Soviet vessels "constitute more than a quarter of the world's fishing fleet and more than one-half of the total tonnage . . ."

Soviet Fisheries: A Review

T. S. SEALY

At the end of the Second World War the Soviet fishing industry, which had produced a total catch of 1.4 million tons in 1940, was almost completely destroyed. More than 5,000 fishing vessels, almost the total complement of the USSR's western fishing fleet, had been lost and many of the ports, harbors and other shore facilities in the Azov, Black, Baltic and Northern sea areas were destroyed or extensively damaged.

However, in the 20 years from 1946 to 1966 the Soviet Union rebuilt and expanded its fishing industry so that by 1967 it had become the world's third largest catcher, after Peru and Japan, with a catch of 5.8 million metric tons, and had the world's largest national fleet of fishing and associated vessels. The USSR's catch at that time was around 11 percent of the world's total catch, whereas the population of the USSR was only around 7 percent of the world total.

This development was made possible only by a massive State investment in the industry (estimated at some $4 billion from 1946 to 1965), and by a centrally planned program of reconstruction and rebuilding through a series of five-year plans. The spur to this development was the Soviet Union's need to meet the continuing short-fall between the nation's protein requirement and agricultural production. A measure of the success achieved can be taken from the fact that fish and fish products are an established part of the average Russian's diet and that the industry provides around one third of the total annual consumption of animal protein in the Union.

The problems facing the industry at the end of the war were, however, immense. Reconstruction of damaged shore facilities took a large part of the available resources and the shipbuilding industry was almost entirely committed to a massive naval shipbuilding program. As a result the USSR bought fishing vessels extensively from abroad, particularly from the newly-created socialist states like Poland and East Germany through COMECON agreements. Although the USSR is now building a far greater proportion of its own vessels, foreign-built ships still comprise a very large part of the fleet.

In addition to the problems of reconstruction and rebuilding, the USSR also had to expand its fishing activities into nontraditional fishing areas and to seek new species in order to meet the catch targets set by the central planners. To do this the industry had to create an extensive research and development organization to develop new fishing techniques and methods in order to extend its operations into every ocean in the world.

The results of this dramatic and rapid expansion of the industry are manifold, affecting not only the internal economy of the USSR but also playing an important role in its foreign policy and in international agreements. As already noted the fishing industry is an important and essential part of the contemporary Soviet economy, not only in providing a significant contribution to the nation's food basket, but also as a large user of human and other resources. In addition to the fleet itself and its share in the ship-handling, shipbuilding, transportation, distribution, and food-production sectors of the economy, the industry is also managed and supported by a large centralized State administration and an extensive R and D and educational establishment. The worldwide operations of the fleet and its continued access to all ocean areas make it an important part of the USSR's relations with both developing and developed nations and in the international political arena generally.

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ADMINISTRATION

The Soviet government is responsible for determining the proportion of the State budget to be invested in the fishing industry, for setting the production targets for the industry in terms of the five-year plans and for integrating fishery production and the fishing industry into the overall economic plan. It is also responsible for fixing the salaries of persons engaged in the industry and for determining the market price of fish and fish products.

The central responsibility for the administration and development of the industry in terms of the "State plans for the National Economy" is vested in the Ministry of Fisheries. The Ministry controls the available funds and coordinates the general plan for all sectors of the industry from catching, processing, and distribution, to ship design and development, and fisheries R and D.

The Ministry, in turn, further delegates executive authority to various "Territorial Administrations," each responsible for some particular aspect of the industry, for example marine fisheries, freshwater fisheries and cultivation, and fisheries conservation and management.

