis argus* samples (females = 65, males = 34, unknown/NA = 18) have been collected to date (September 2023). Median fork length is 28 cm (min=16.5 cm, max=41.1 cm).

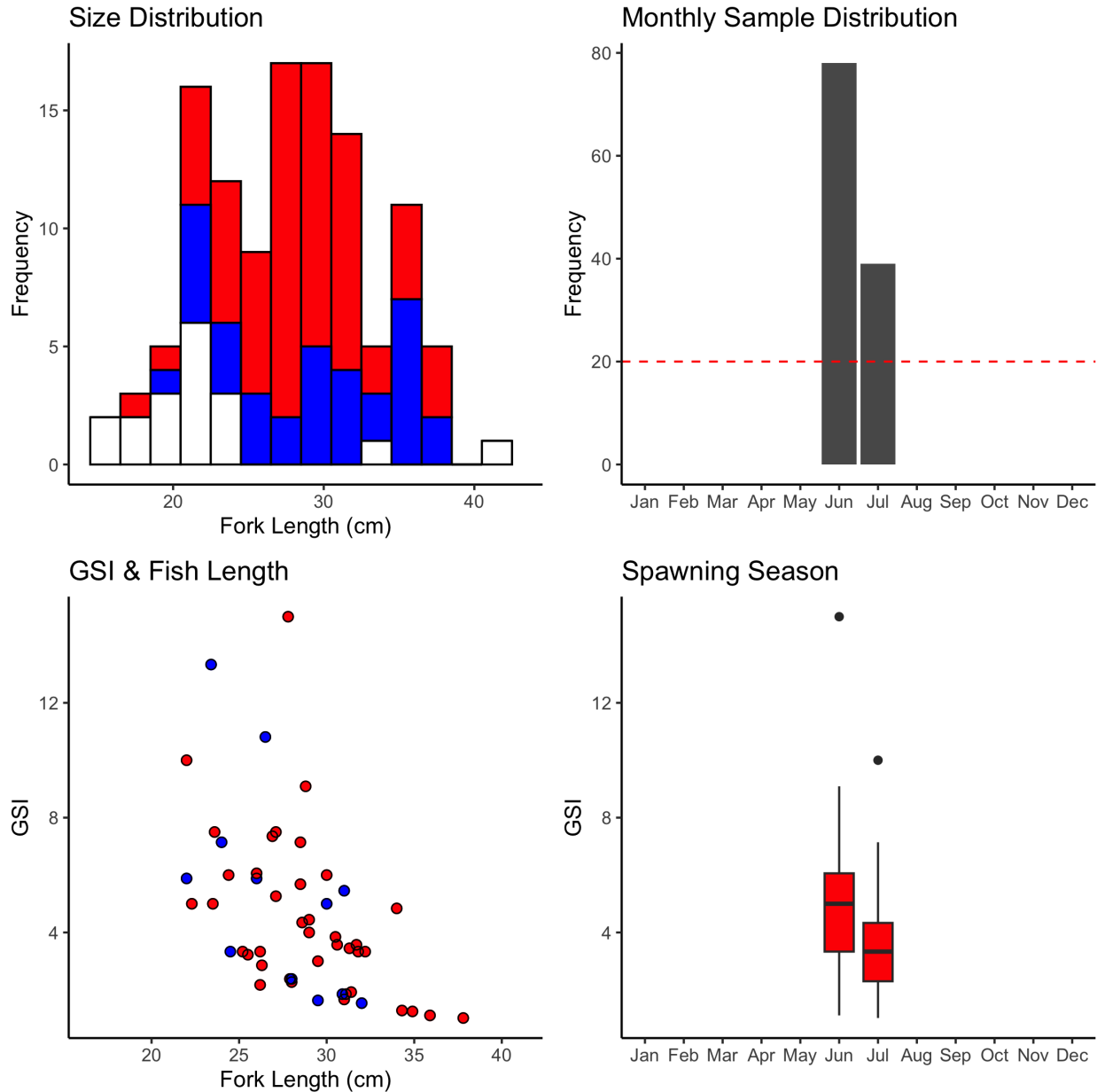


Figure B18. *C. argus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Cheilinus trilobatus

A total of 411 *Cheilinus trilobatus* samples (females = 284, males = 91, unknown/NA = 36) have been collected to date (September 2023). Median fork length is 22.7 cm (min=16.2 cm, max=34.1 cm).

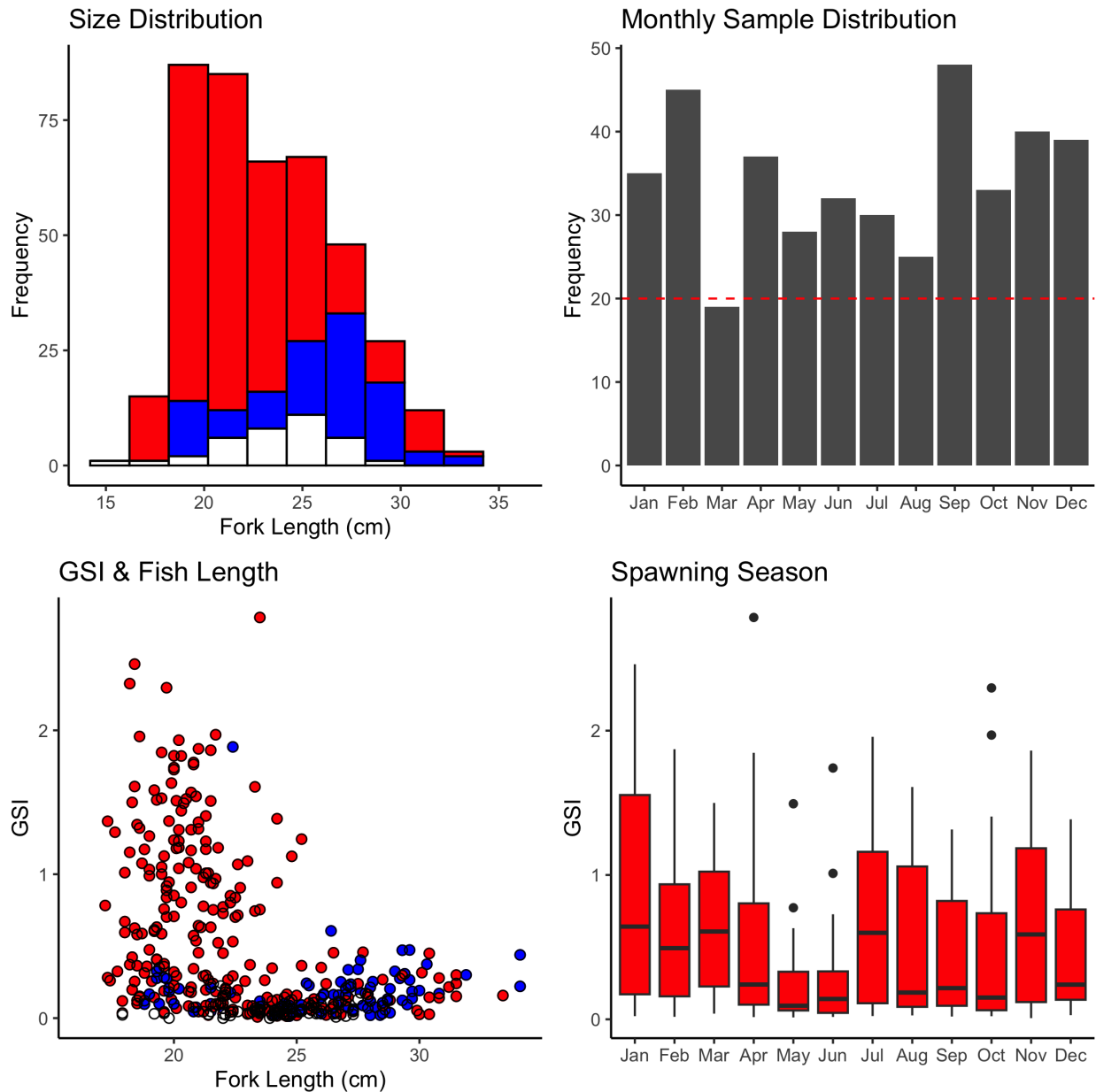


Figure B19. *C. trilobatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Cheilinus undulatus

A total of 306 *Cheilinus undulatus* samples (females = 113, males = 12, unknown/NA = 181) have been collected to date (September 2023). Median fork length is 26.5 cm (min=15.5 cm, max=126.2 cm).

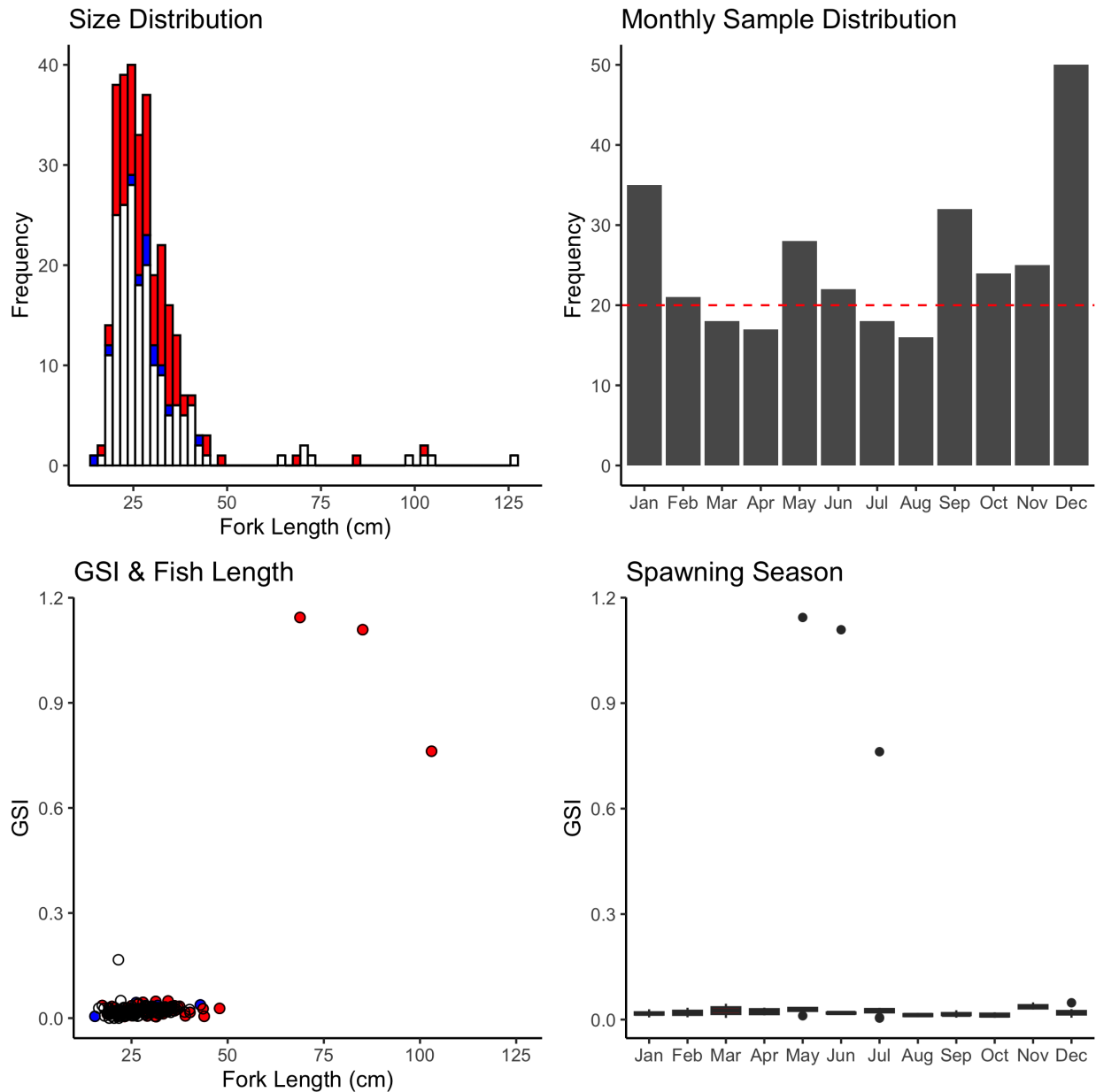


Figure B20. *C. undulatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Chlorurus sordidus

A total of 723 *Chlorurus sordidus* samples (females = 444, males = 277, unknown/NA = 2) have been collected to date (September 2023). Median fork length is 20.5 cm (min=14.5 cm, max=27.1 cm).

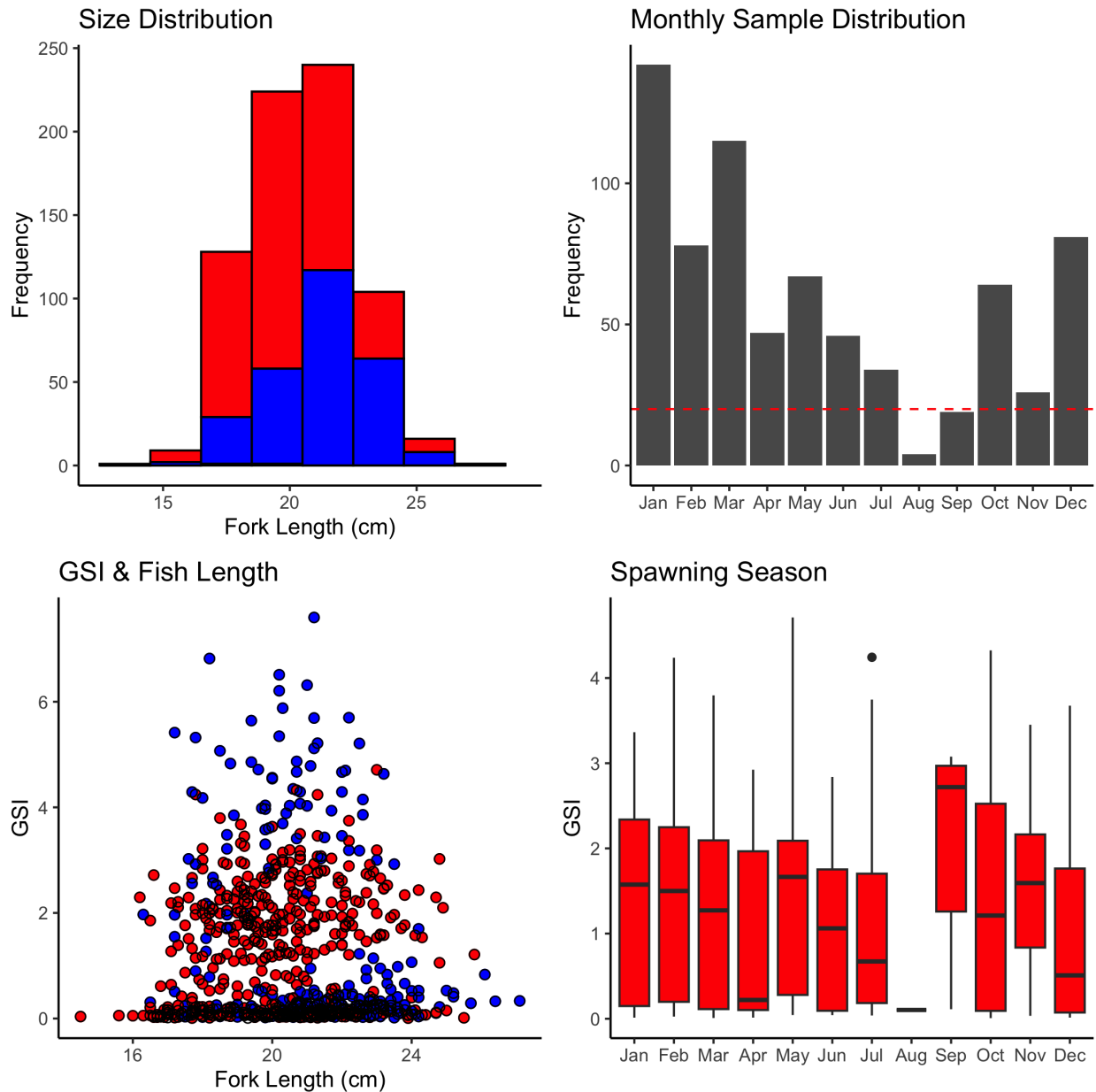


Figure B21. *C. sordidus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Kyphosus cinerascens

A total of 297 *Kyphosus cinerascens* samples (females = 125, males = 166, unknown/NA = 6) have been collected to date (September 2023). Median fork length is 23.9 cm (min=17.5 cm, max=40.1 cm).

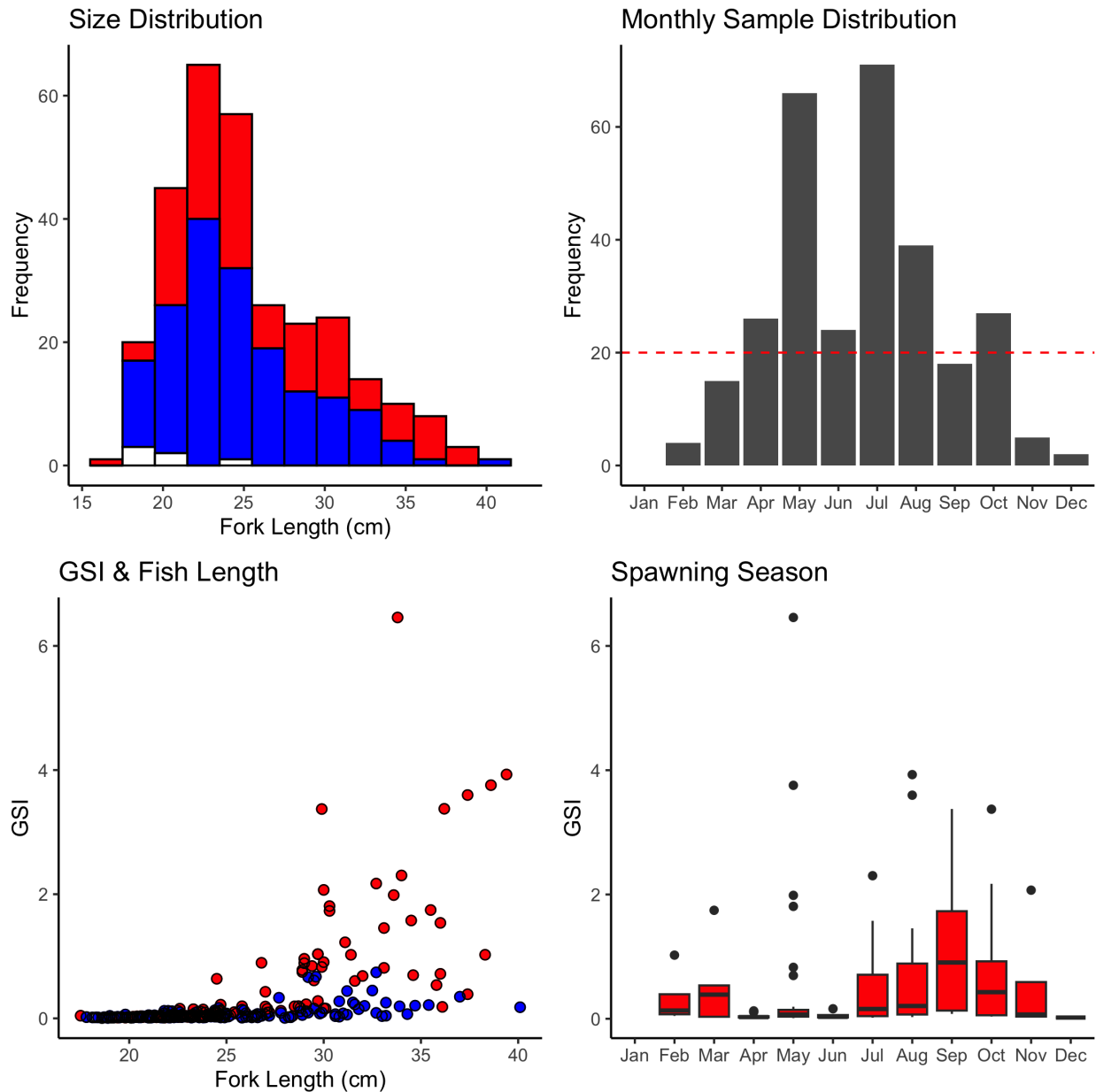


Figure B22. *K. cinerascens* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Lethrinus obsoletus

A total of 1011 *Lethrinus obsoletus* samples (females = 678, males = 175, unknown/NA = 158) have been collected to date (September 2023). Median fork length is 20.5 cm (min=14.1 cm, max=29.7 cm).

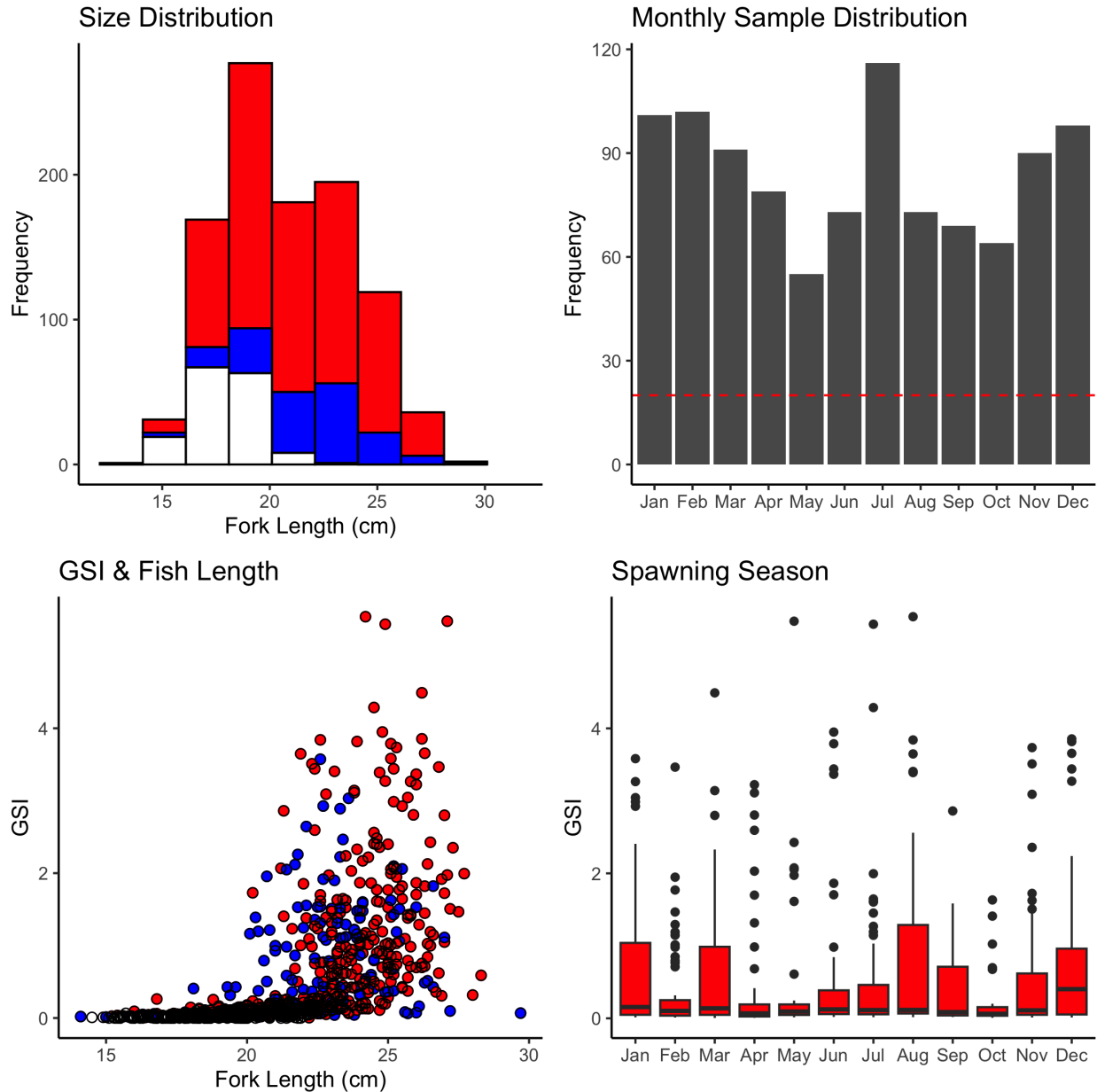


Figure B23. *L. obsoletus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Monotaxis grandoculis

A total of 248 *Monotaxis grandoculis* samples (females = 121, males = 90, unknown/NA = 37) have been collected to date (September 2023). Median fork length is 30.2 cm (min=15.8 cm, max=46.2 cm).

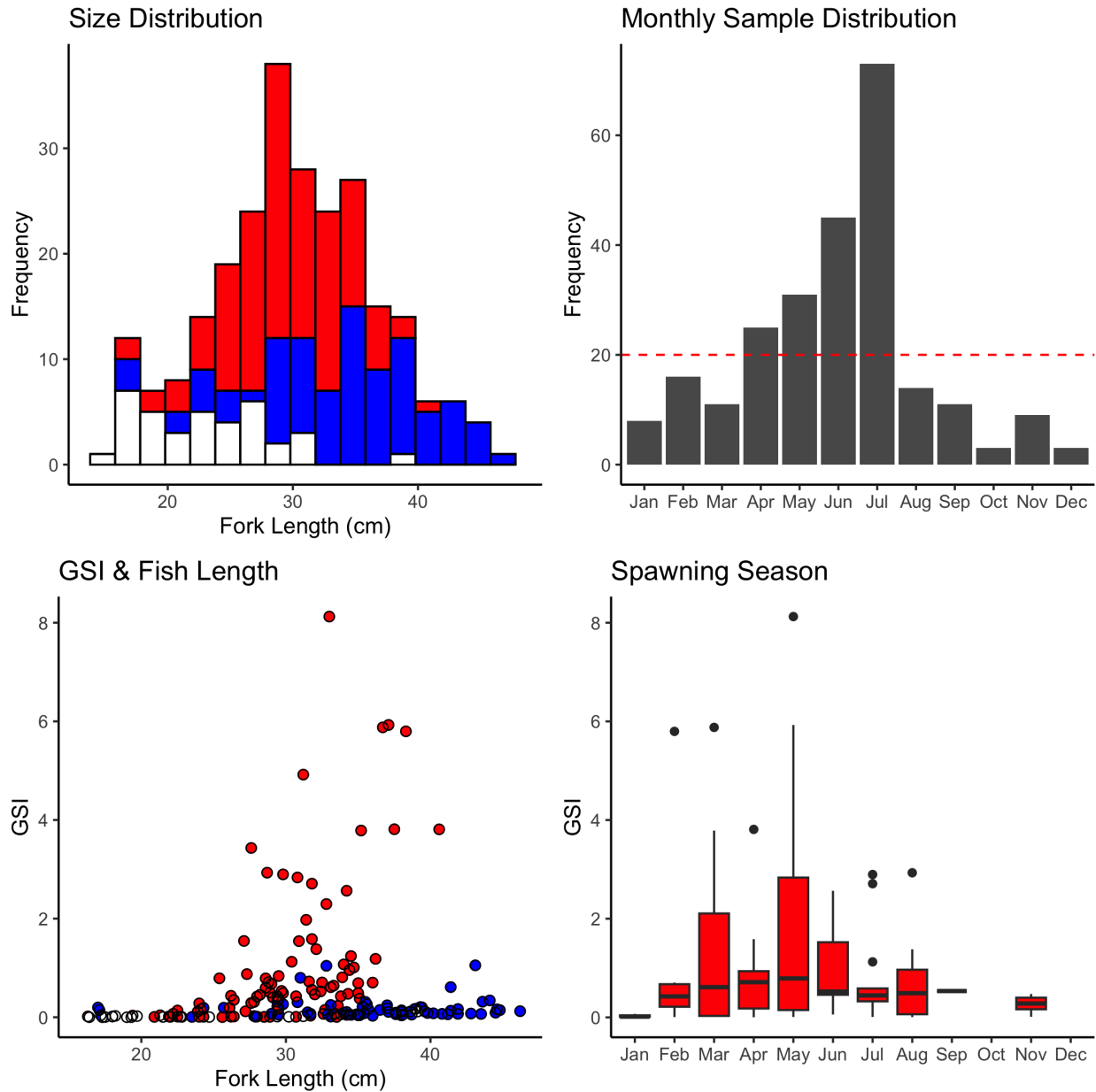


Figure B24. *M. grandoculis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Mulloidichthys vanicolensis

A total of 985 *Mulloidichthys vanicolensis* samples (females = 460, males = 402, unknown/NA = 123) have been collected to date (September 2023). Median fork length is 18.1 cm (min=8.9 cm, max=28.5 cm).

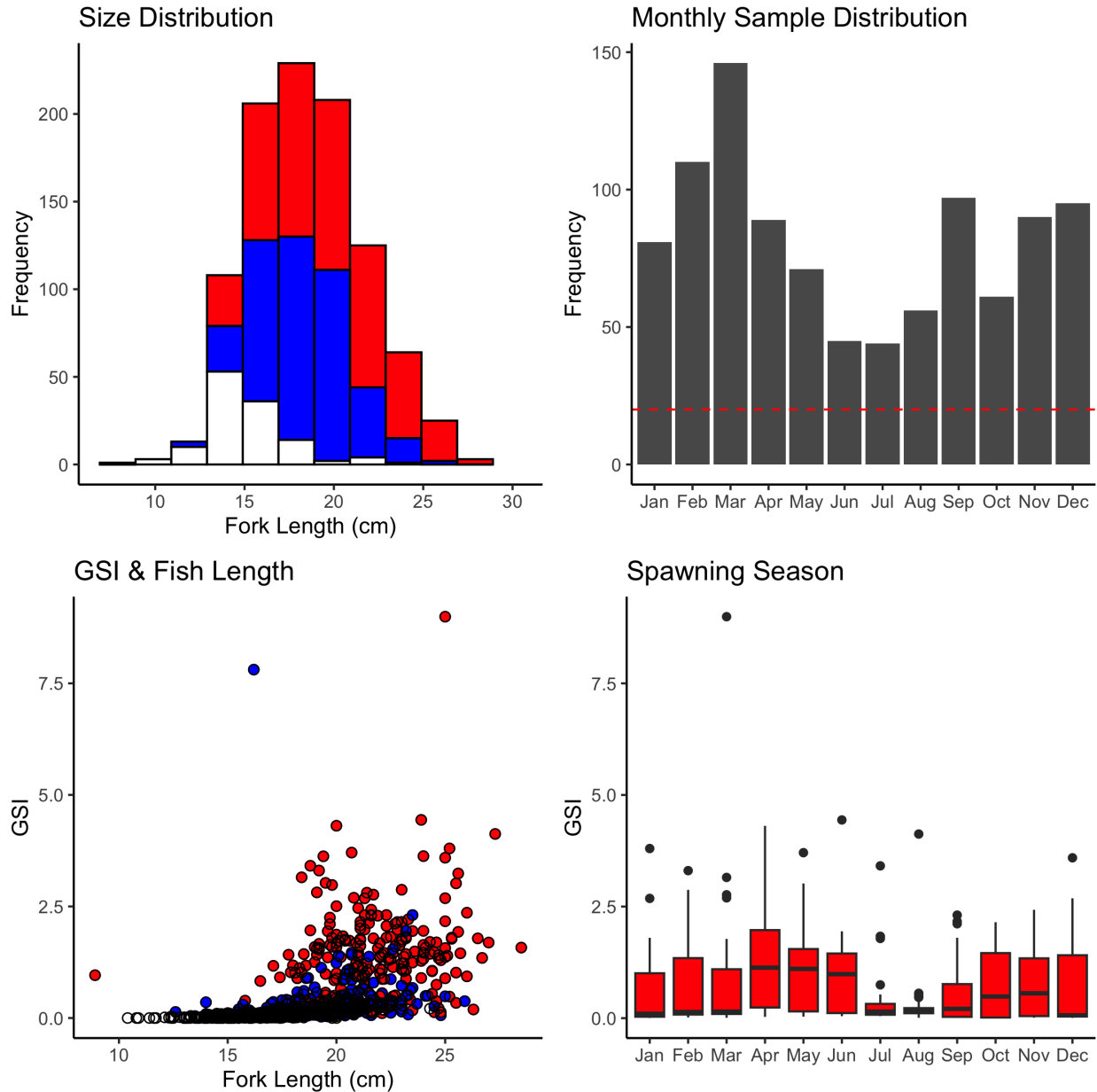


Figure B25. *M. vanicolensis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Naso lituratus

A total of 1408 *Naso lituratus* samples (females = 503, males = 850, unknown/NA = 55) have been collected to date (September 2023). Median fork length is 20.2 cm (min=7.9 cm, max=29.8 cm).

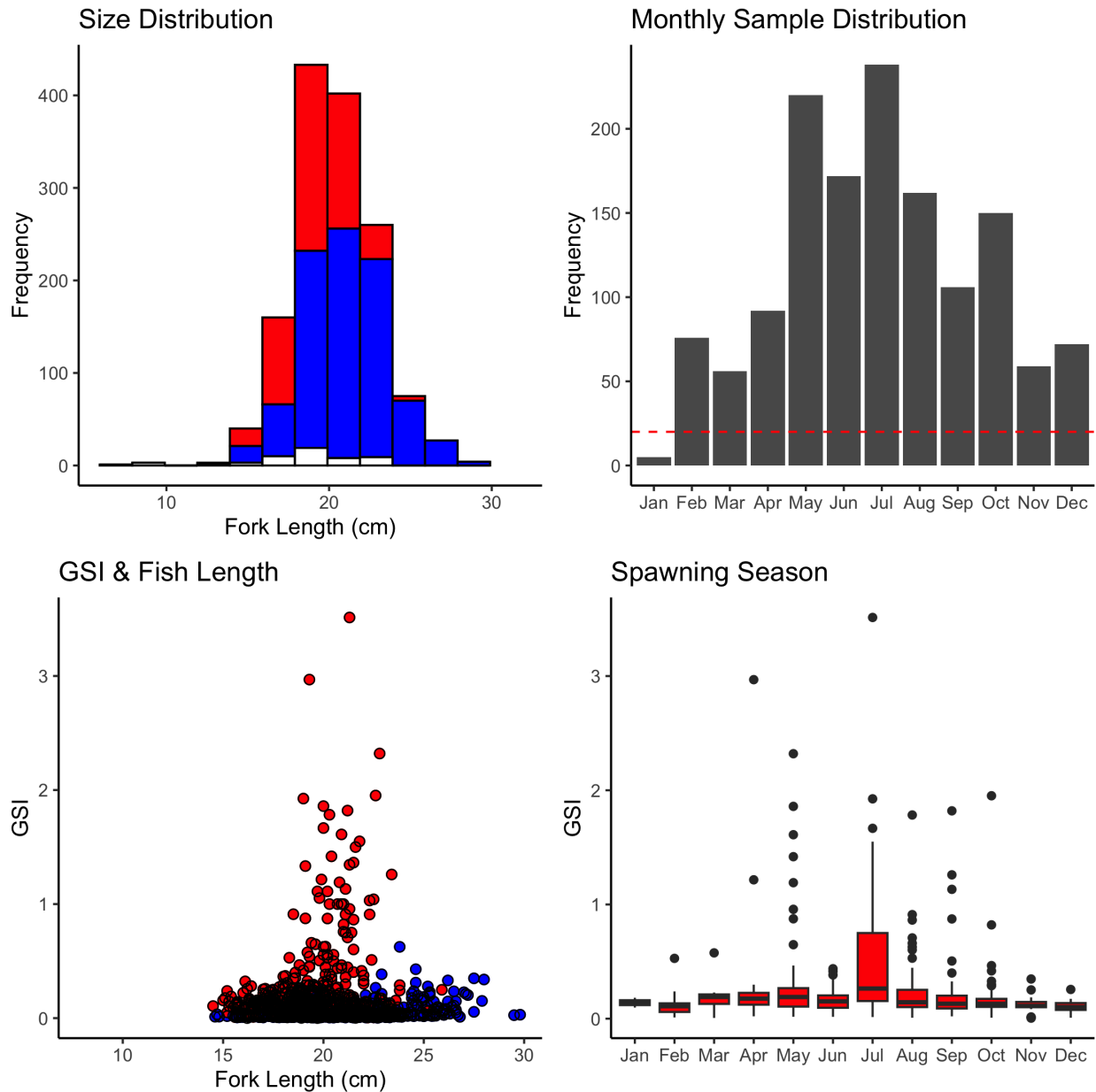


Figure B26. *N. lituratus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Naso unicornis

A total of 2558 *Naso unicornis* samples (females = 1269, males = 1209, unknown/NA = 80) have been collected to date (September 2023). Median fork length is 27.1 cm (min=10.4 cm, max=53.2 cm).

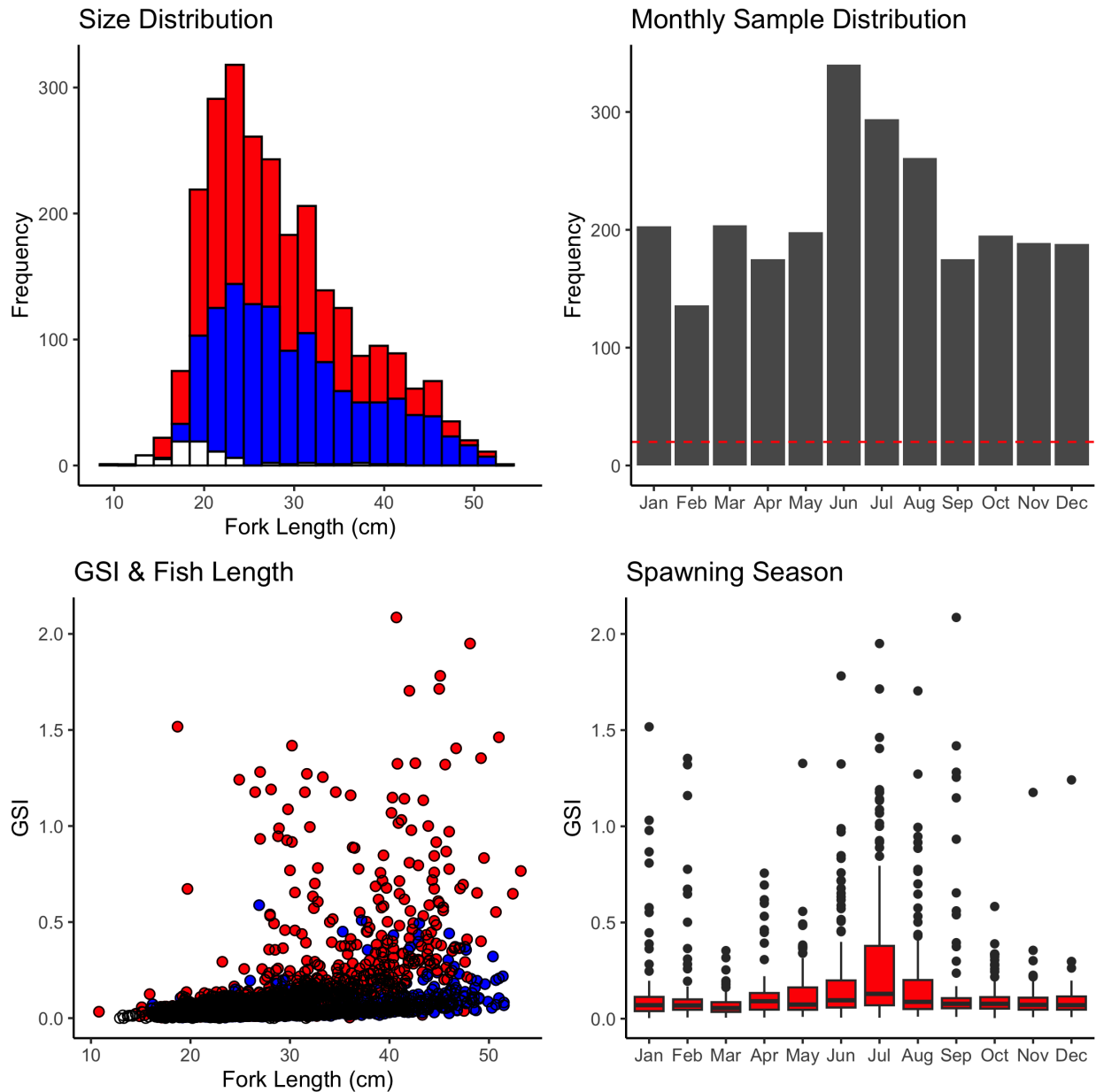


Figure B27. *N. unicornis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Sargocentron spiniferum

A total of 944 *Sargocentron spiniferum* samples (females = 344, males = 169, unknown/NA = 431) have been collected to date (September 2023). Median fork length is 18.5 cm (min=11.5 cm, max=34.2 cm).

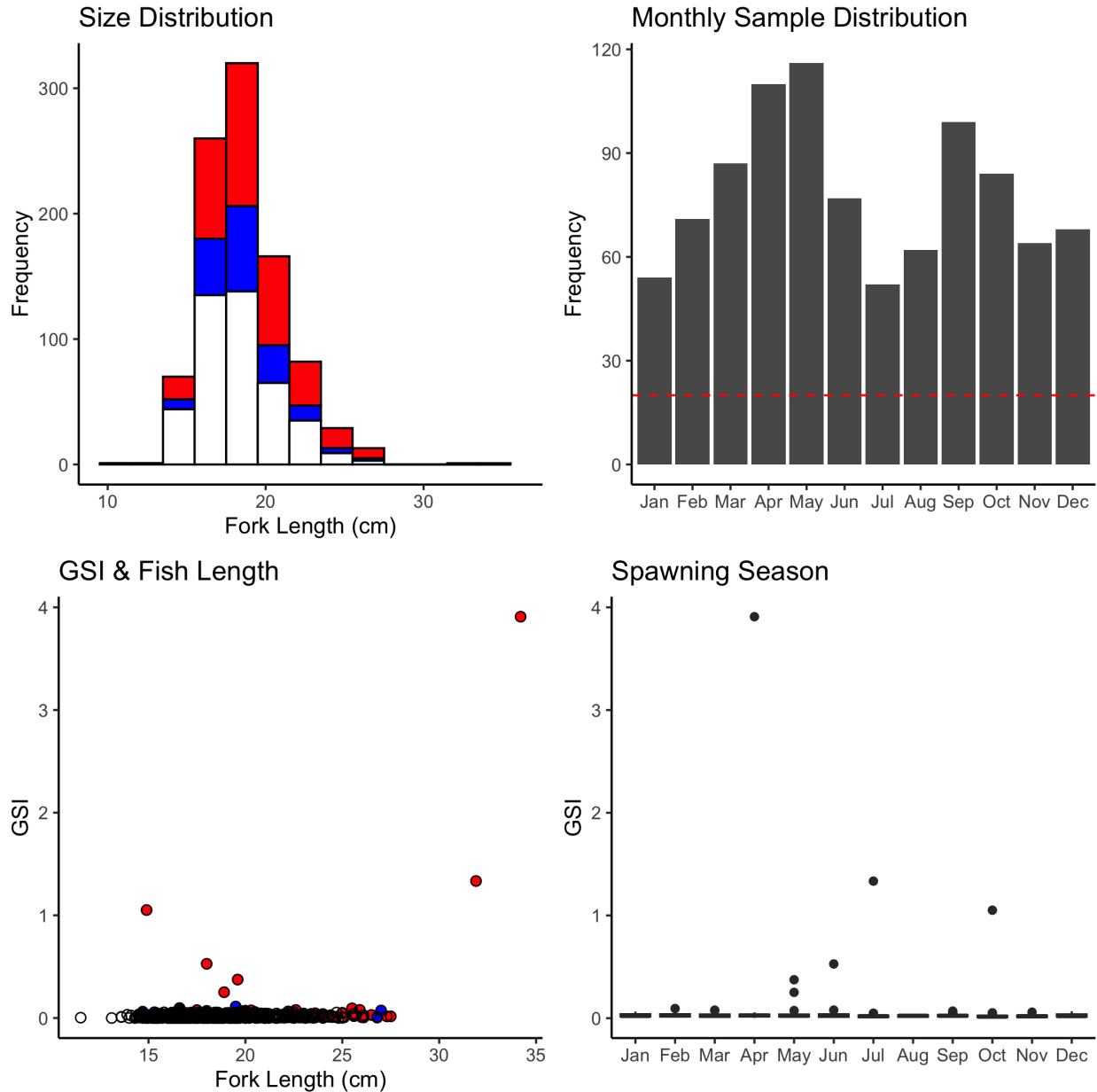


Figure B28. *S. spiniferum* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Sargocentron tiere

A total of 727 *Sargocentron tiere* samples (females = 447, males = 204, unknown/NA = 76) have been collected to date (September 2023). Median fork length is 17.5 cm (min=12.9 cm, max=23.2 cm).

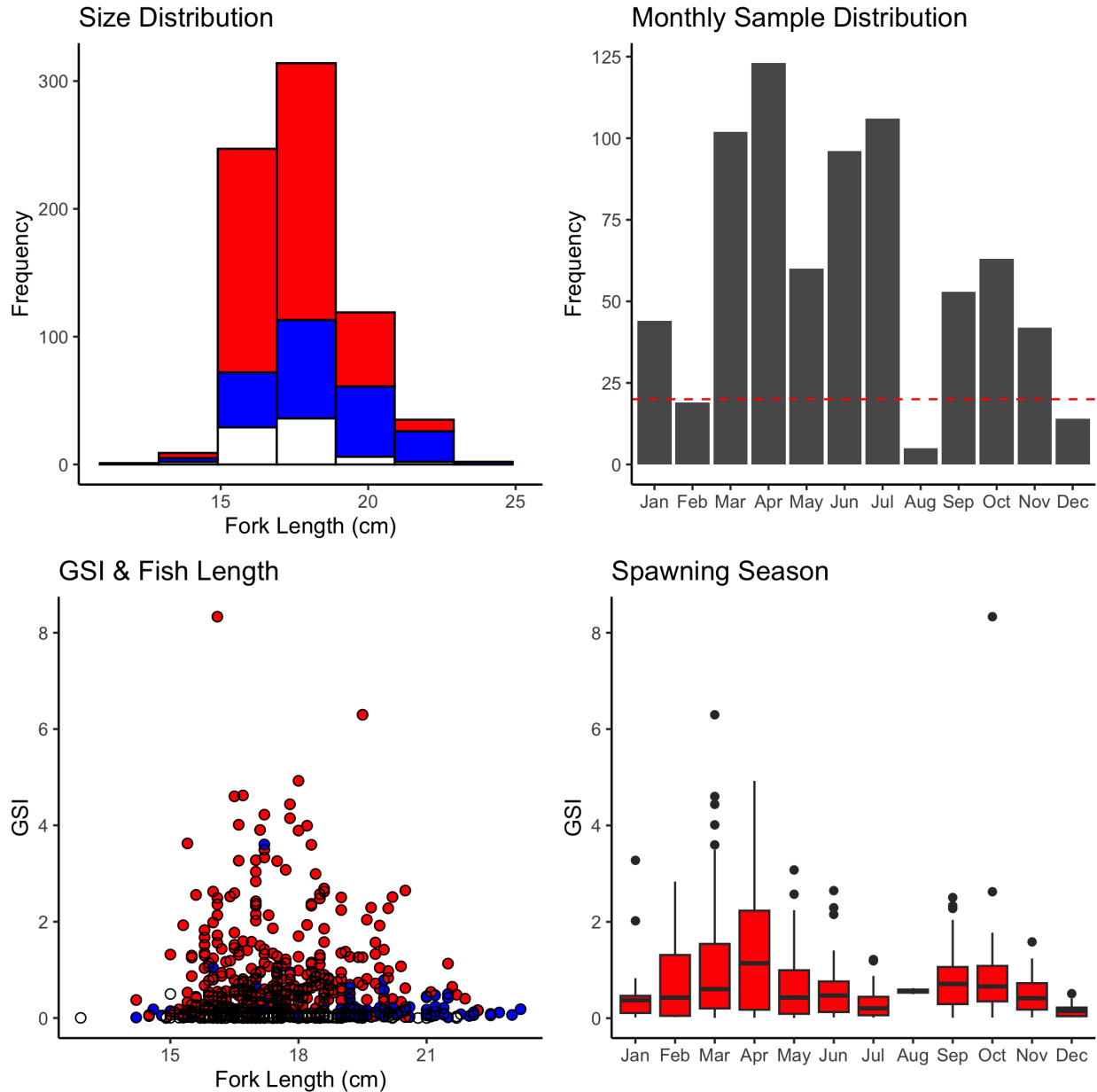


Figure B29. *S. tiere* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Scarus rubroviolaceus

A total of 102 *Scarus rubroviolaceus* samples (females = 57, males = 33, unknown/NA = 12) have been collected to date (September 2023). Median fork length is 32.8 cm (min=17 cm, max=43.5 cm).