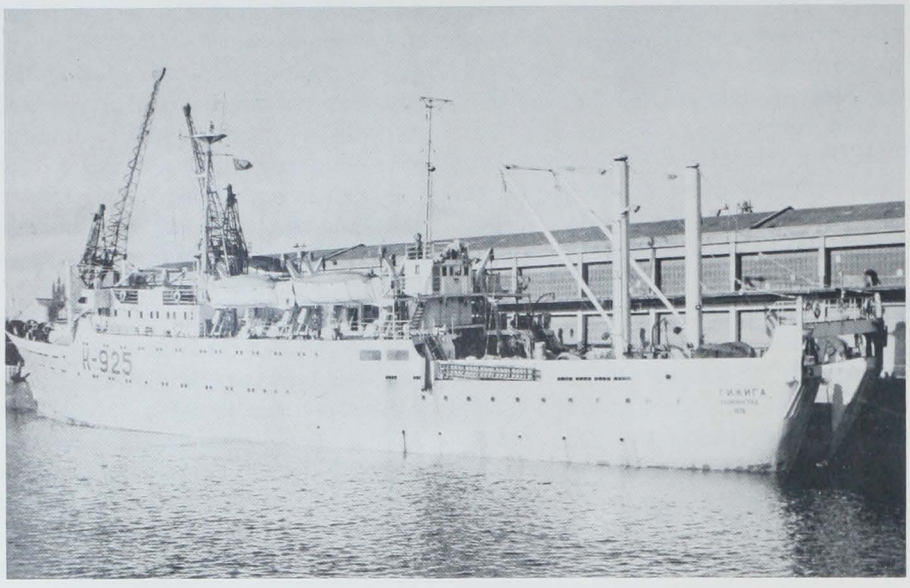

Figure 1.—Soviet Fisheries Research Vessel *Gizhiga*, converted BMRT.

In the case of the marine sector of the industry, there are five such Territorial Administrations:

SEVRYBA, the Northern TA responsible for fishing operations in the White, Barents, and Norwegian Seas and the North and Central Atlantic Ocean;

ZAPRYBA, the Western TA responsible for fishing operations in the Baltic and North Seas and in the Central and Southern Atlantic;

AZCHERRYBA, the Azov/Black Sea TA responsible for fishing operations in the Black, Azov, Mediterranean, and Red Seas and the Indian Ocean;

KASPRYBA, the Caspian Sea TA responsible only for fishing operations in the Caspian Sea;

DAL'RYBA, the Far-Eastern TA responsible for fishing operations in the Sea of Okhotsk, the Bering Sea, and the Pacific and Indian Oceans.

These Territorial Administrations delegate authority to smaller administrative units—the Regional Administrations, which, in turn, control the smallest units, the "Collective" and "State" fishing enterprises.

The areas controlled by the Territorial Administrations bear no relationship to the boundaries of the Republics which constitute the USSR, a fact which emphasizes, once again, the national or "all-union" character of the industry.

RESEARCH AND DEVELOPMENT

The expansion of the fishing industry is based upon its research and development effort which again is organized in the same pyramid fashion as the administrative side of the industry. At the top is VNIRO, the All-Union Scientific Research Institute for Fisheries and Oceanography in Moscow, and VNIRORKh, the All-Union Scientific Research Institute for River and Lake Fisheries in Leningrad. Both of these institutions are responsible to the Ministry which controls the overall planning of the research program.

VNIRO, as the central authority, is responsible for integrating the R and D programs of the Territorial Research Institutes under its umbrella. These are subdivided in exactly the same fashion as the Territorial Administrations, that is in SEVRYBA (Northern TA) there is PINRO (Polar Scientific Research Institute of Fisheries and Oceanography); ZAPRYBA (Western TA) has ATLANTniro (Atlantic Scientific Research Institute of Fisheries and Oceanography); AZCHERRYBA has AZCHERniro; KASPRYBA has KASPniro; and DAL'RYBA has DAL'niro.

Each of these research centers comprises a number of departments, not all of which are necessarily at the same location, so that all sectors of the industry relevant to that particular Territorial Administration can be investigated by teams fully acquainted with local problems.

Each Territorial Administration operates one or more fisheries research vessels. Many of these vessels are converted commercial fishing vessels which allows them to conduct comparative and feasibility studies of new gear and techniques under near-commercial fishing conditions, in addition to basic fisheries research work like the location, identification, and assessment of new stocks, studying environmental factors, plotting migration routes, and so on.