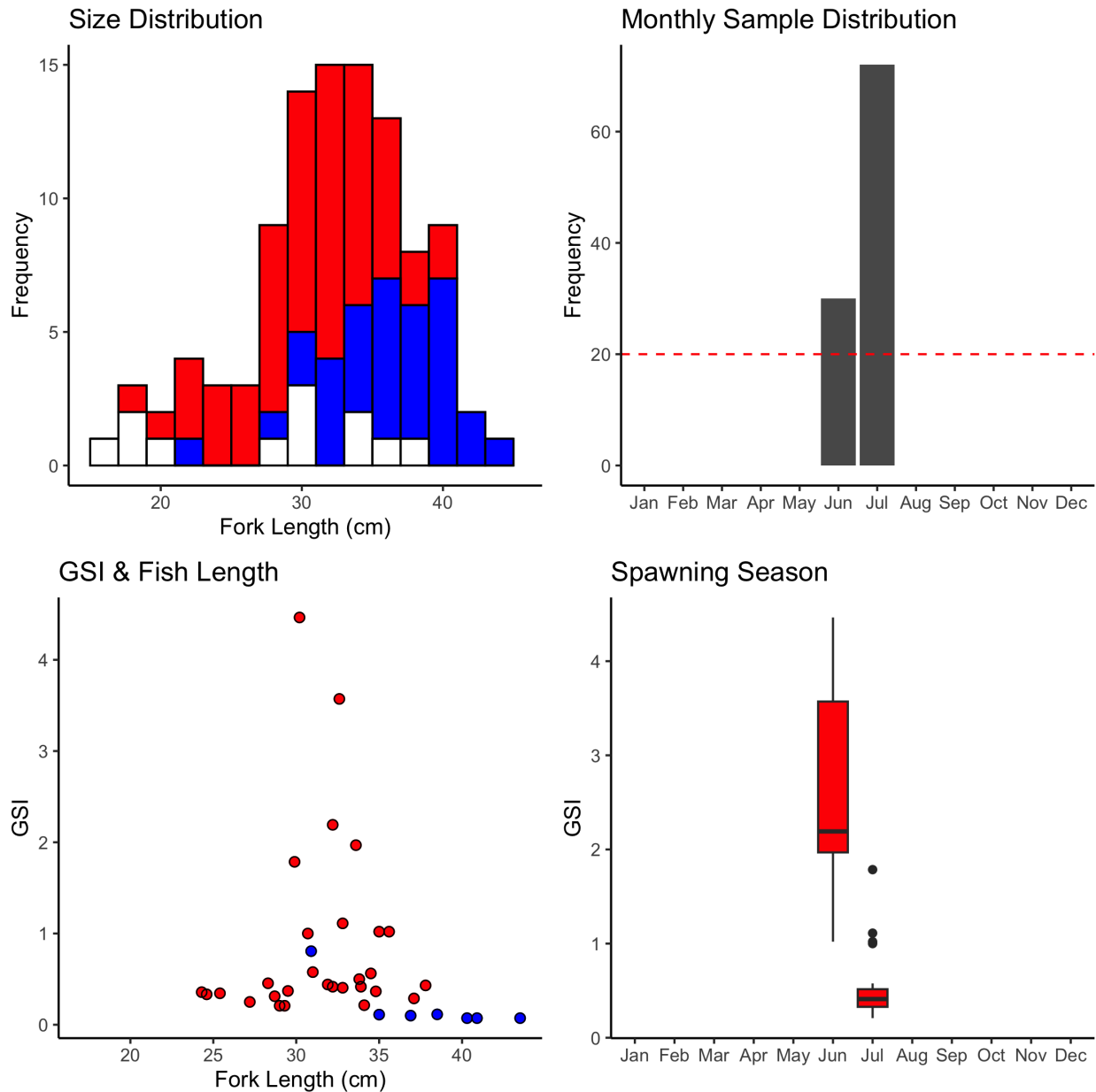
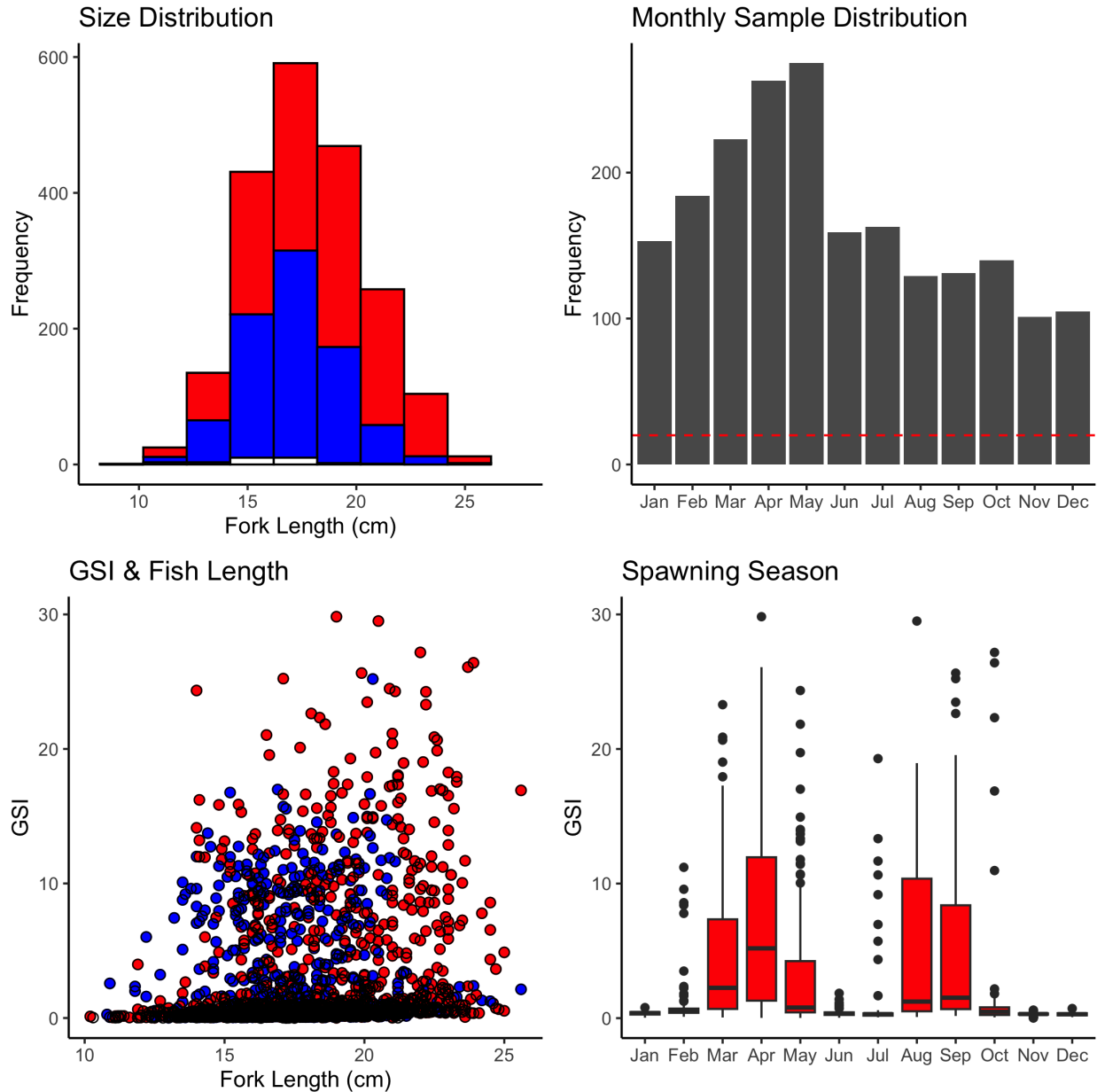


Figure B30. *S. rubroviolaceus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Siganus spinus

A total of 2026 *Siganus spinus* samples (females = 1169, males = 828, unknown/NA = 29) have been collected to date (September 2023). Median fork length is 17.7 cm (min=10.2 cm, max=25.6 cm).



Appendix B31. *S. spinus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Zanclus cornutus

A total of 118 *Zanclus cornutus* samples (females = 60, males = 55, unknown/NA = 3) have been collected to date (September 2023). Median fork length is 16.7 cm (min=7.4 cm, max=24.8 cm).

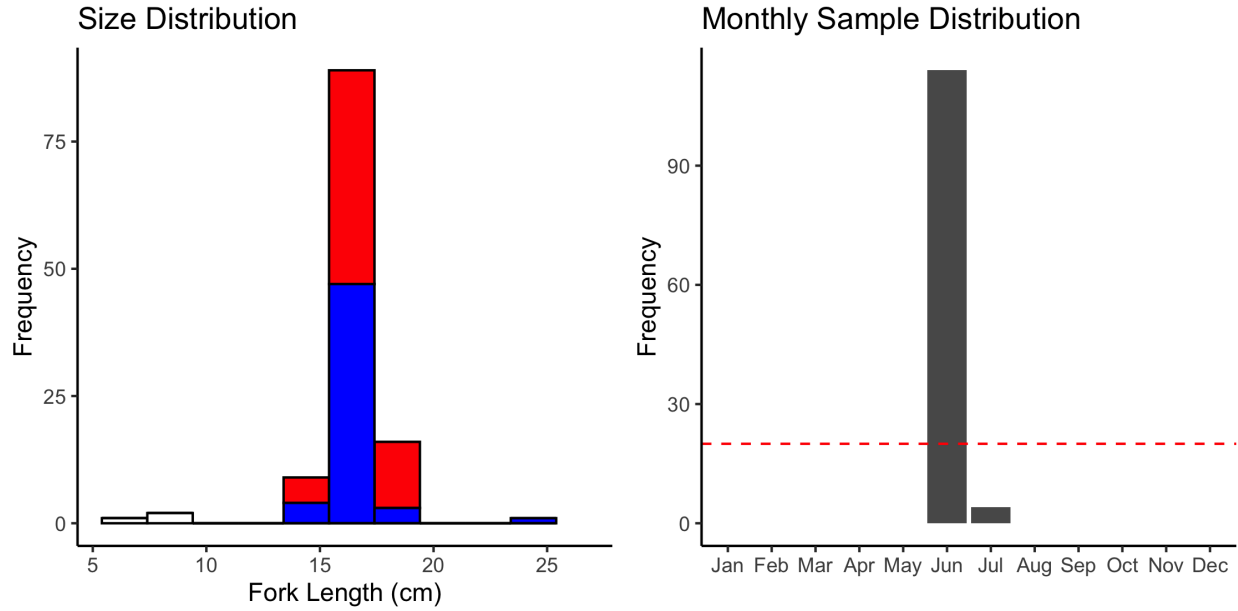


Figure B32. *Z. cornutus* sampling summaries for size distribution and monthly sample collection. Gonad weight was not recorded for this species and thus GSI and fish length and spawning season summary figures are not available at this time. Females are red (triangles)

CNMI Unfished Species

Updated October 2023

The following species were sampled through the Jurisdictional 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:

- *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 jurisdiction 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. There is a blank summary page if there are not any samples collected for a BMUS. 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 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: GSI ($\text{gonad weight} / \text{fish weight} * 100$) is plotted against fish size to visualize the sample distribution as a proxy for size at maturity.

Spawning season: female 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 (October 2023). Median fork length is 73.6 cm (min=38.4 cm, max=96.1 cm).

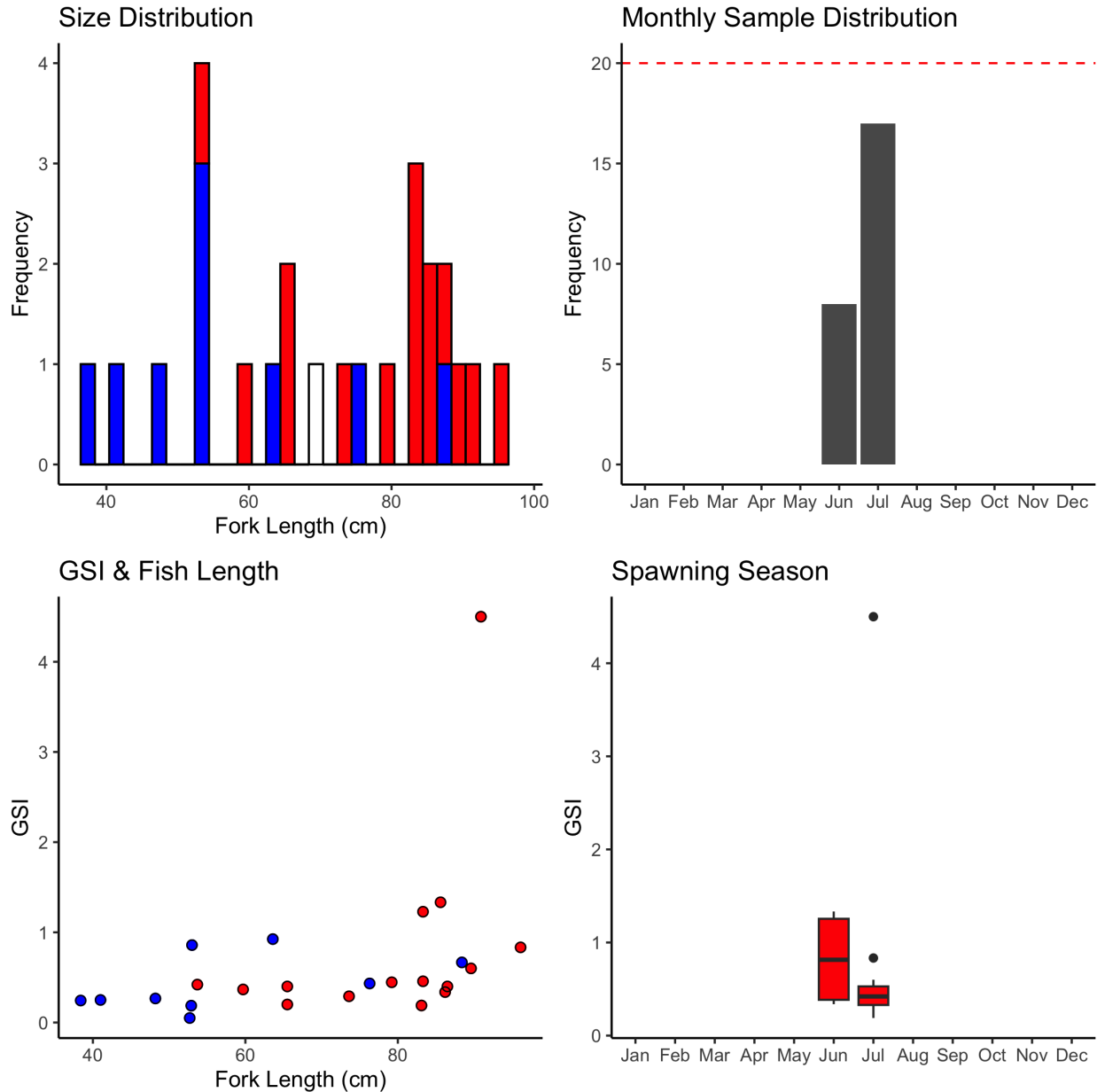


Figure B33. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx ignobilis

A total of 0 *Caranx ignobilis* samples (females = 0, males = 0, unknown/NA = 0) have been collected to date (October 2023).

Caranx lugubris

A total of 6 *Caranx lugubris* samples (females = 1, males = 2, unknown/NA = 3) have been collected to date (October 2023). Median fork length is 36.2 cm (min=29.2 cm, max=56.9 cm).

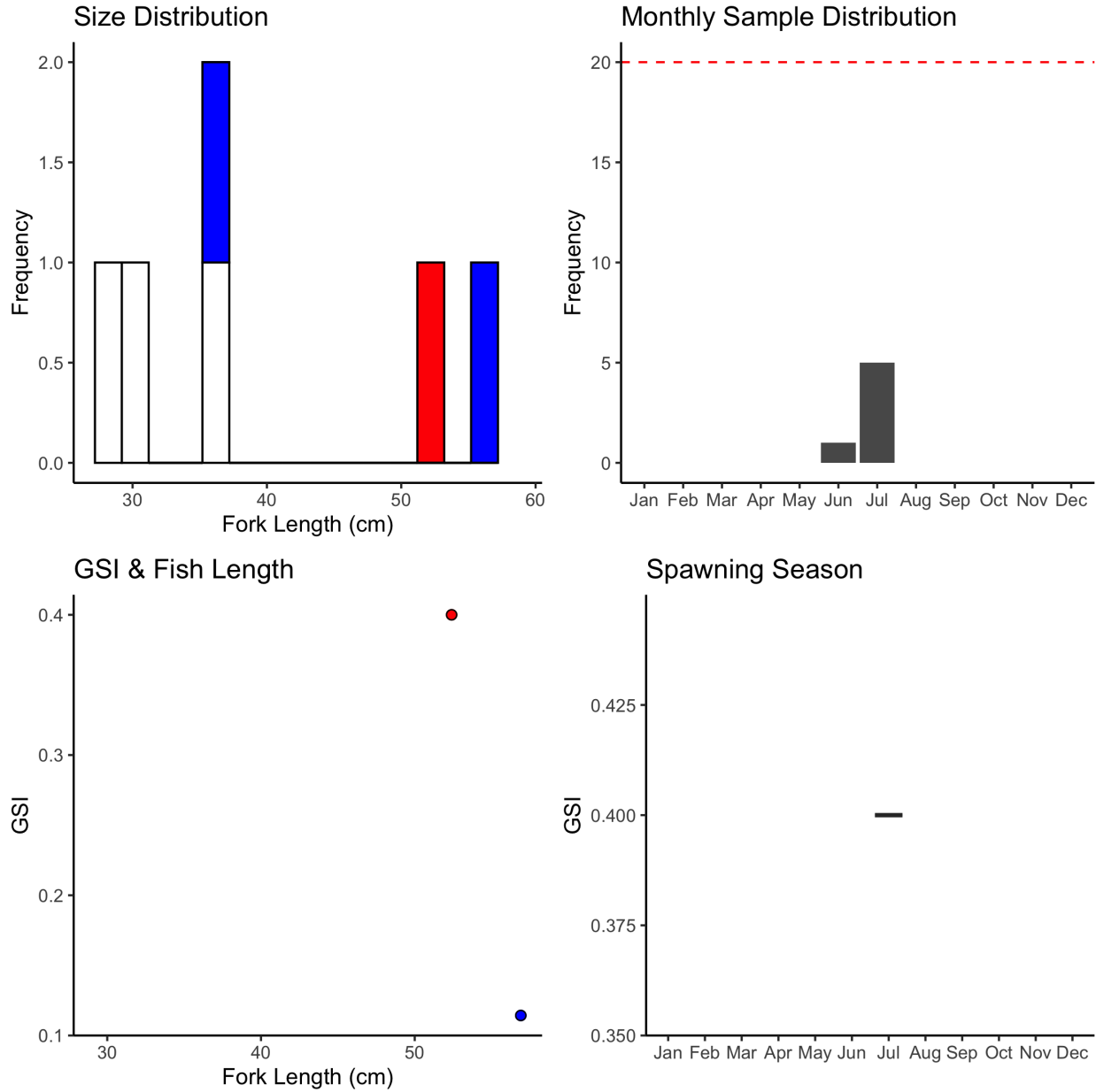


Figure B34. *C. lugubris* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis carbunculus

A total of 156 *Etelis carbunculus* samples (females = 91, males = 64, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 33.45 cm (min=20.8 cm, max=51.2 cm).

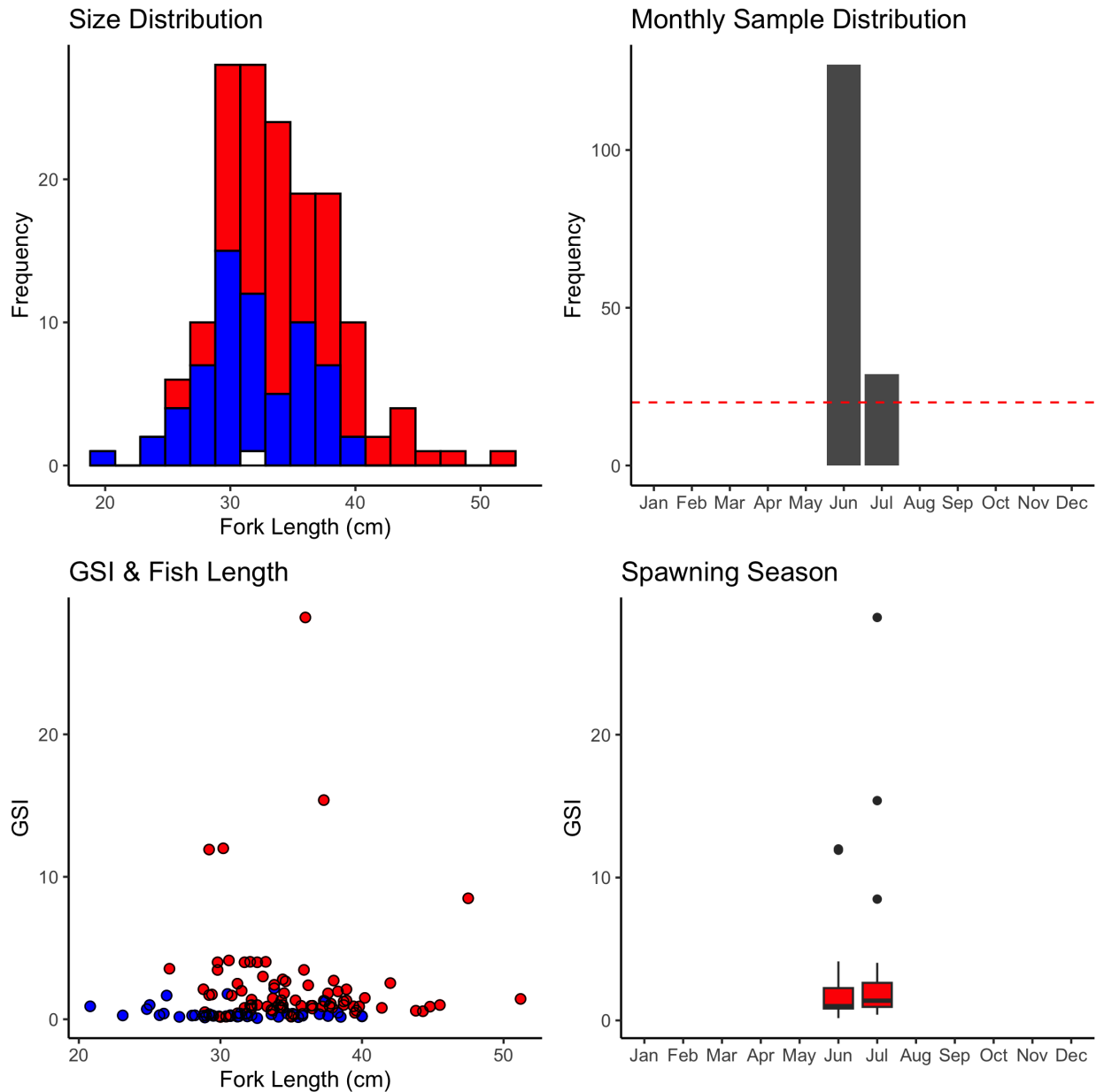


Figure B35. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 214 *Etelis coruscans* samples (females = 91, males = 121, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 74.95 cm (min=47.8 cm, max=92 cm).

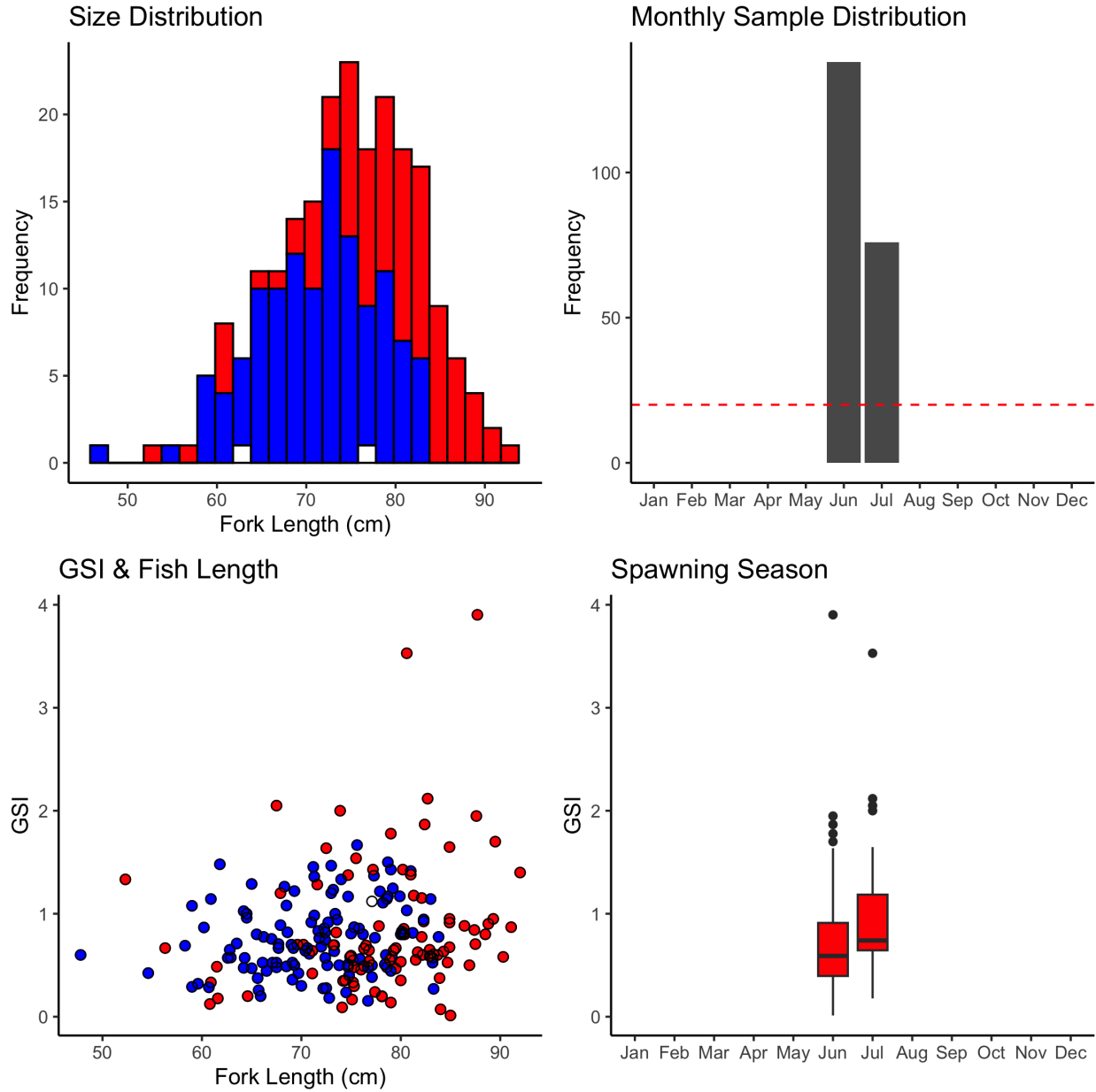


Figure B36. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Lethrinus rubrioperculatus

A total of 0 *Lethrinus rubrioperculatus* samples (females = 0, males = 0, unknown/NA = 0) have been collected to date (October 2023).

Lutjanus kasmira

A total of 0 *Lutjanus kasmira* samples (females = 0, males = 0, unknown/NA = 0) have been collected to date (October 2023).

Pristipomoides auricilla

A total of 212 *Pristipomoides auricilla* samples (females = 78, males = 129, unknown/NA = 5) have been collected to date (October 2023). Median fork length is 34.3 cm (min=22.5 cm, max=40.3 cm).

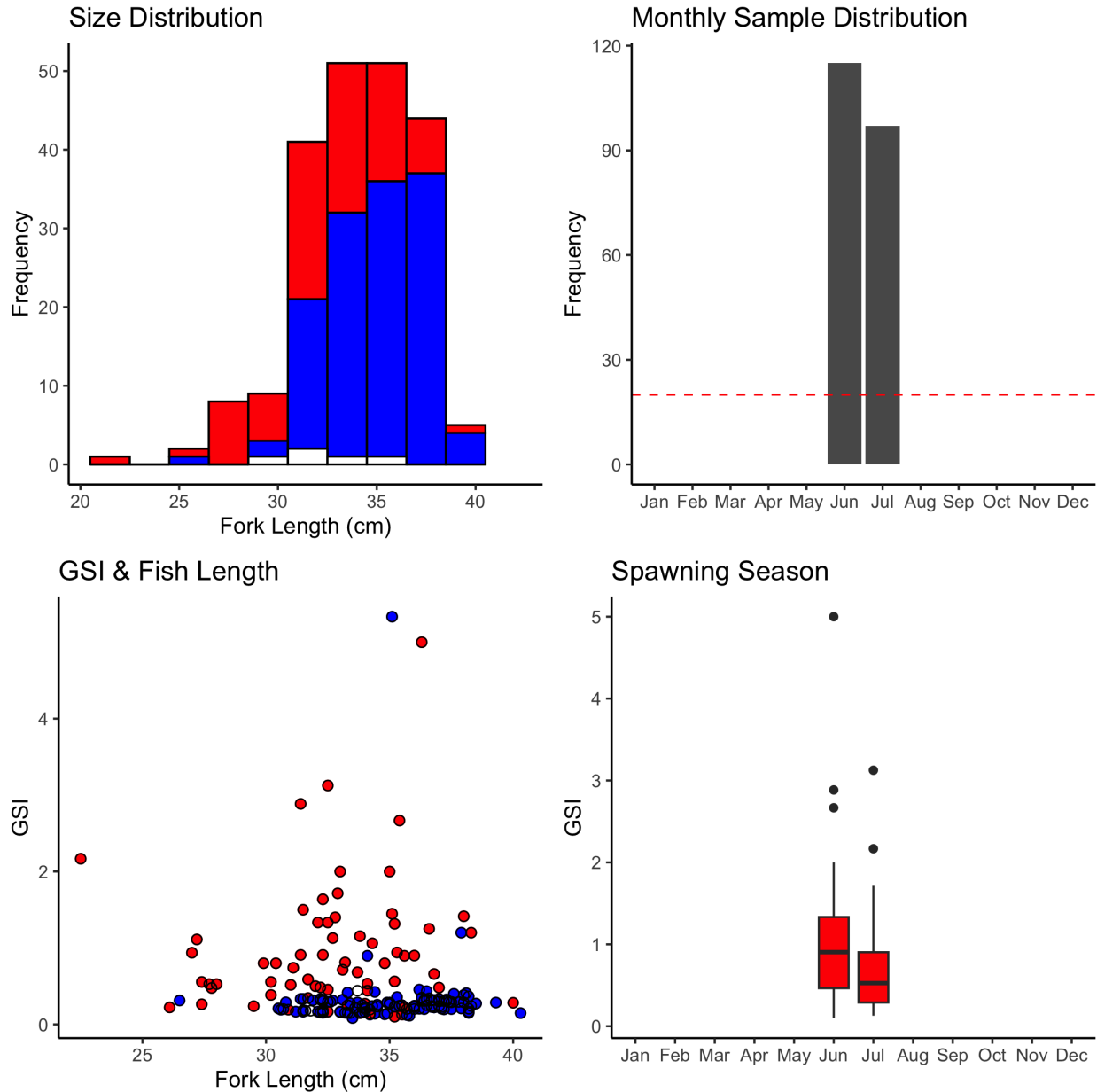


Figure B37. *P. auricilla* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides filamentosus

A total of 133 *Pristipomoides filamentosus* samples (females = 49, males = 83, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 48.4 cm (min=15.06 cm, max=65.3 cm).

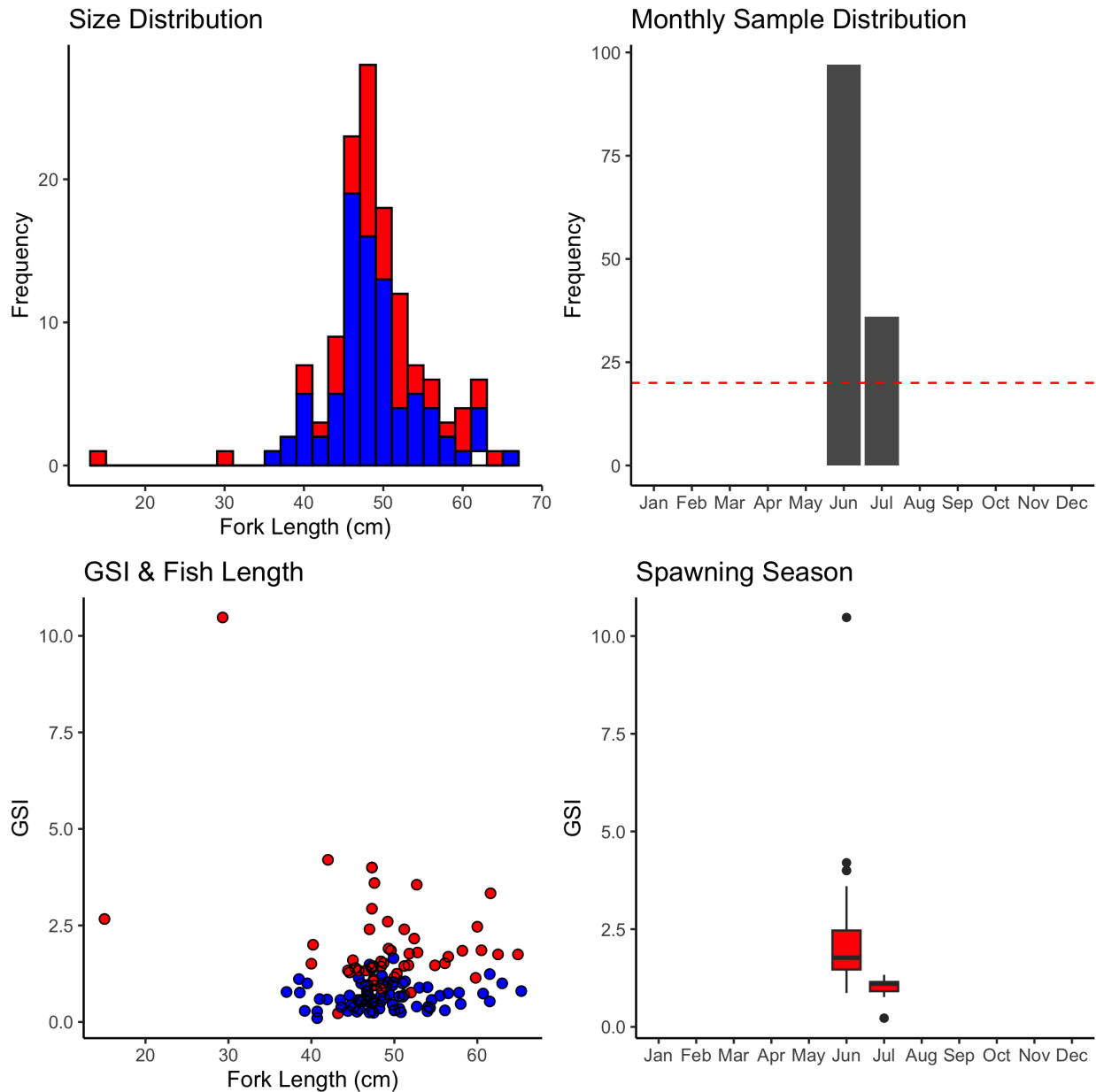


Figure B38. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides flavipinnis

A total of 65 *Pristipomoides flavipinnis* samples (females = 26, males = 37, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 37.4 cm (min=30.4 cm, max=53.2 cm).

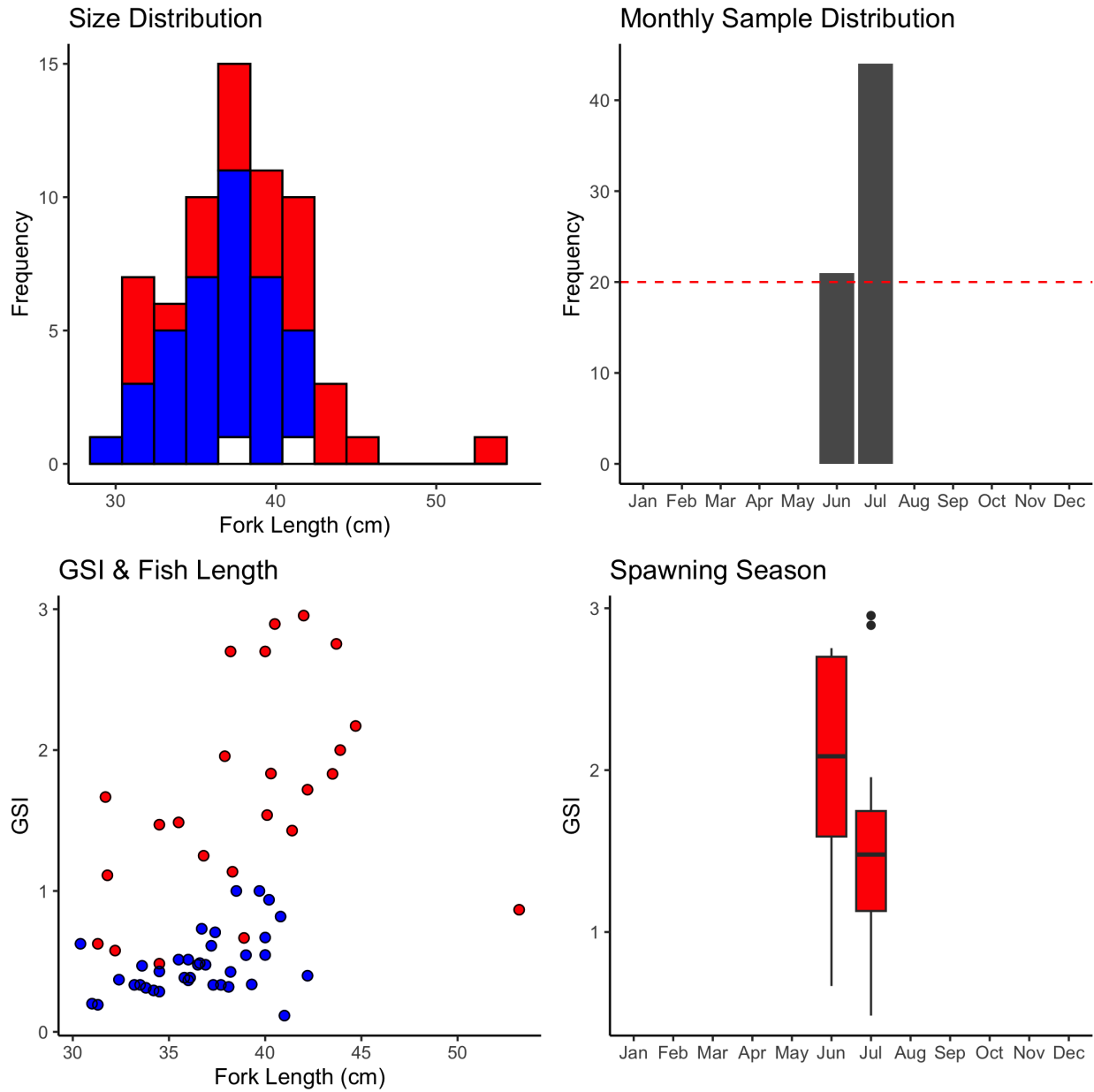


Figure B39. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides sieboldii

A total of 6 *Pristipomoides sieboldii* samples (females = 2, males = 3, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 32.5 cm (min=32.2 cm, max=35.2 cm).

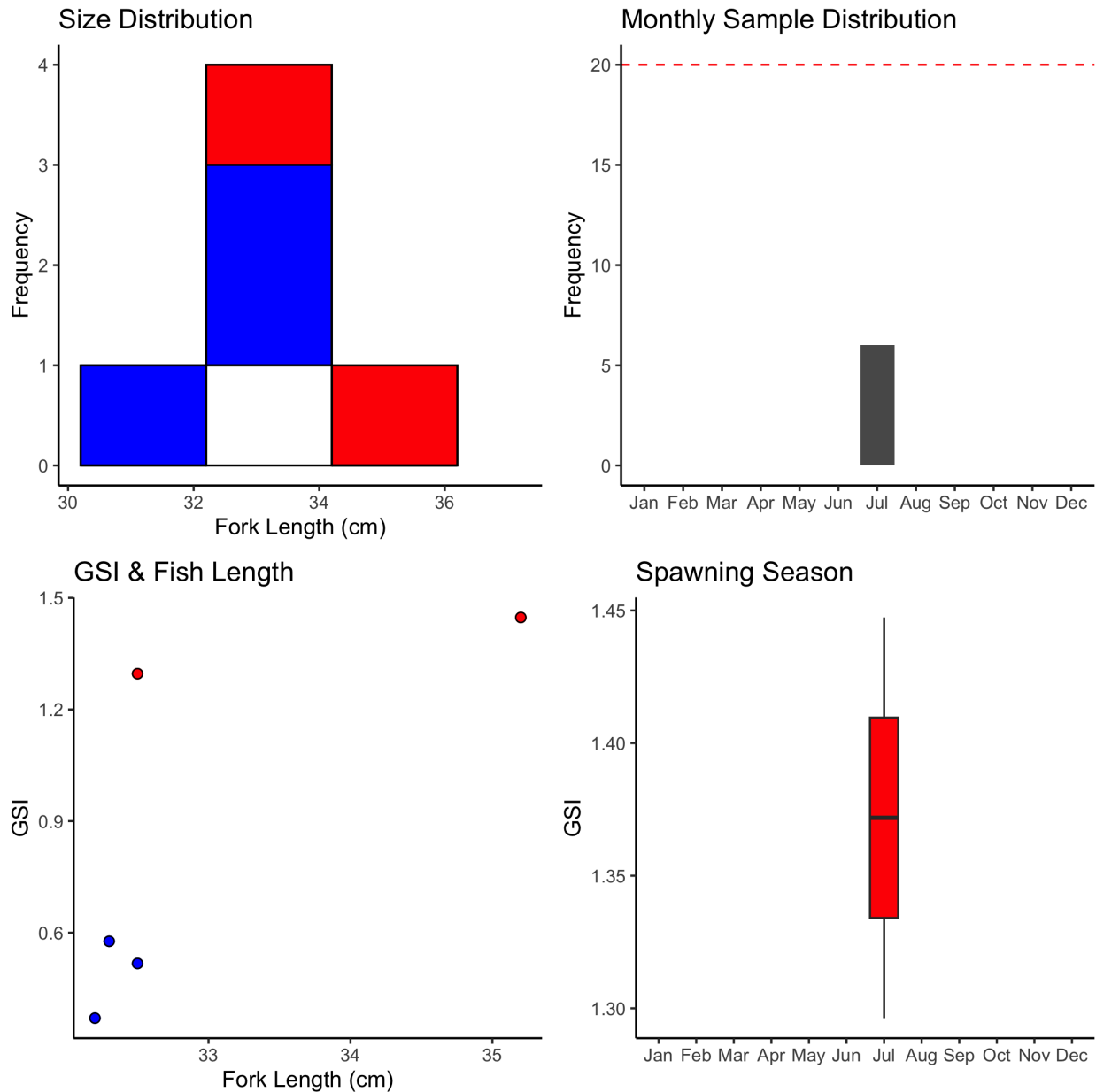


Figure B40. *P. sieboldii* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Pristipomoides zonatus

A total of 484 *Pristipomoides zonatus* samples (females = 329, males = 101, unknown/NA = 54) have been collected to date (October 2023). Median fork length is 36.2 cm (min=23.3 cm, max=44.6 cm).

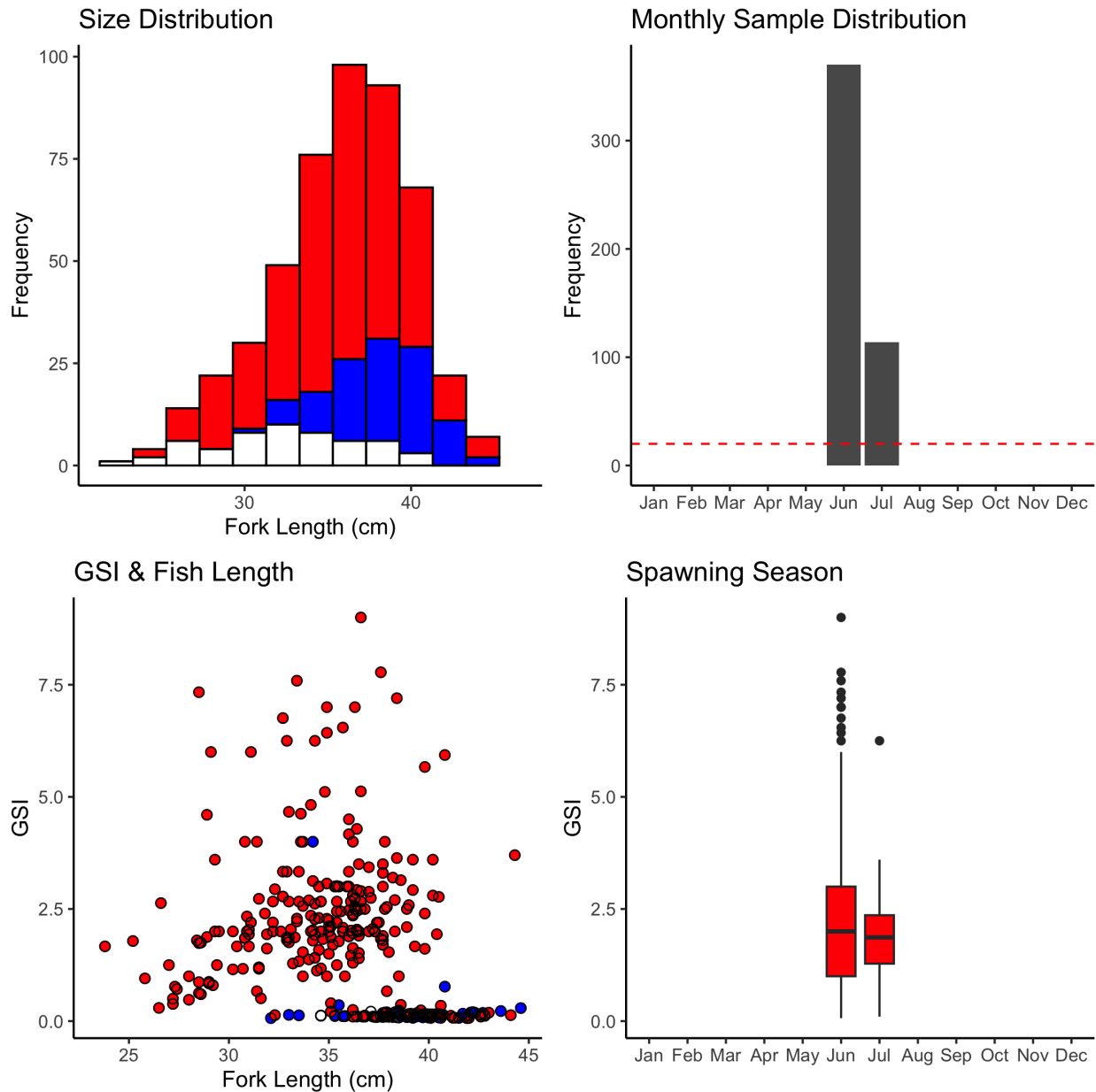


Figure B41. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Variola louti

A total of 6 *Variola louti* samples (females = 2, males = 4, unknown/NA = NA) have been collected to date (October 2023). Median fork length is 36.55 cm (min=25.9 cm, max=41.1 cm).