Typical of such vessels is the *Gizhiga* (Fig. 1) which is a converted BMRT. This particular vessel, which belongs to the ZAPRYBA TA and is based at Kaliningrad, undertook extensive fish surveys in the southwest

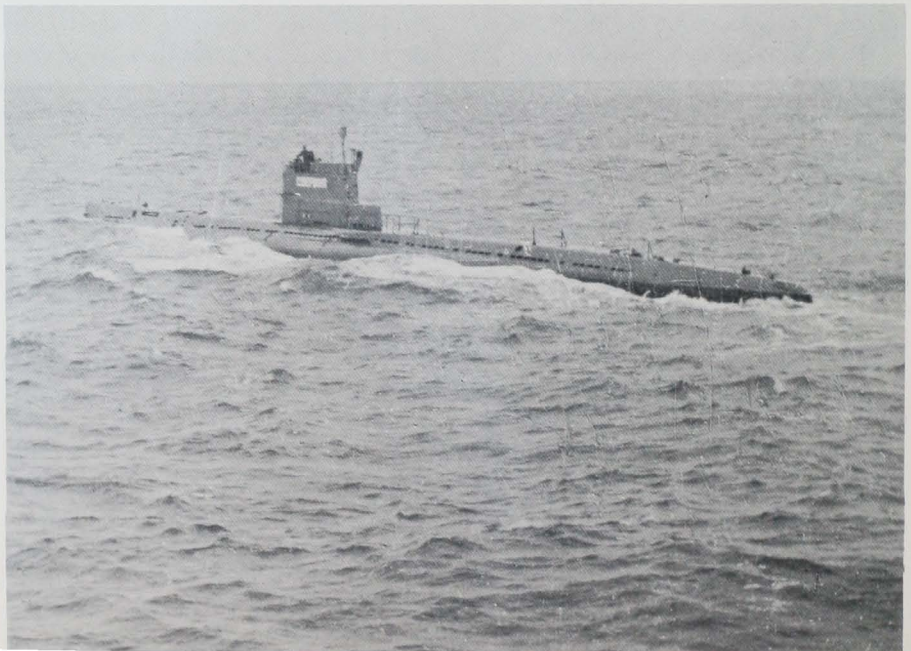

Figure 2.—*Severyanka*, Soviet Fisheries Research submarine.

Atlantic in 1966. As a result of her work a successful fishery has been established in the area (Table 3). It is true that since the establishment of this fishery in 1966, the recorded catches have fluctuated over a wide range. However in 1971, of the 12 countries (including Japan) exploiting the fishery, the Soviet fleet returned the third highest catch after Brazil and Argentina. In 1970 the Soviet fleet was the largest catcher in the area.

In addition to the surface vessels a number of submersibles are employed. These include "pure" fisheries research submersibles like the converted submarine *Severyanka* (Fig. 2) and small manned and unmanned, self-propelled and towed submersibles like *Batiplan* and *AMS-200*. These vehicles are used for making underwater observations of the operation and effectiveness of traditional and new designs of fishing gear. They also study the normal, near-gear, and escape behavior of different species of fish in the vicinity of such gear and the vessels operating them. Their use has played a vital role in the successful design of large-mesh midwater trawls, krill nets and associated fishing techniques, and submersible pump/light fishing systems.

A measure of the success of this approach to fisheries development can be seen in the fact that in 1972, 33 percent of the overall trawled catch from BMRT's (Large Freezer Trawlers) and above was by midwater trawl. From 1970 to 1972, 3,500 large-mesh midwater trawls of a new design were introduced into the fleet and almost all vessels are now equipped with this gear.

At the present time Soviet fisheries R and D is concentrated in two basic directions: the discovery of new, little, or unexploited stocks and the development of gear, vessels, and machinery to catch and process them effectively.

Examples of recent developments in this program are the discovery of large unexploited stocks of grenadier (*Macrurus rupestris*) at traditional fishing grounds, and the complementary development of a deep-water trawling technique to catch them.

The maximum working depth of conventional trawl gear is around 500 meters and it is for this reason that such fishing is concentrated on the continental shelf. However international competition on traditional grounds has already approached a level at which it is becoming increasingly difficult for catchers to maintain, let alone improve on, present catches. Because of this, the Soviet fishing industry set up an R and D program about 1965 to discover a new exploitable stock at depths in excess of 500 meters. As a result they discovered large stocks of grenadier at depths of around 1,000 meters off the northeastern shelf of the Great Newfoundland Bank and developed the gear and techniques to fish at this depth. A successful commercial fishery for this species has now been established.