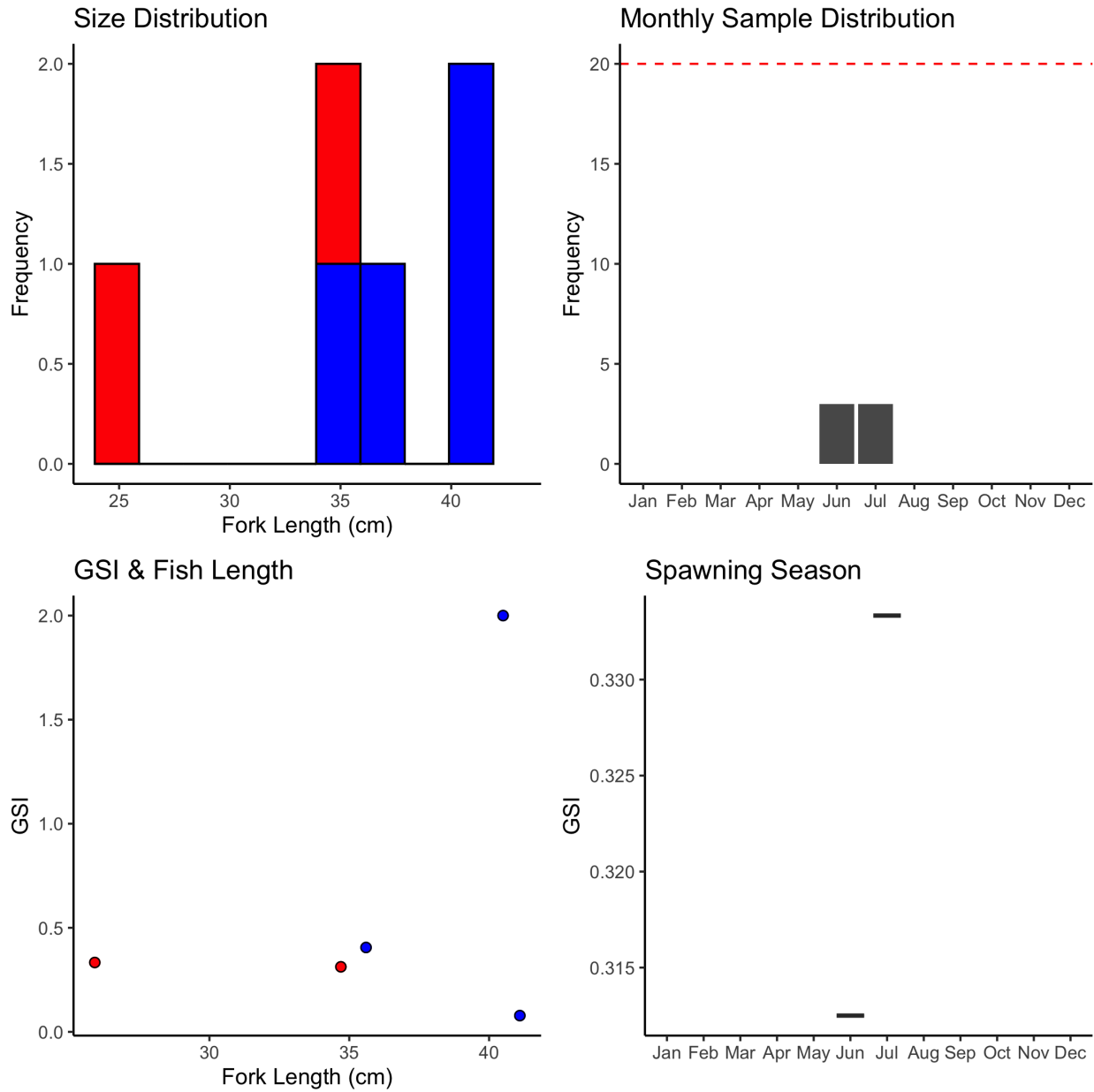


Figure B42. *V. louti* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Non-BMUS

Acanthurus lineatus

A total of 272 *Acanthurus lineatus* samples (females = 68, males = 96, unknown/NA = 108) have been collected to date (October 2023). Median fork length is 19.2 cm (min=6.9 cm, max=23.9 cm).

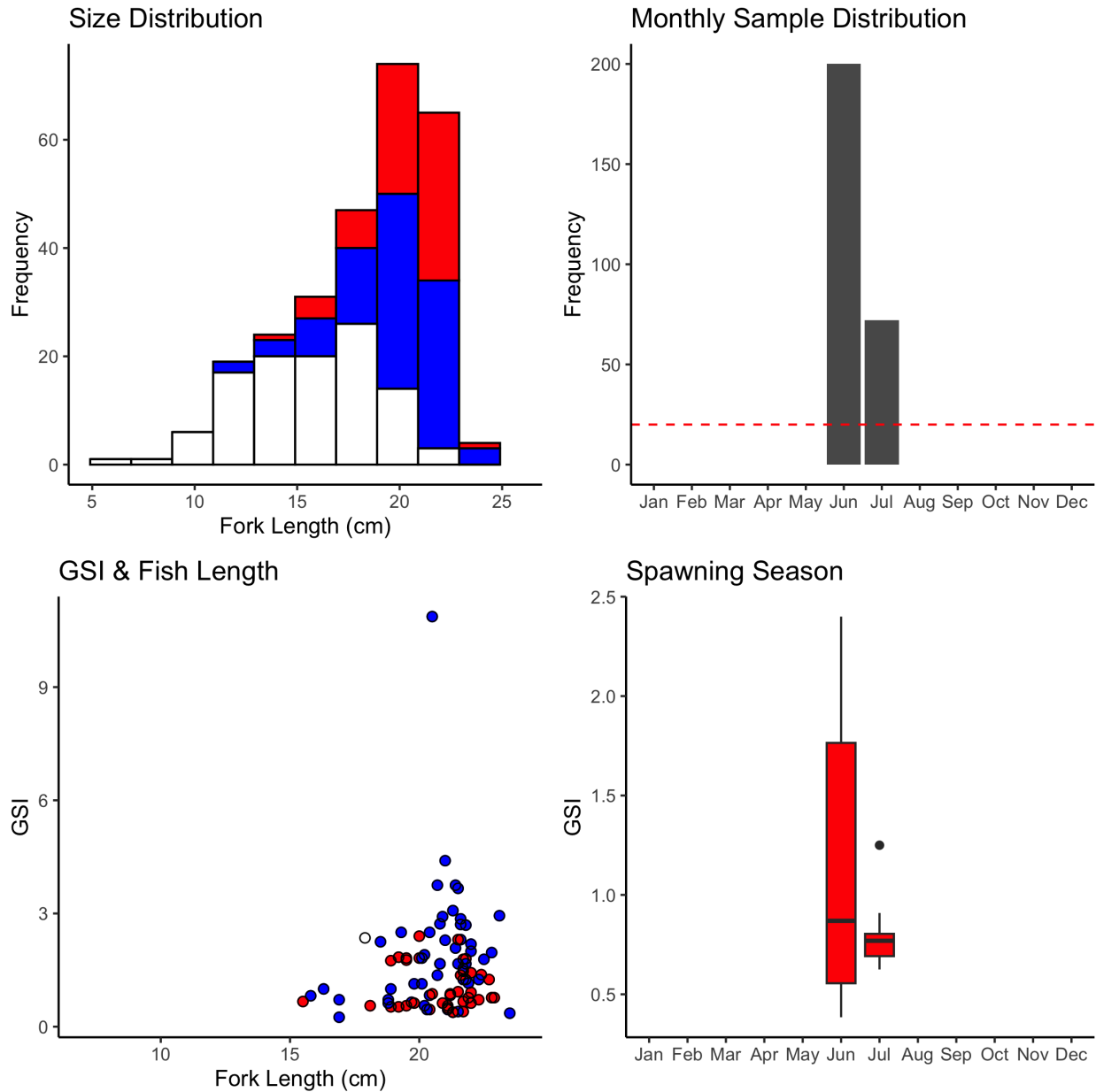


Figure B43. *A. lineatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Caranx melampygus

A total of 224 *Caranx melampygus* samples (females = 132, males = 90, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 42 cm (min=24.1 cm, max=79 cm).

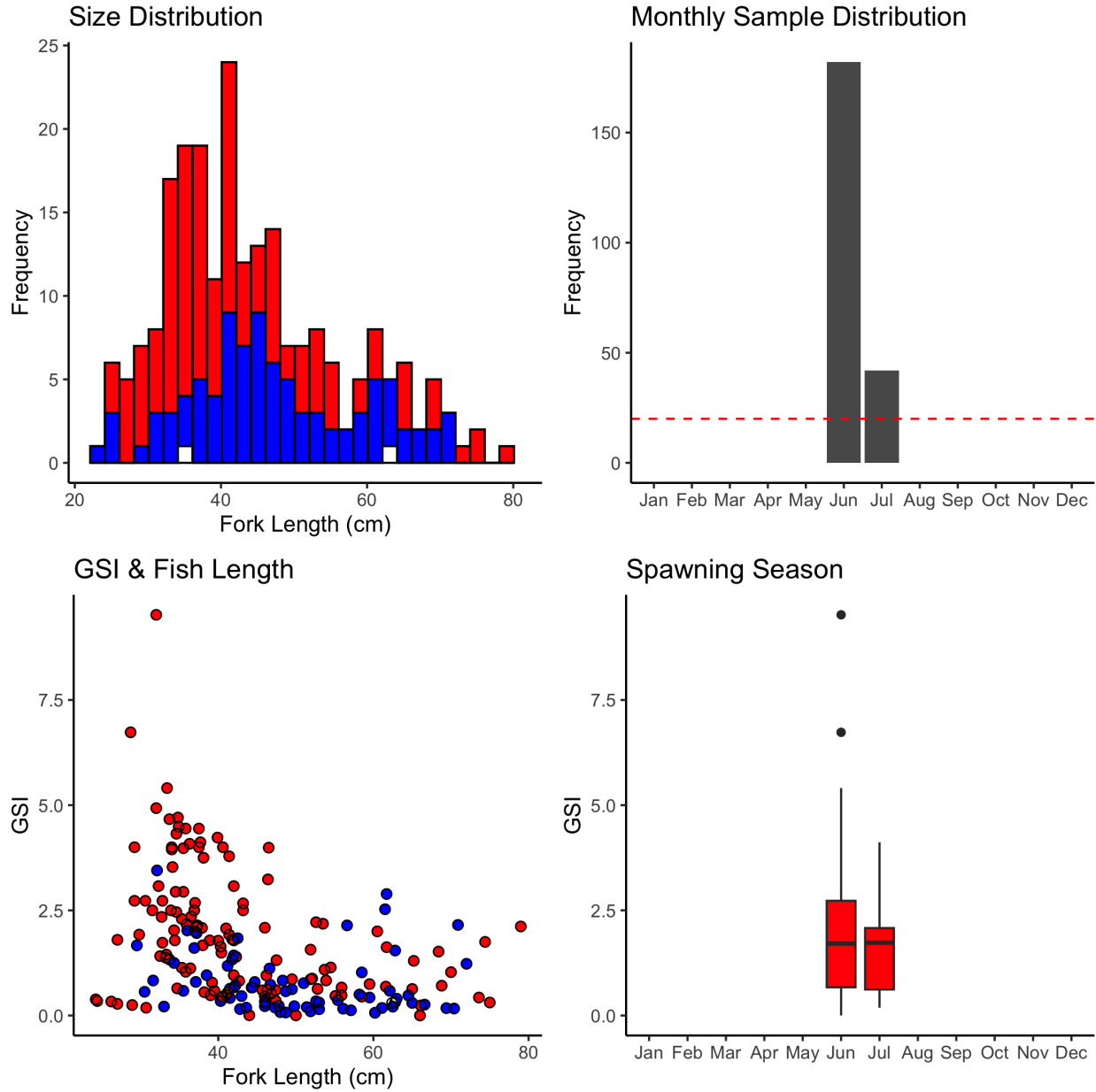


Figure B44. *C. melampygus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Cephalopholis argus

A total of 223 *Cephalopholis argus* samples (females = 131, males = 57, unknown/NA = 35) have been collected to date (October 2023). Median fork length is 31.5 cm (min=6.5 cm, max=44.9 cm).

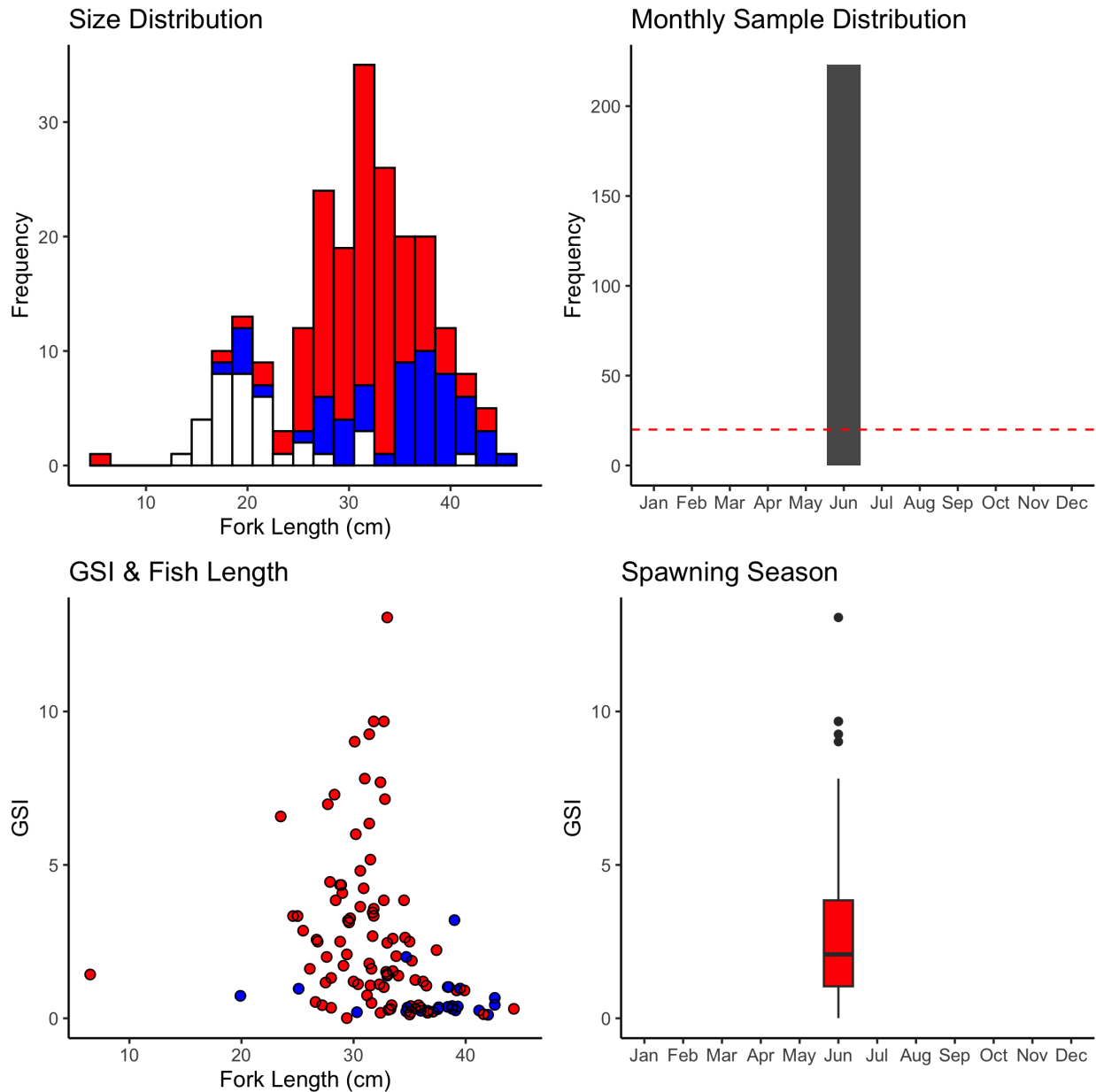


Figure B45. *C. argus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Monotaxis grandoculis

A total of 171 *Monotaxis grandoculis* samples (females = 80, males = 69, unknown/NA = 22) have been collected to date (October 2023). Median fork length is 29.8 cm (min=8.6 cm, max=40 cm).

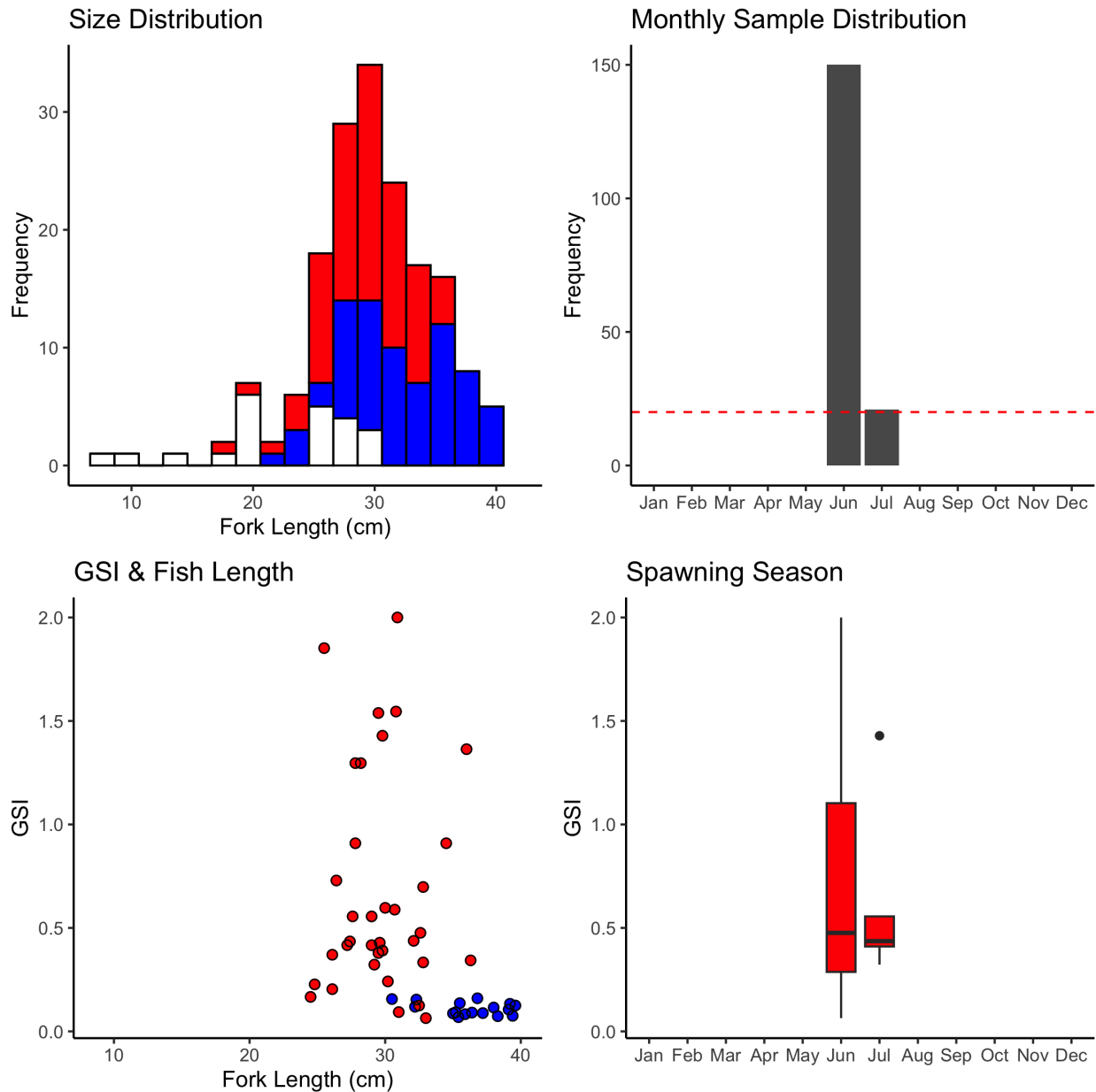


Figure B46. *M. grandoculis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso lituratus

A total of 274 *Naso lituratus* samples (females = 144, males = 97, unknown/NA = 33) have been collected to date (October 2023). Median fork length is 24.2 cm (min=10.5 cm, max=30.4 cm).

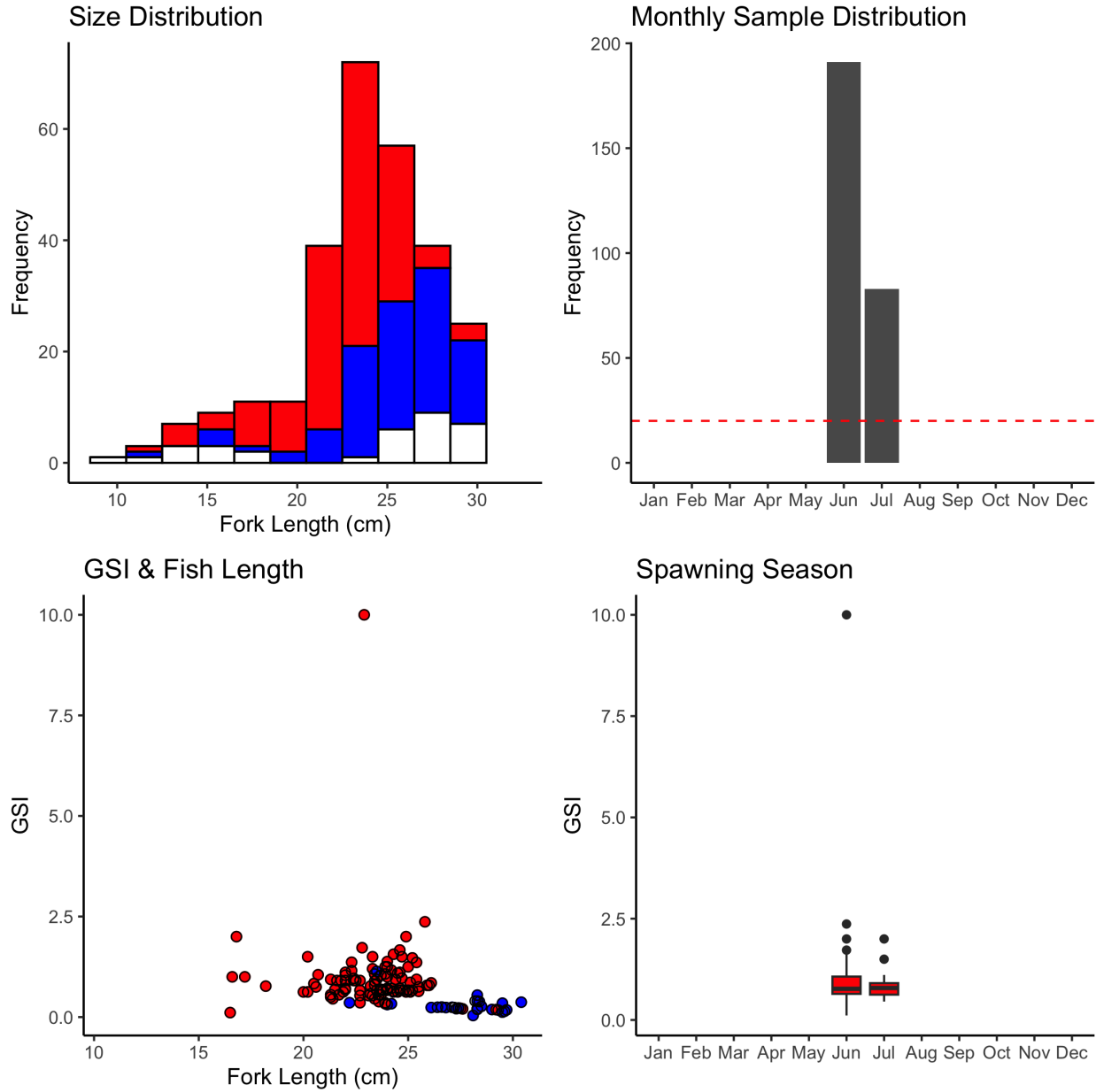


Figure B47. *N. lituratus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Naso unicornis

A total of 178 *Naso unicornis* samples (females = 84, males = 81, unknown/NA = 13) have been collected to date (October 2023). Median fork length is 35.8 cm (min=16.5 cm, max=52 cm).

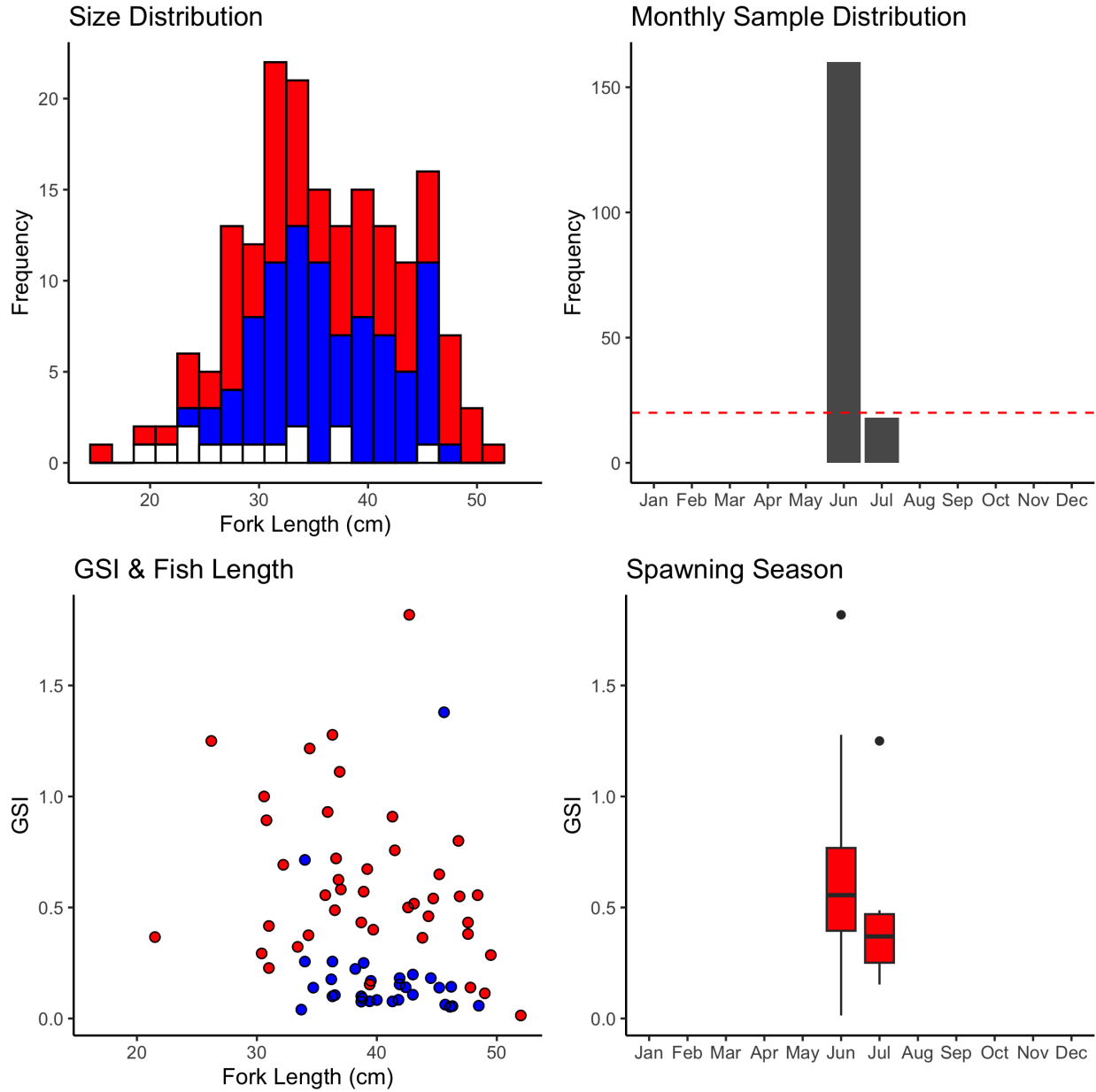


Figure B48. *N. unicornis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Scarus rubroviolaceus

A total of 259 *Scarus rubroviolaceus* samples (females = 132, males = 100, unknown/NA = 27) have been collected to date (October 2023). Median fork length is 33.6 cm (min=17.2 cm, max=51.8 cm).

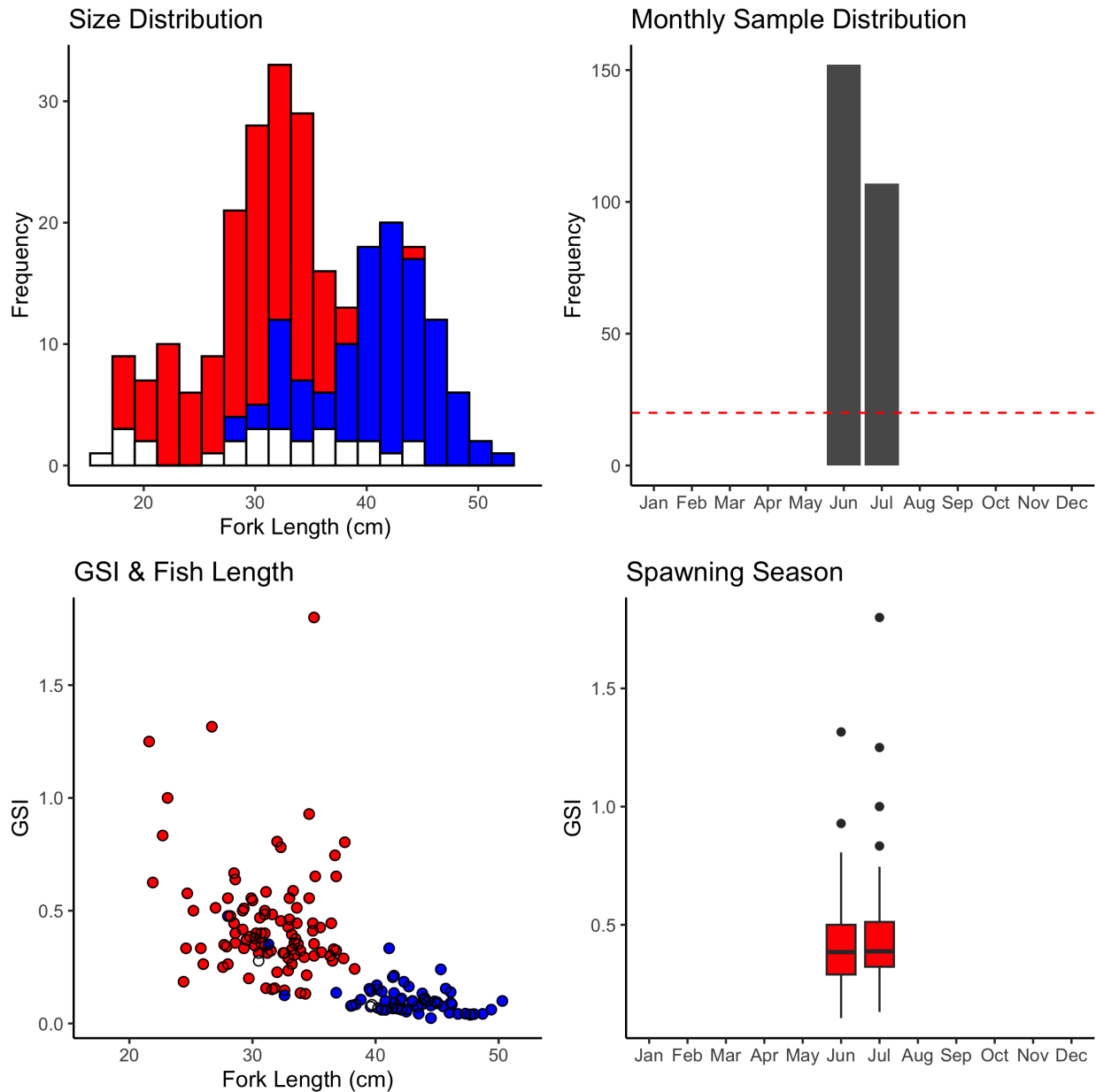


Figure B49. *S. rubroviolaceus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Zanclus cornutus

A total of 202 *Zanclus cornutus* samples (females = 124, males = 76, unknown/NA = 2) have been collected to date (2023-08). Median fork length is 17.2 cm (min=13 cm, max=20.8 cm).

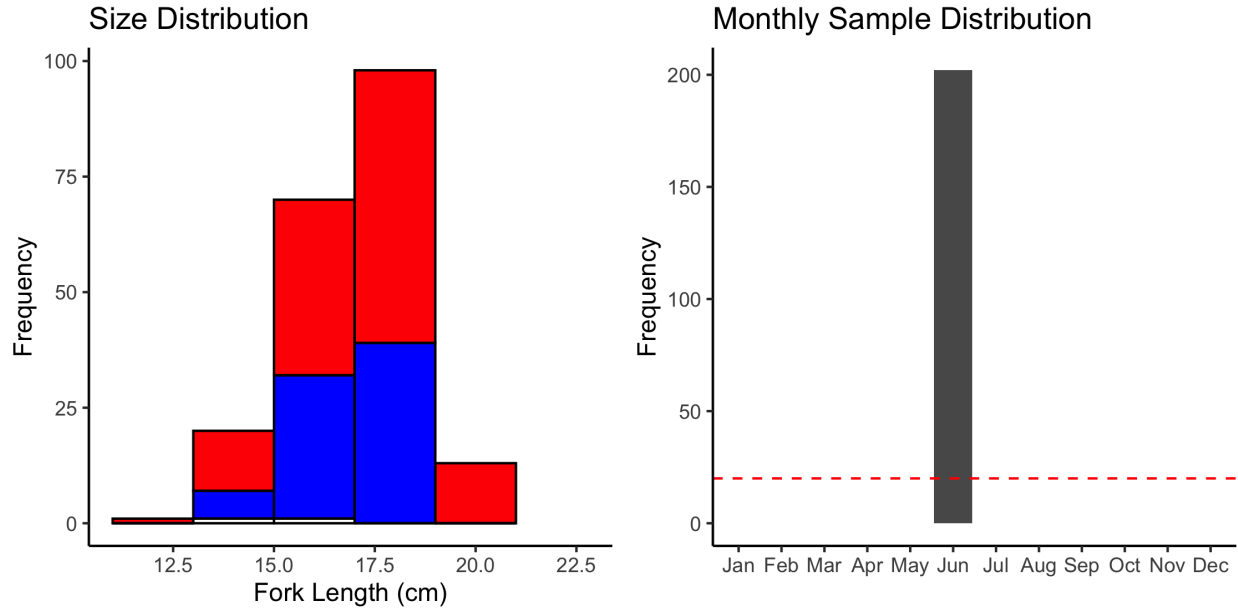


Figure B50. *Z. cornutus* sampling summaries for size distribution and monthly sample collection. Gonad weight was not recorded for this species and thus GSI and fish length and spawning season summary figures are not available at this time. Females are red (triangles)

Appendix C: American Samoa Fished Species Summaries

Updated October 2023

The following species were sampled through the Jurisdictional 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 jurisdictional 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. There is a blank summary page if there are not any samples collected for a BMUS. 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 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: GSI (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 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 (October 2023). Median fork length is 51.8 cm (min=30.9 cm, max=95.9 cm).

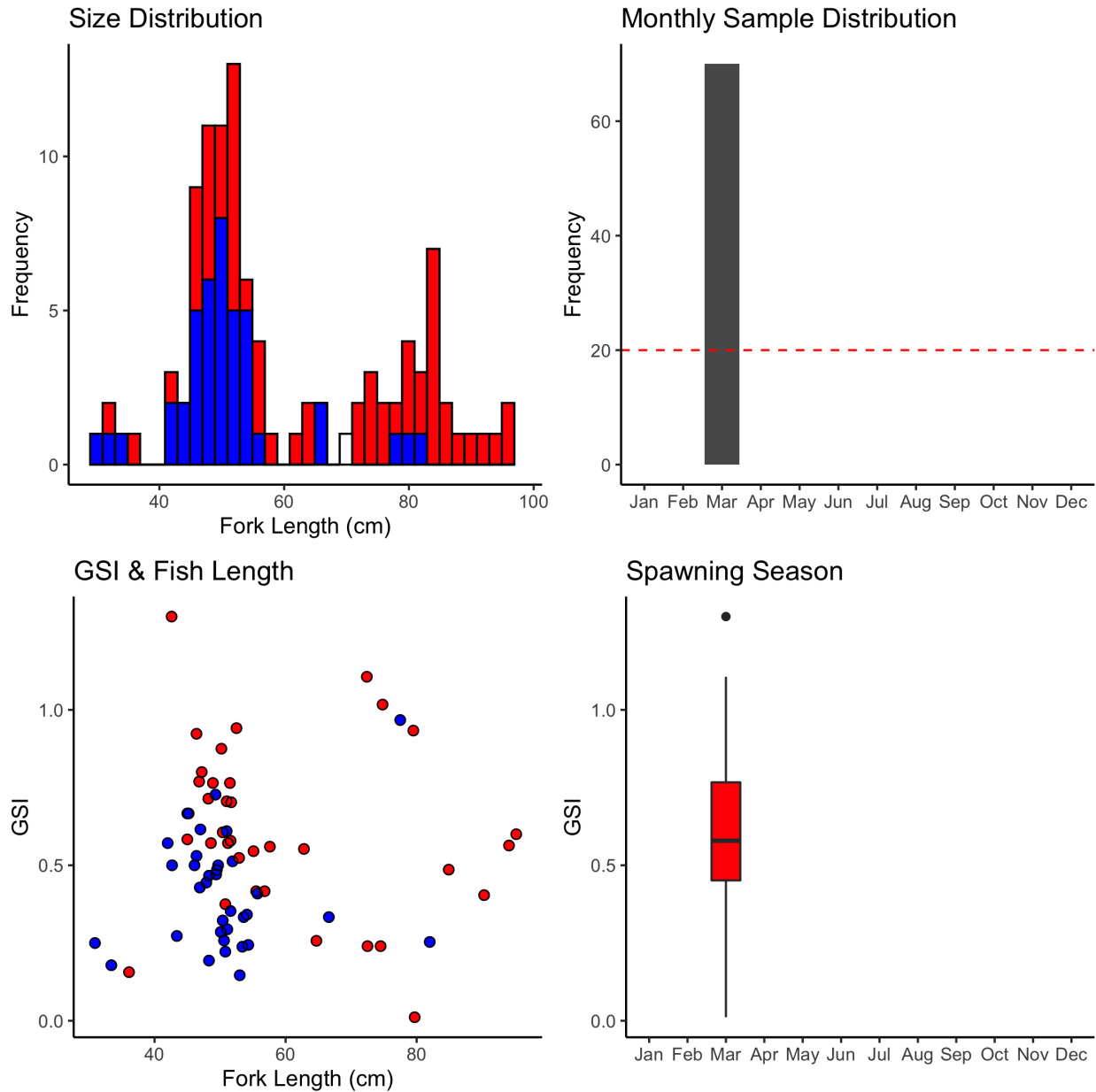


Figure C1. *A. rutilans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Aprion virescens

A total of 3 *Aprion virescens* samples (females=1, males=2, unknown/na=NA) have been collected to date (2022-12-02). Median fork length is 59.4 cm (min=57.1 cm, max=61.3 cm).

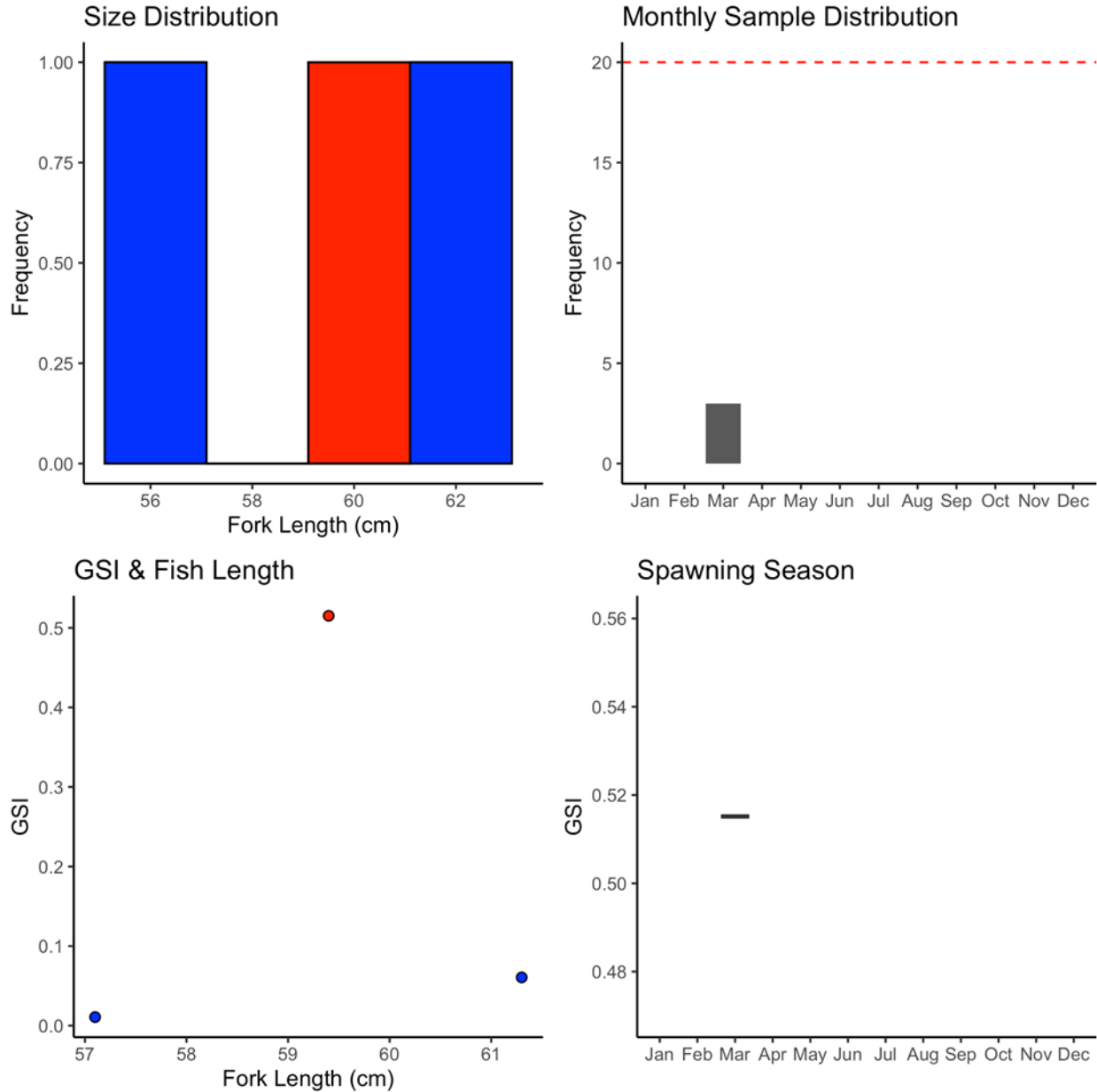


Figure C2. *A. virescens* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Caranx lugubris

A total of 0 *Caranx lugubris* samples (females = NA, males = NA, unknown/NA = NA) have been collected to date (October 2023).

Etelis carbunculus

A total of 179 *Etelis carbunculus* samples (females = 119, males = 59, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 33.3 cm (min=23.7 cm, max=57 cm).

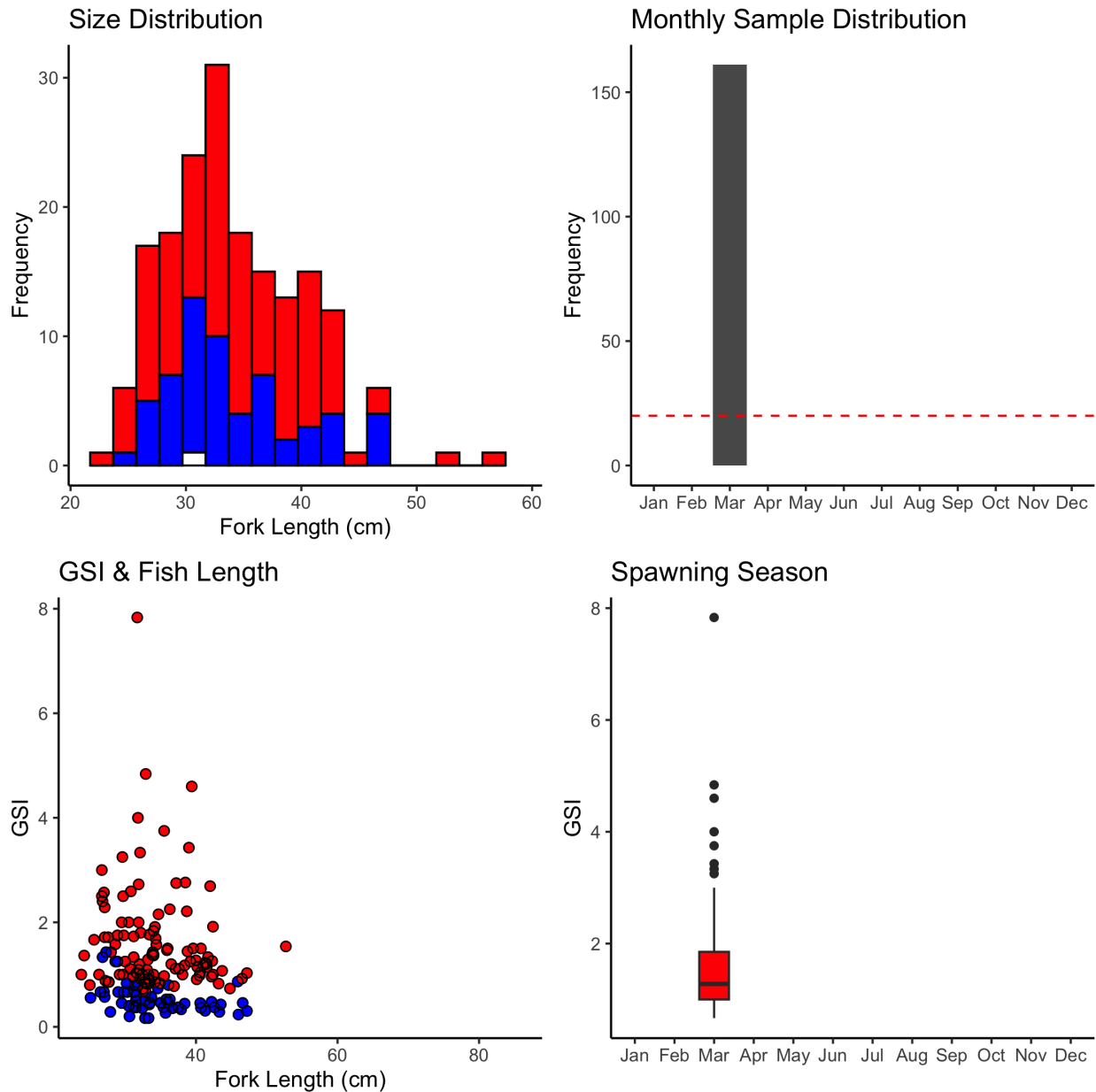


Figure C3. *E. carbunculus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red, males are blue, unknown sex is blank.

Etelis coruscans

A total of 155 *Etelis coruscans* samples (females = 81, males = 73, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 70.8 cm (min=45.6 cm, max=88.7 cm).