Another development in the quest for new stocks is the fishery for krill (*Euphausia superba*), a small crustacean which forms the staple part of the diet of some species of whale and of seals and penguins. In this case, in addition to surveying the stocks and designing the gear and techniques to exploit it, the Soviets have also developed pastes, butter, and other food products from this raw material so that it can be readily used for both animal and human consumption. Although still in its early developmental stages, the Soviet industry anticipates that krill will be a major exploitable stock within a very short time.

In the field of mechanization, the USSR has pioneered the introduction of submersible and other fish pumps which are now widely used in the industry both for catching and transporting fish (vessel to vessel, ship to shore, dock to factory, and interfactory). Such pumps have done much to reduce manpower and to improve the quality of the finished product. This development has been accompanied by an increasing utilization of machines for all stages of processing both at sea and ashore.

EDUCATION AND TRAINING

The expansion of the industry and the effective and rapid introducion into the fleet of the increasingly sophisticated results of the industry's R and D program depend upon a capable and highly skilled labor force.

To ensure that such a labor force is always available, the USSR has transformed its industry from the localized "community" industry, which is its most common form outside the Soviet Union, into a nationally recognized profession with a planned career structure. The result is that fishing is an attractive and accessible career to all citizens irrespective of sex or geographical origin, which enables the industry to select personnel on the basis of their ability rather than simply their availability.

Education and training play two important roles in this process: They help to attract young men and women seeking a higher education who might otherwise enter other professions, and; they provide a climate of professional interest and awareness which makes the acceptance, assimilation, and utilization of the results of R and D more rapid and effective.

Higher professional education is catered for, principally, by the "Technical Institutes for Fisheries and Fishing" of which there is one in each Territorial Administation. In addition to these polytechnics, which are entirely devoted to the industry, there are "food-industry" and "marine" polytechnics which provide specialized courses in relevant fields like fish processing, seamanship, navigation, and marine engineering. All these institutes provide full-time day and part-time evening and correspondence courses, all of which lead to a higher qualification or degree.

Each Territorial Administration has, therefore, its own comprehensive educational organization which benefits from the cross-fertilization of the practical experience of its fleet and the developmental work of its "Research Institute for Fisheries and Oceanography." In addition, this territorial organization is backed up by "national" educational centers like the All-Union Correspondence Institute for the Food Industry in Moscow which offers correspondence courses in fishing and fisheries leading to degree qualification. Some of the courses offered by this establishment are: ichthyology and fish cultivation; canning technology; fish product technology; ships' power plants; refrigerator and compressor plant and machinery; machines and apparatus; engineering economics; and the automation of food production.

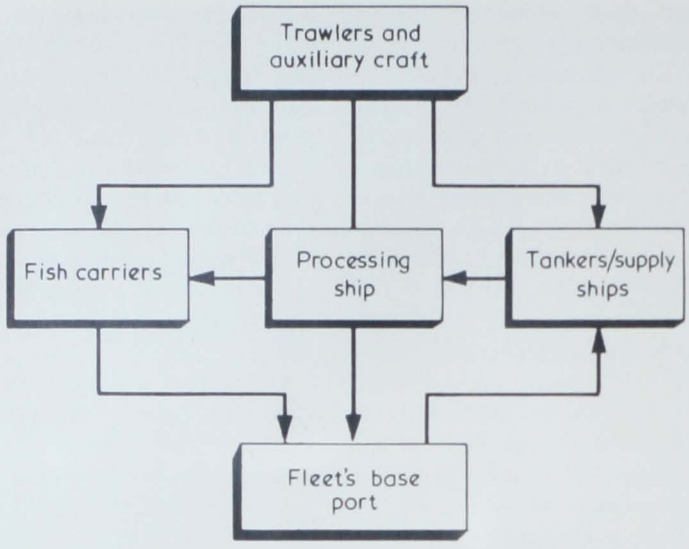

Figure 3.—Flotilla fishing organization.