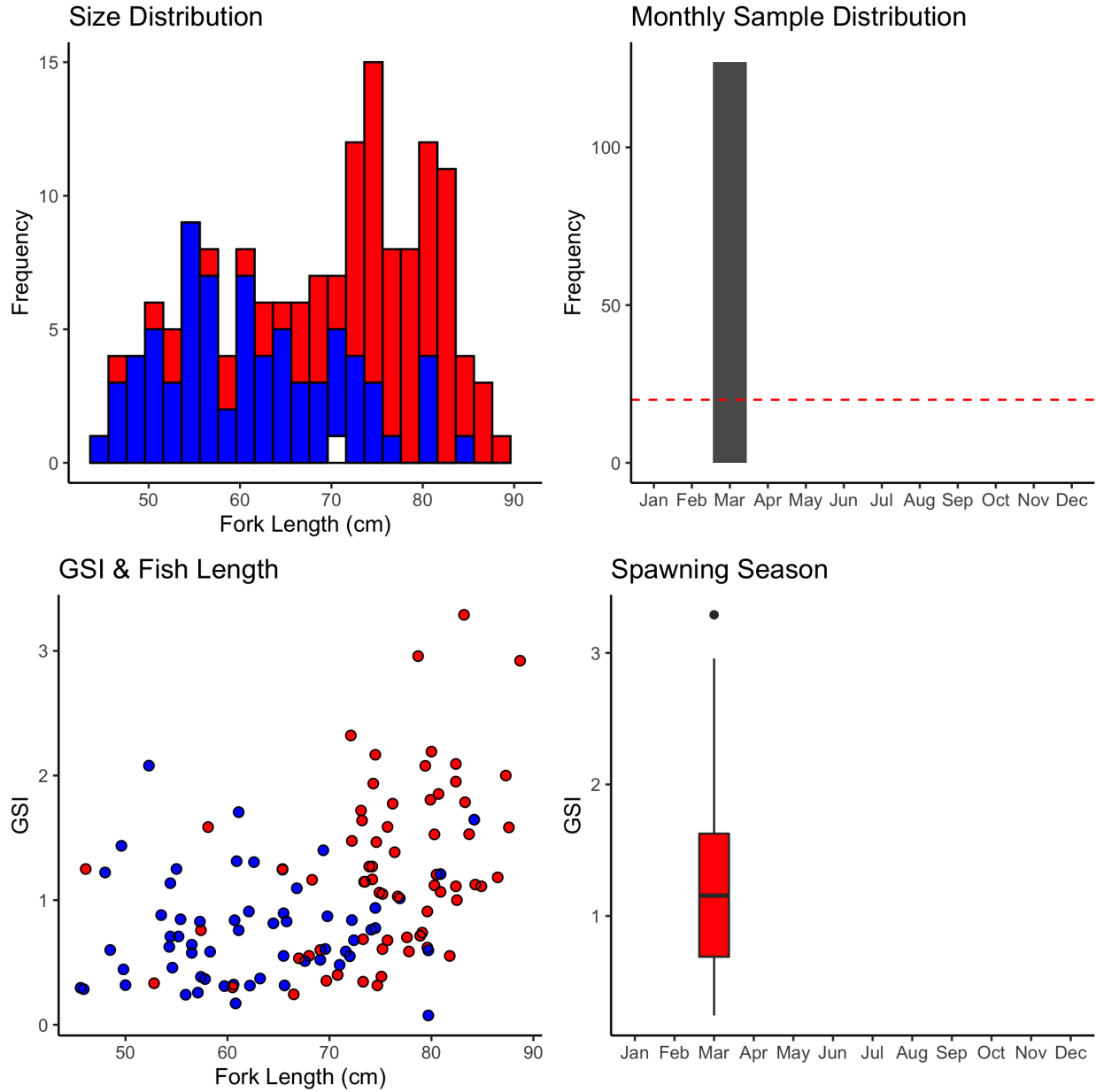


Figure C4. *E. coruscans* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Lethrinus rubrioperculatus

A total of 0 *Lethrinus rubrioperculatus* samples (females = NA, males = NA, unknown/NA = NA) have been collected to date (October 2023).

Lutjanus kasmira

A total of 155 *Lutjanus kasmira* samples (females = 81, males = 73, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 70.8 cm (min=45.6 cm, max=88.7 cm).

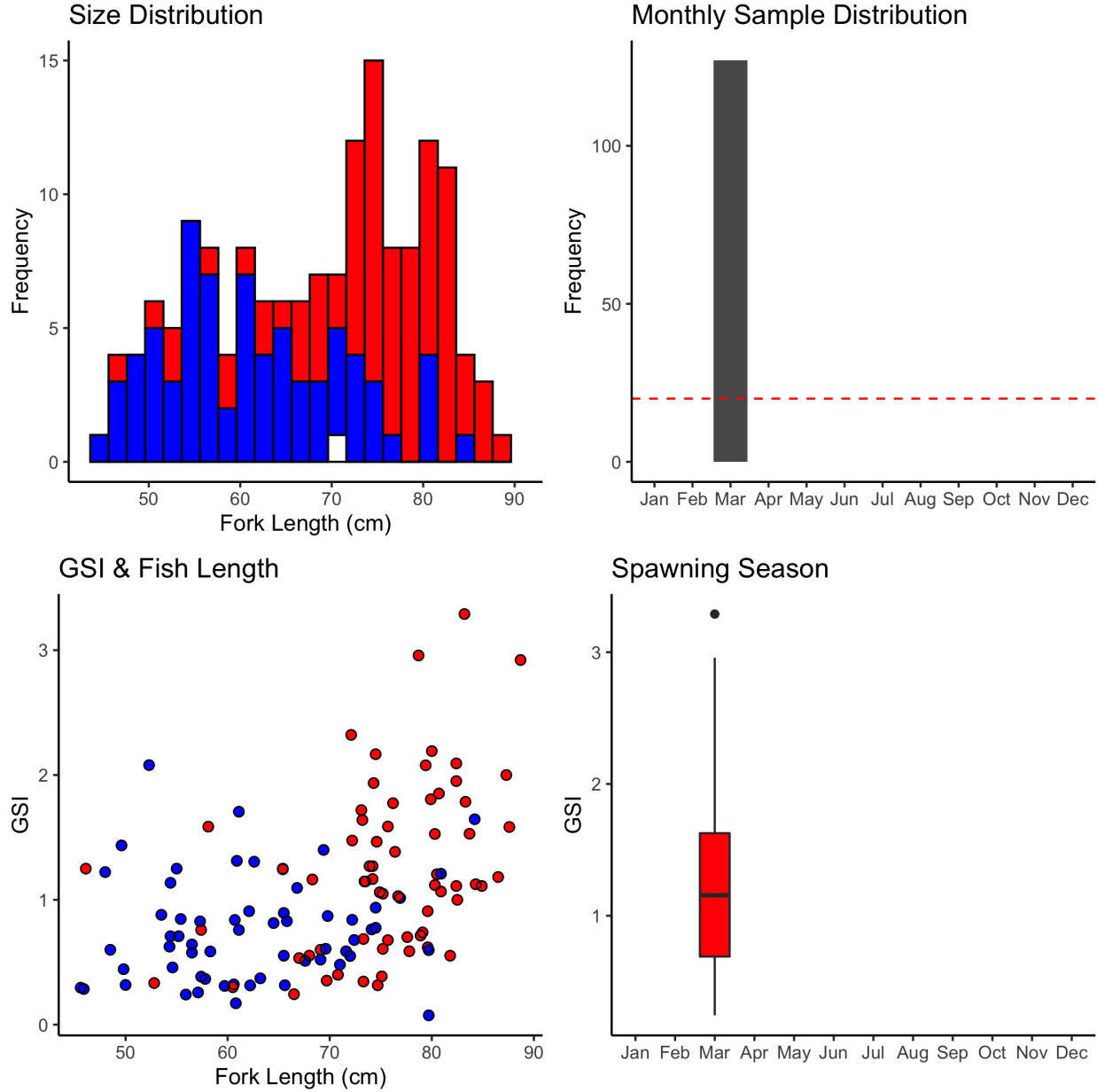


Figure C5. *L. kasmira* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides filamentosus

A total of 66 *Pristipomoides filamentosus* samples (females = 24, males = 42, unknown/NA = NA) have been collected to date (October 2023). Median fork length is 40.85 cm (min=34.1 cm, max=54.4 cm).

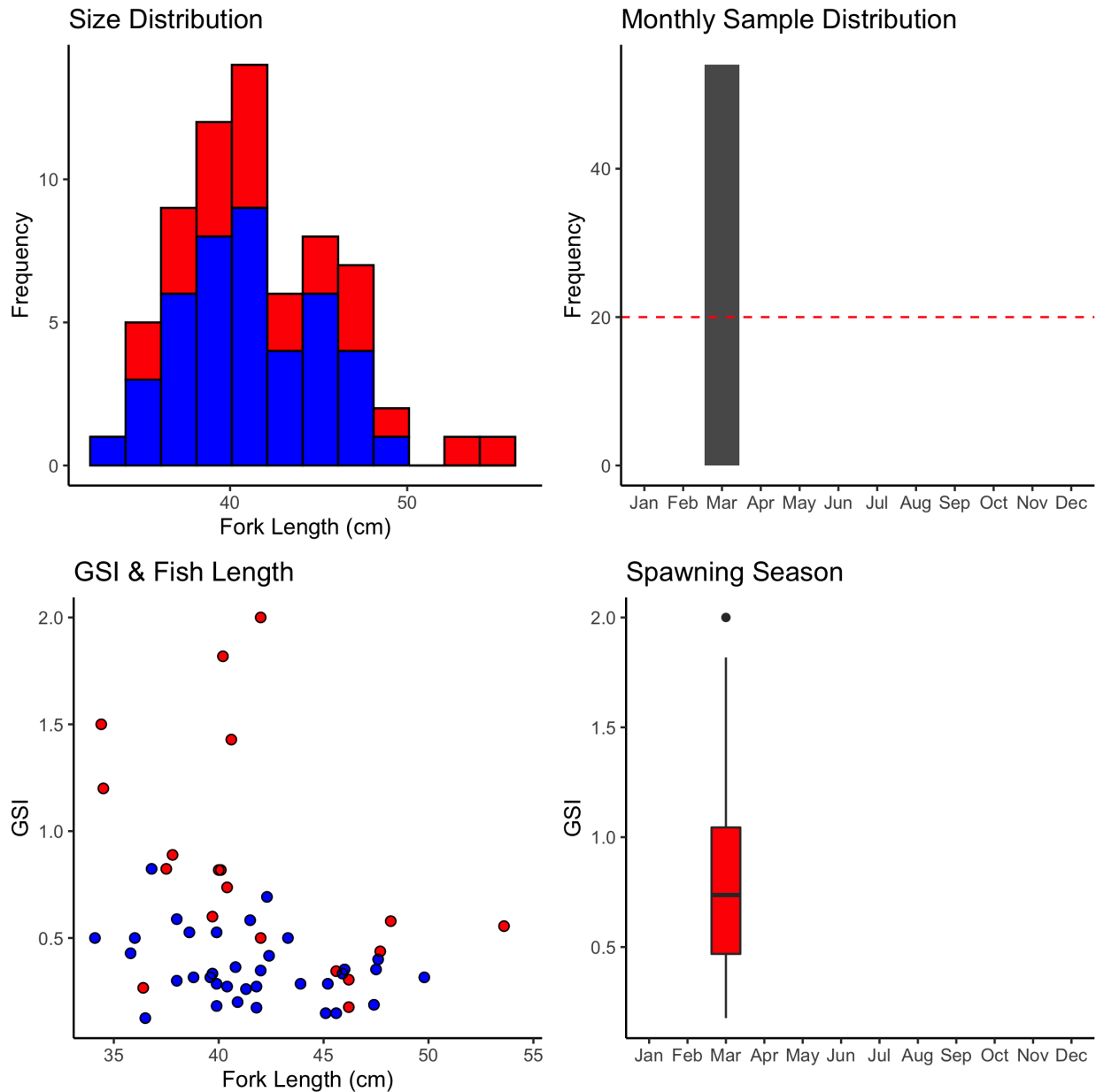


Figure C6. *P. filamentosus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides flavipinnis

A total of 274 *Pristipomoides flavipinnis* samples (females = 124, males = 148, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 39.7 cm (min=32.5 cm, max=47.4 cm).

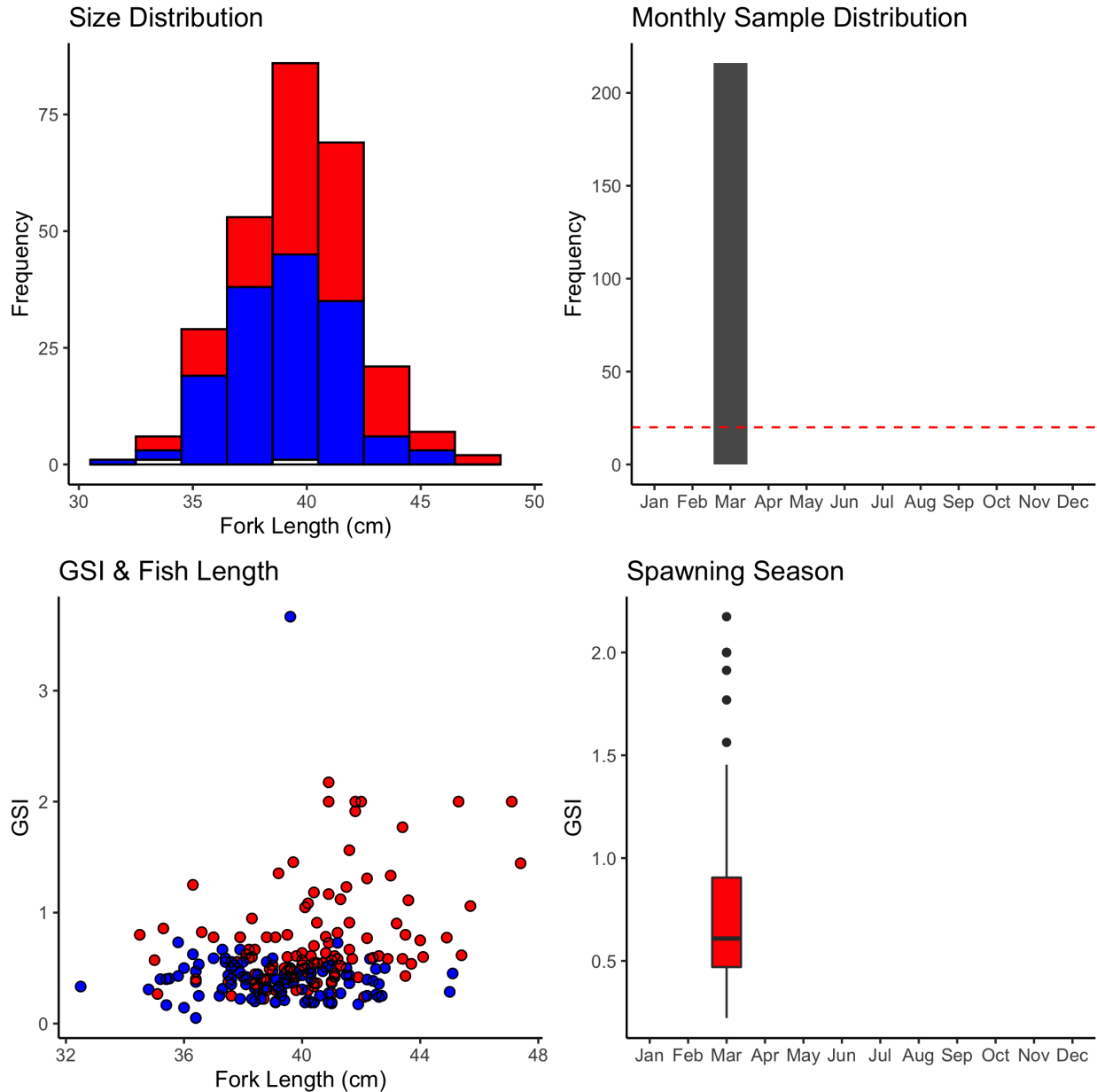


Figure C7. *P. flavipinnis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Pristipomoides zonatus

A total of 83 *Pristipomoides zonatus* samples (females = 56, males = 17, unknown/NA = 10) have been collected to date (October 2023). Median fork length is 33 cm (min=23 cm, max=43.7 cm).

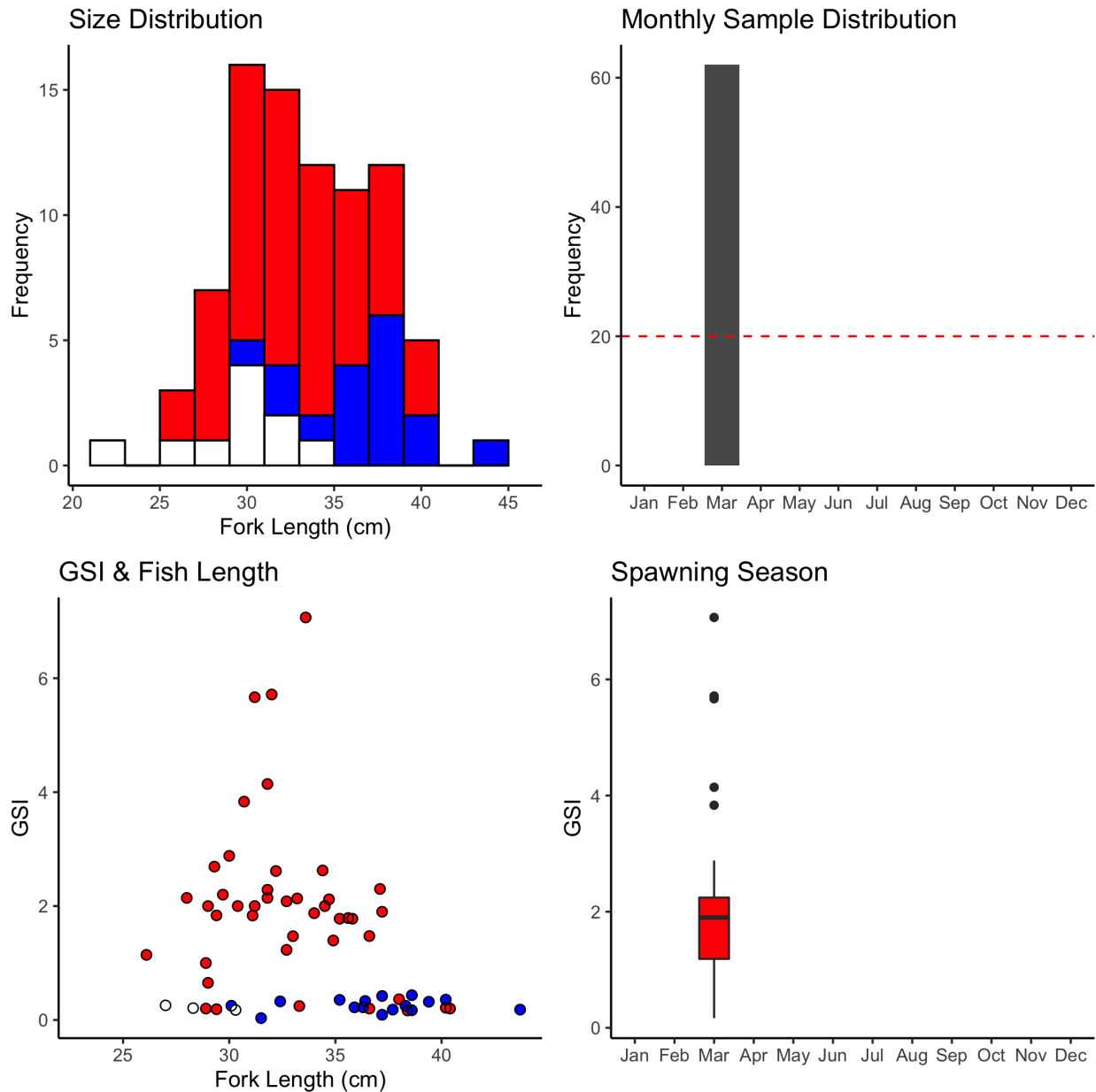


Figure C8. *P. zonatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Variola louti

A total of 0 *Variola louti* samples (females = NA, males = NA, unknown/NA = NA) have been collected to date (October 2023).

Non-BMUS

Lethrinus xanthochilus

A total of 397 *Lethrinus xanthochilus* samples (females = 222, males = 174, unknown/NA = 1) have been collected to date (October 2023). Median fork length is 37.2 cm (min=19 cm, max=54 cm).

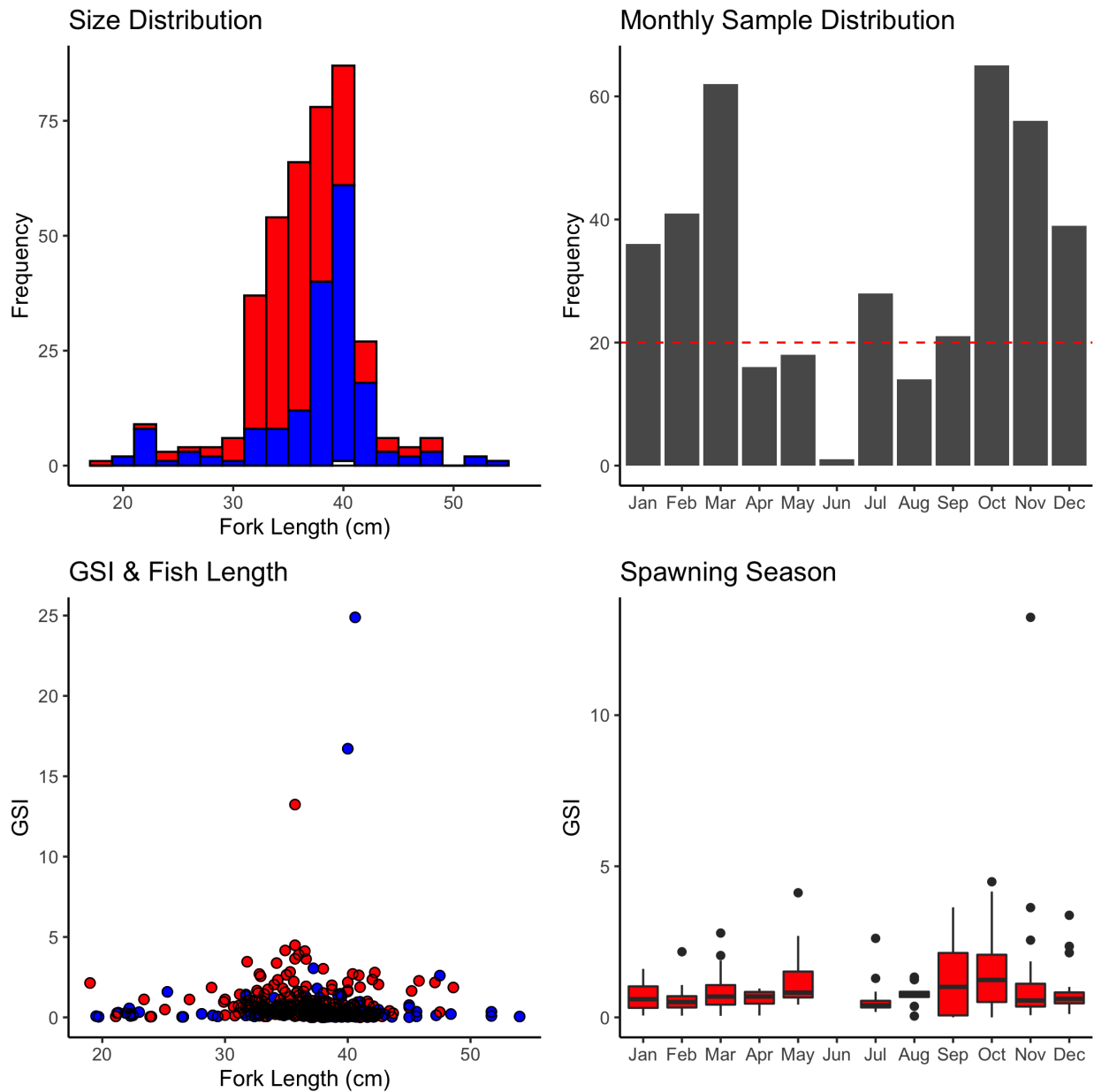


Figure C9. *L. xanthochilus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Lutjanus rufolineatus

A total of 260 *Lutjanus rufolineatus* samples (females = 64, males = 194, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 22 cm (min=14.9 cm, max=43.3 cm).