All members of the industry, particularly the young, are encouraged to study through advertisements in the technical fishing press but also by the visible evidence that the attainment of a higher professional education provides for more rapid promotion, greater responsibility, and a higher salary.

Basic training in fishing skills is provided to all newcomers to the industry and comprises both onshore and at-sea training on specially-designed fishery training ships. A variety of such vessels exist, most of which are converted commercial vessels. One series of these are the *Nikolaj Zystar* class which were designed on the basis of the *Yantarnij* class fish processing/carrier ships (see Table 10). These particular vessels began construction in 1967 and the main design changes are in the superstructure and poop, and in the incorporation of additional accommodation, classrooms, training workshops, and so on.

FISHING OPERATIONS

As already noted, the Soviet fishing industry has had to rapidly extend its area of operation on a worldwide basis in order to achieve, maintain, and improve its production. This requirement for the industry to operate at great distances from base ports brought about the development of "flotilla" fishing and it is this type of operation which has governed the design of Soviet fishing vessels and the structure of the fleet.

As the range of fishing activities gradually increased it became necessary to supply vessels with all essential consumables (fuel, salt, ice, water, provisions, and so on) while on the grounds in order to extend their operational time and range of operation (Fig. 3). It also became essential, in terms of greater safety and more effective operation, to support vessels at sea for extended periods of time with medical, spare-crew, and other facilities, and this could only be sensibly arranged if vessels were organized into flotillas under the direction and control of a large "mother" ship. The mother ship also had to be capable of relieving the fishing vessels of their catch and of processing it; otherwise the fleet may have been forced to leave profitable grounds because of full fish rooms or the possiblity that their catch might begin to spoil. Supported by tankers and fish carriers, the mother ship could now accept the trawlers' catch, process or partially process it, and then pass it on to the fish carriers for transportation to the base port. Similarly it could accept fuel, etc. for the whole flotilla from tankers and supply ships for distribution as the need arose (Fig. 4).

Flotilla fishing requires a highly complex organization and, because of the growing requirement to fish farther and farther away from the coastline of the Soviet Union, lines of communication between shore base and flotilla become more and more difficult to maintain, thus necessitating the design of new types of trawlers which were not only able to catch the fish but also to process and transport it, thus relieving the mother ships and fish carriers of some of the work load. The incorporation of such ships (factory, refrigerated, and freezer trawlers) has permitted a much greater variation in fishing operations, thus making the fleets and the industry as a whole a more adaptable and flexible organization. Figure 5 shows the

Table 1.—Total Soviet fish catch (in thousand metric tons), 1967-71.

Year	At sea	Inland	Total
1967	4,961.2	816.0	5,777.2
1968	5,301.6	780.5	6,082.1
1969	5,751.9	746.5	6,498.4
1970	6,398.8	853.4	7,252.2
1971	6,401.3	935.4	7,336.7

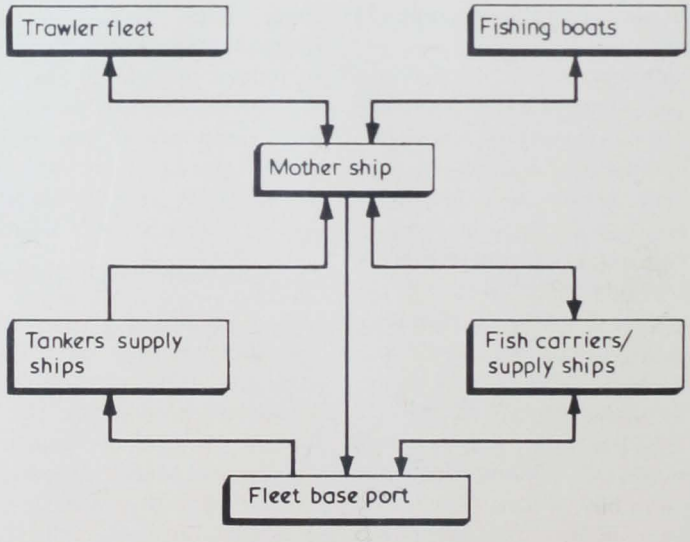

Figure 4.—Flotilla commanded by a mother ship.