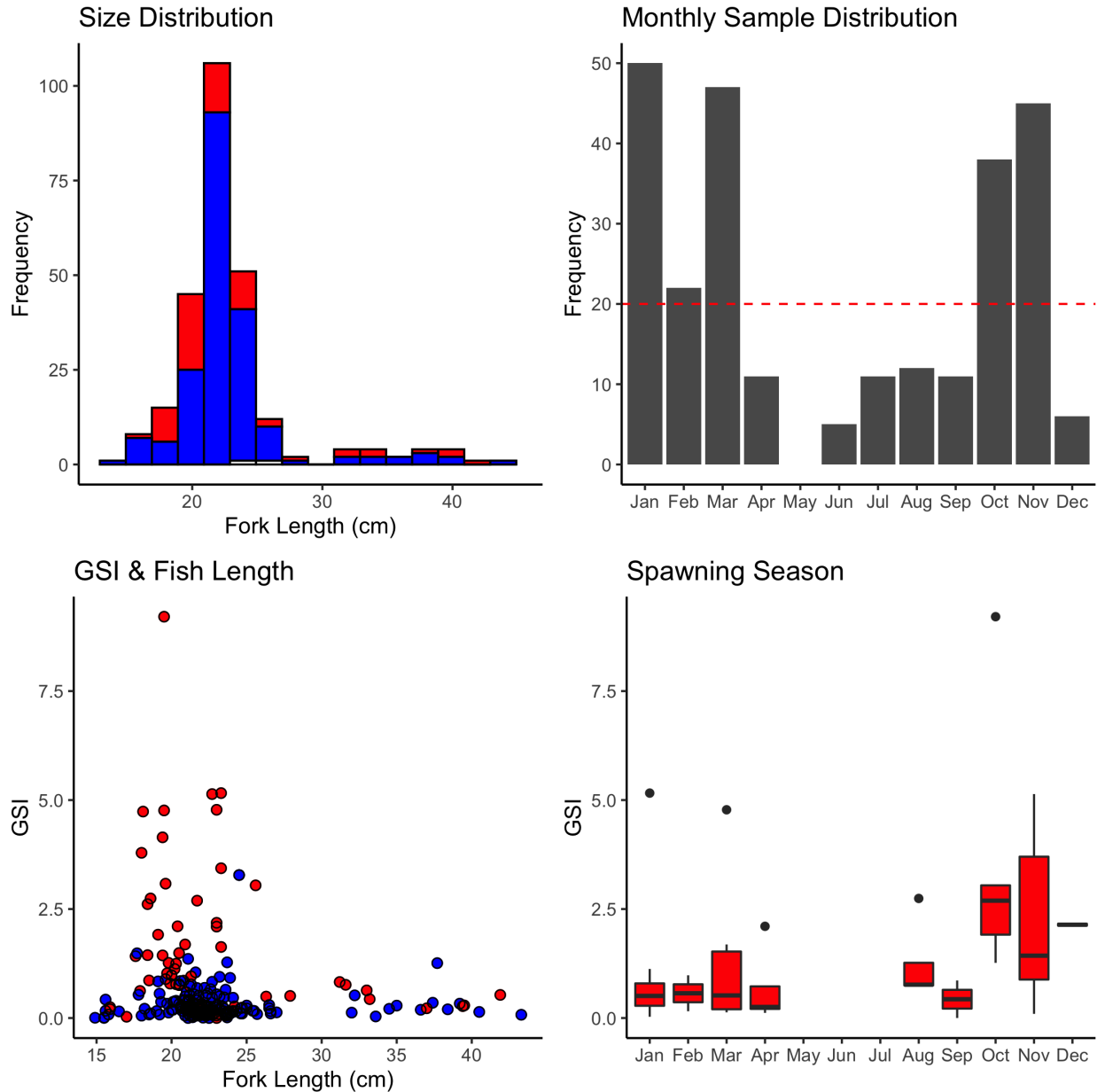


Figure C10. *L. rufolineatus* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Myripristis amaena

A total of 344 *Myripristis amaena* samples (females = 130, males = 214, unknown/NA = NA) have been collected to date (October 2023). Median fork length is 17.2 cm (min=12.5 cm, max=21 cm).

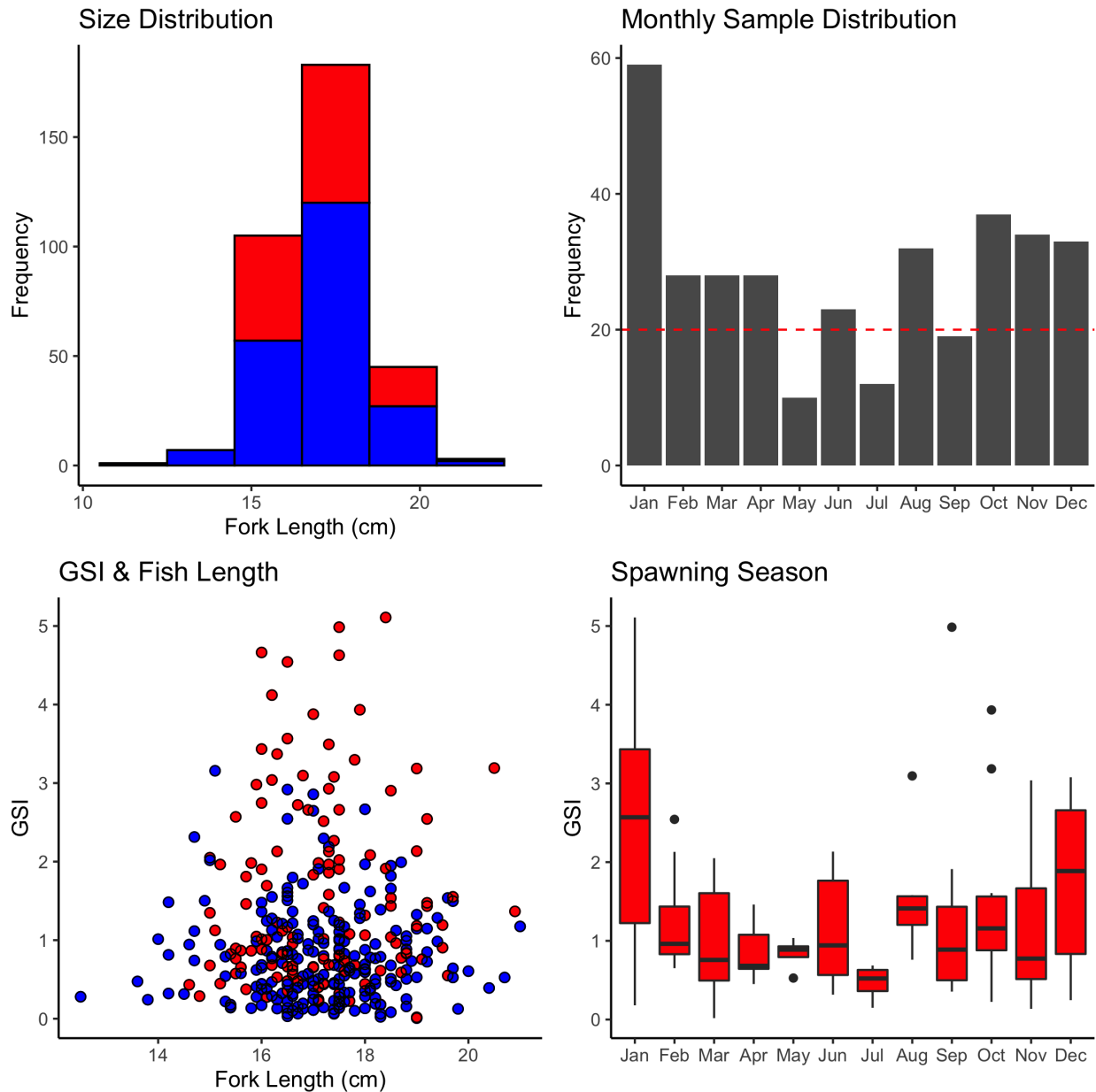


Figure C11. *M. amaena* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Myripristis berndti

A total of 703 *Myripristis berndti* samples (females = 292, males = 409, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 18 cm (min=12.5 cm, max=32.5 cm).

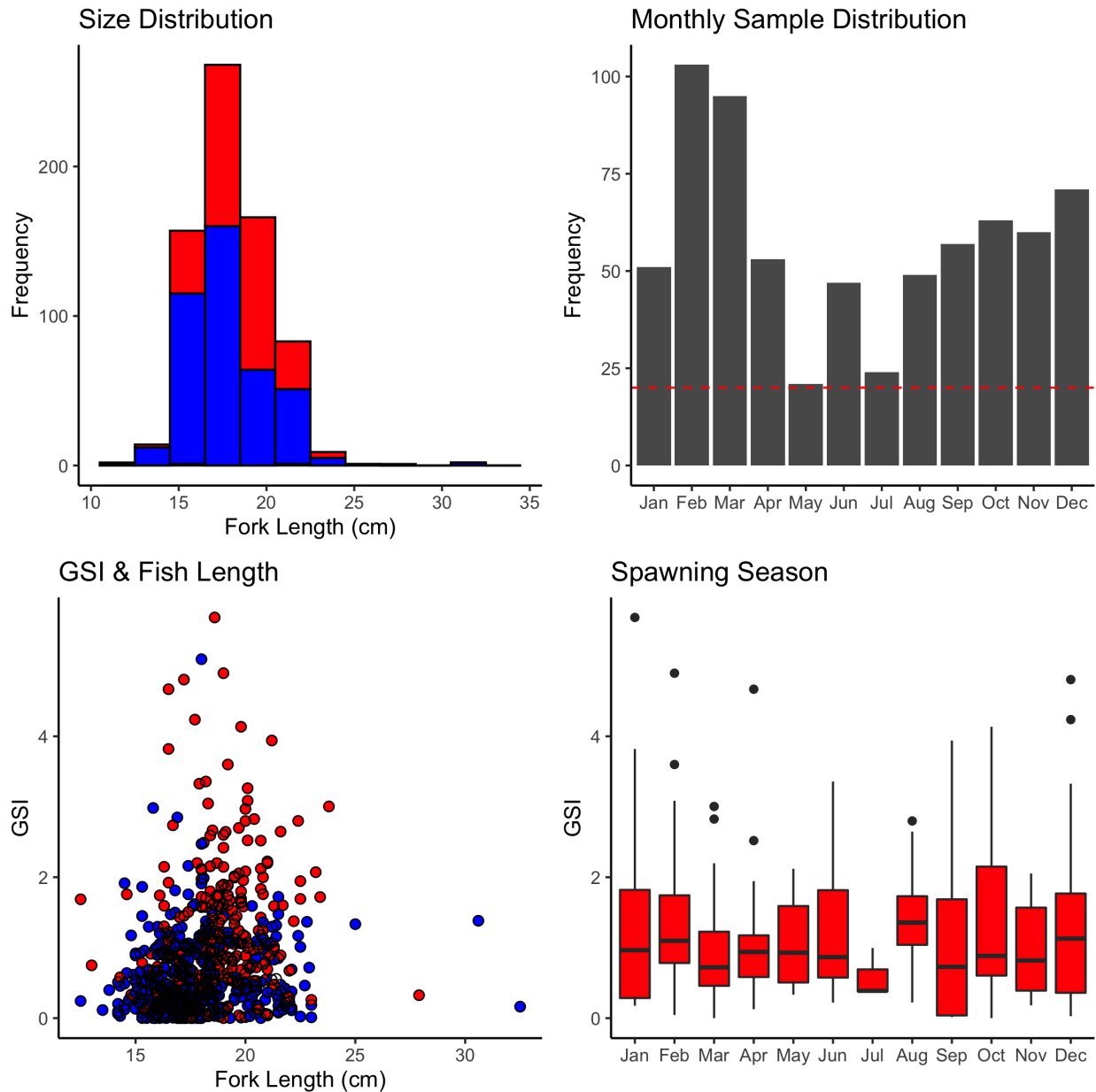


Figure C12. *M. berndti* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Myripristis murdjan

A total of 296 *Myripristis murdjan* samples (females = 123, males = 171, unknown/NA = 2) have been collected to date (October 2023). Median fork length is 16.35 cm (min=9.3 cm, max=20.5 cm).

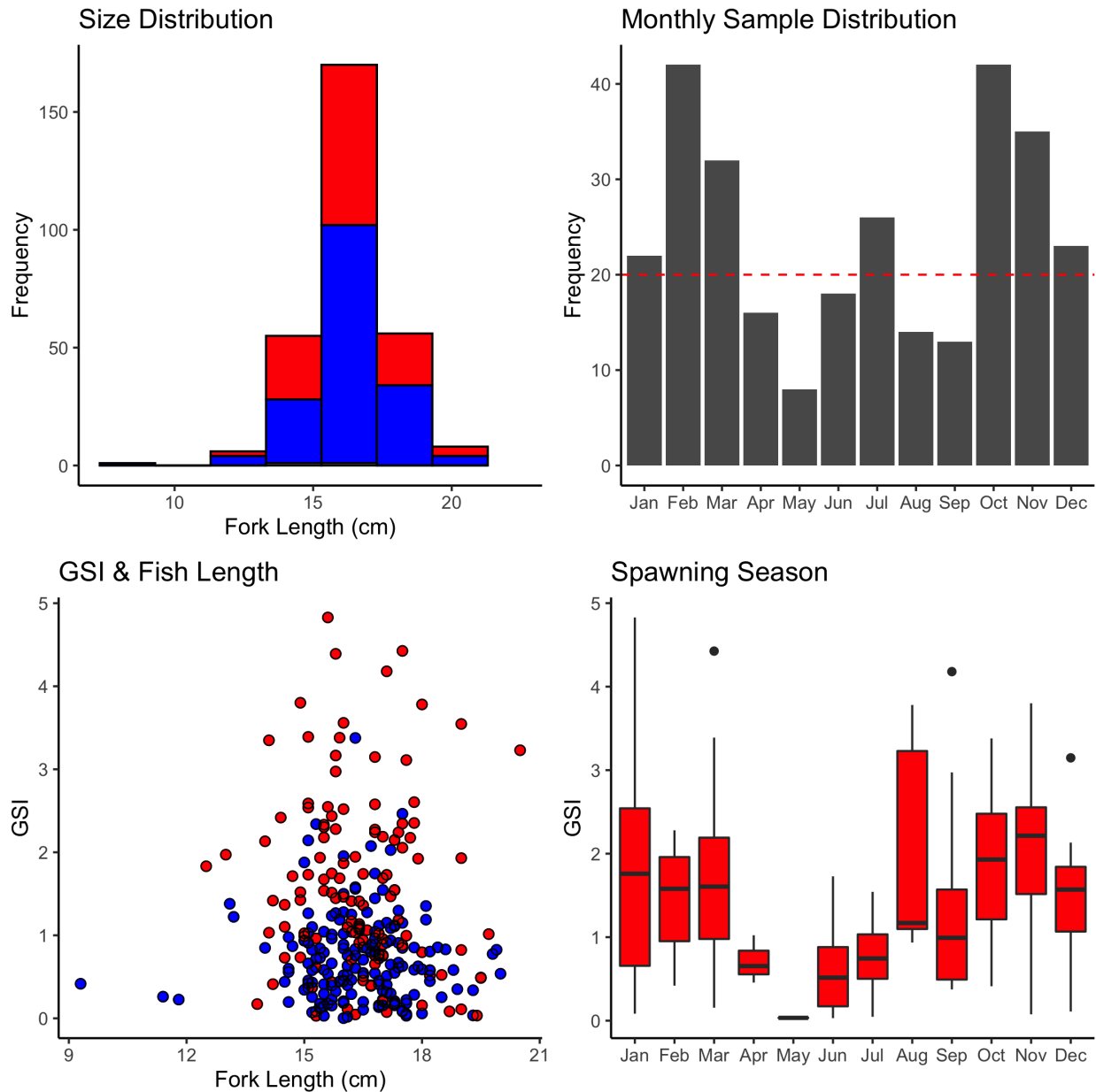


Figure C13. *M. murdjan* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Naso unicornis

A total of 558 *Naso unicornis* samples (females = 262, males = 292, unknown/NA = 4) have been collected to date (October 2023). Median fork length is 29.3 cm (min=12.4 cm, max=53.5 cm).

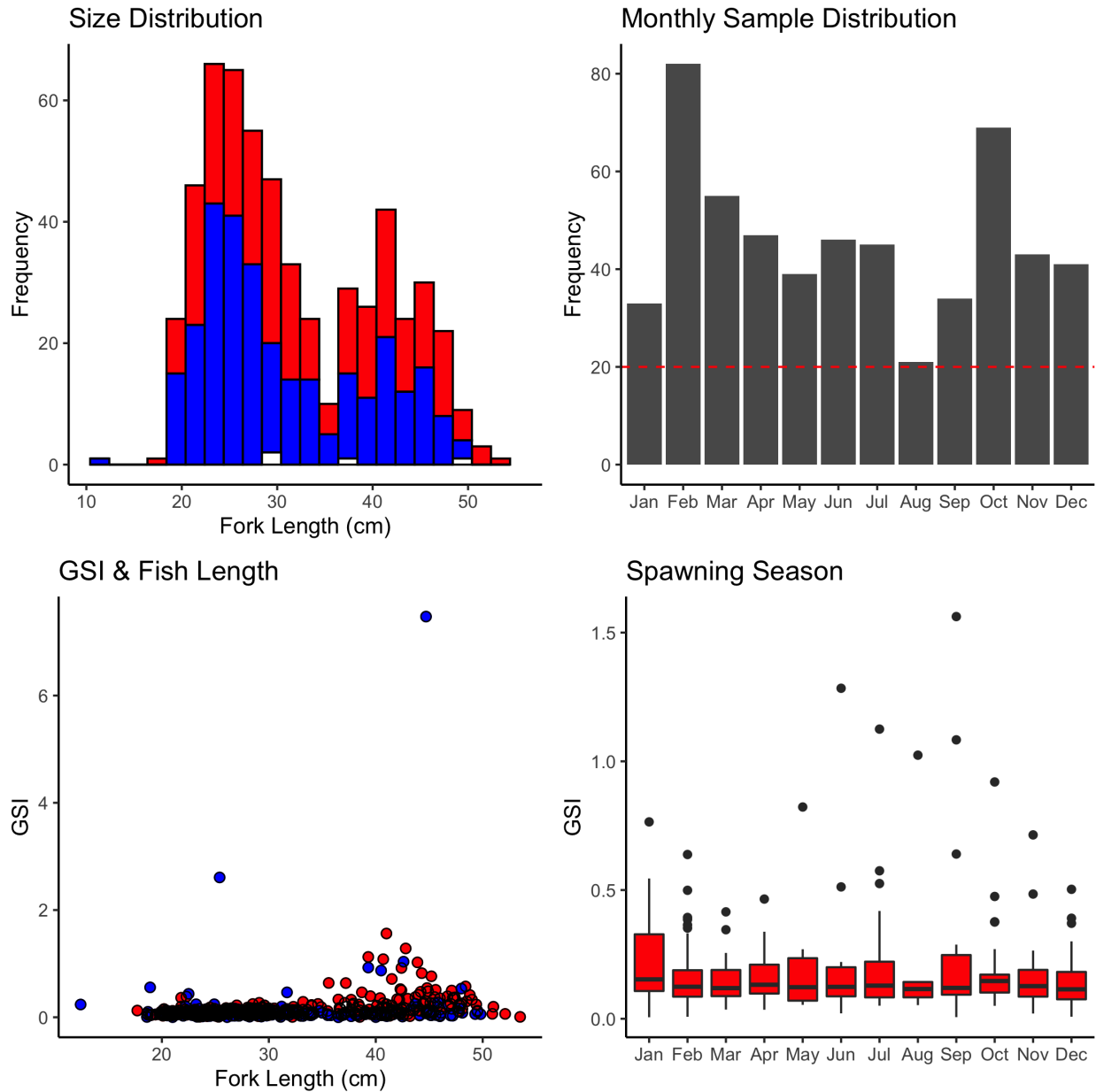


Figure C14. *N. unicornis* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).

Sargocentron tiere

A total of 699 *Sargocentron tiere* samples (females = 278, males = 387, unknown/NA = 34) have been collected to date (October 2023). Median fork length is 17.9 cm (min=10.3 cm, max=31.6 cm).

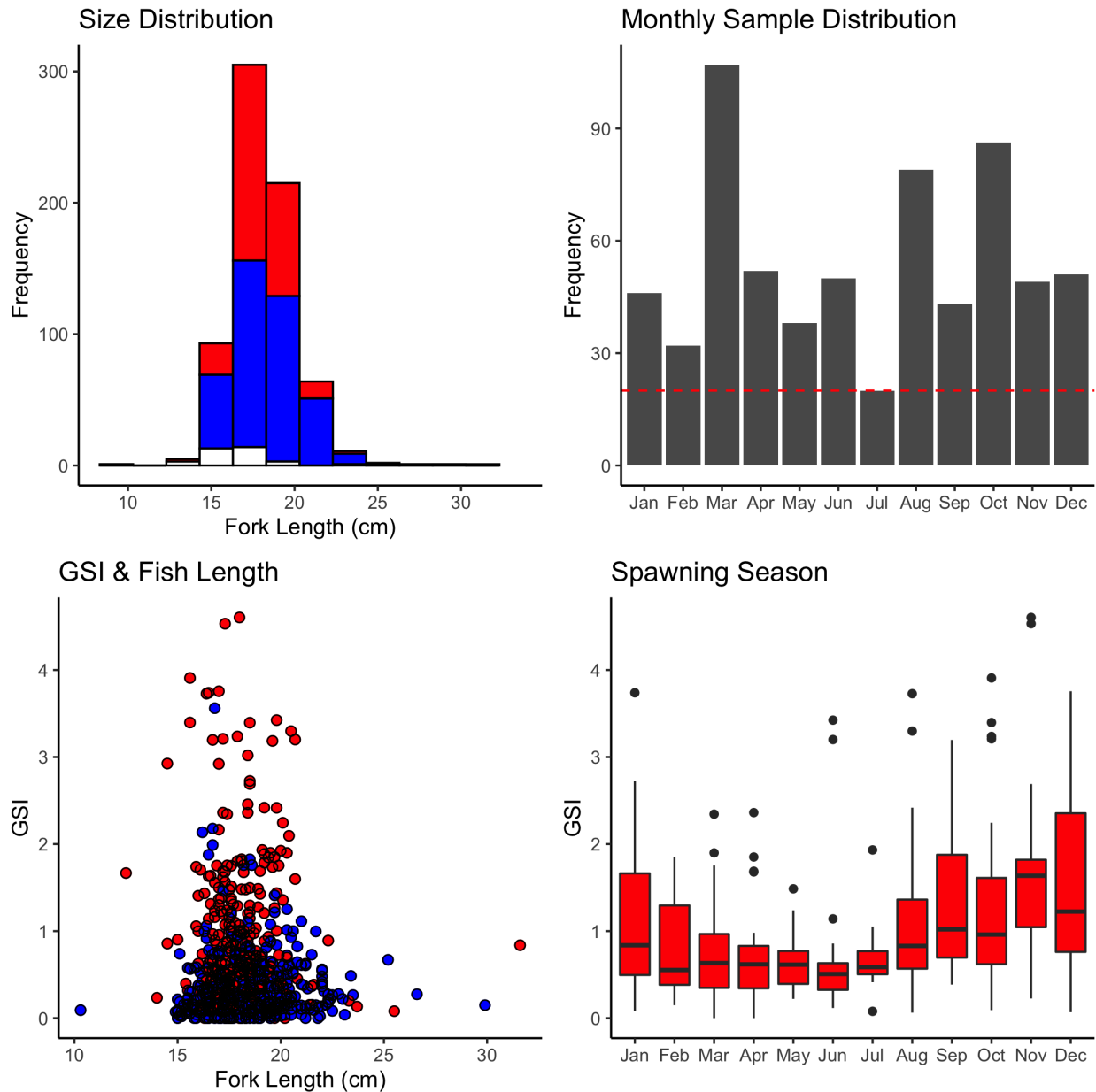


Figure C15. *S. tiere* sampling summaries for size distribution, monthly sample collection, GSI and fish length, and spawning season. Females are red (circles), males are blue (circles), unknown sex is blank (circles).