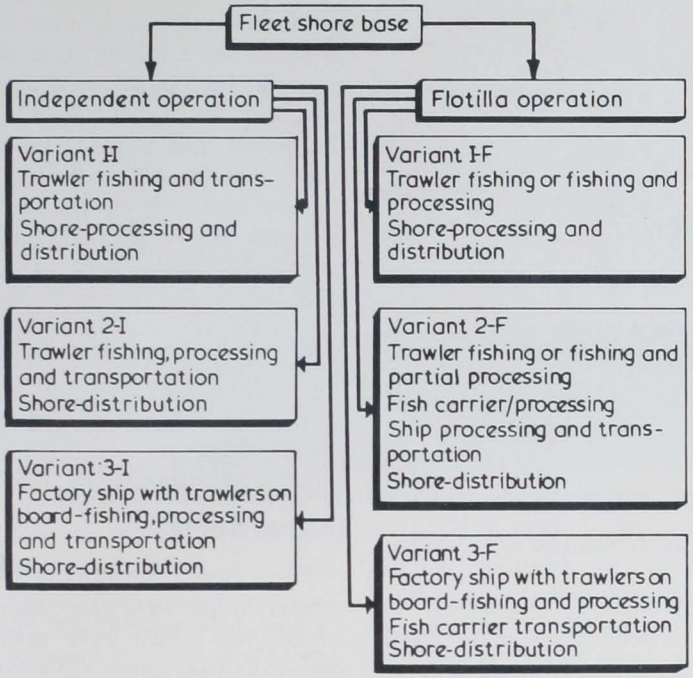

Figure 5.—Basic Soviet methods of organizing fishing operations.

variety of fishing operations today. Generally speaking, methods I-I and I-F are used for near-water fishing (up to 1,000 miles from the base port), methods 2-I and 2-F are used for middlewater fishing (1,000-3,500 miles from base port), and methods 3-I and 3-F for distant-water operations (3,500-5,000 miles from the base port).

THE CATCH

In 1971, the USSR retained its place as the world's third largest fish catcher (as it has since 1967) with a catch totalling 7.3 million metric tons of which 6.4 million metric tons were caught at sea (Table 1). From 1965, the industry has increased its total catch by an average of 356,000 metric tons per annum.

The largest proportion of the catch is of demersal fish species, but pelagic species of all kinds contribute close to 40 percent of the total, (Table 2). The largest contributor to the demersal catch is Alaska pollock, which amounted to some 861.9 thousand metric tons in 1971 and which was caught exclusively in the North Pacific. The largest contributors to the pelagic catch in this year were jack- and horse-mackerel which totalled 435.7 thousand metric tons and were caught principally in the east-central Atlantic (329.6 thousand metric tons).

The largest overall catch (Table 4) is taken from the Atlantic (3,664.8 thousand metric tons in 1971), but the most productive ocean area is the northwest Pacific, which produced a catch of 1,562.1 thousand metric tons in 1971 (Table 3). The most heavily caught species in this area was Alaska pollock at 802.9 thousand metric tons. The most heavily caught pelagic species was herring at 282.4 thousand metric tons and this same area also produces the greater part of the shellfish catch (71.3 thousand metric tons).

In some ocean areas, particularly those in which the Soviet fleet pioneered the exploitation of the fishery, the increase in the catch is quite dramatic (Fig. 6). The catch in the northwest African fishery (East-Central Atlantic) was increased to 789.8 thousand metric tons in 1971.

There has been an even more dramatic increase in the Indian Ocean fishery where the catch has been increased from 47.0 thousand metric tons in 1970 to 242.4 thousand metric tons in 1971. Total catches have, however, fallen in the Mediterranean, southwest and northeast Atlantic, and the northeast and East-Central Pacific.

As far as fisheries for individual species are concerned there was a fall in the USSR's tuna catch in 1971 to 8.3 thousand metric tons which reduced the 1970 catch by 4.3 thousand metric tons. This particular fishery is conducted in the East-Central Atlantic and Indian Oceans. The most productive area in 1971 was the East-Central Atlantic which provided 4.9 thousand metric tons.

The USSR continues to take virtually the whole of the world catch of the deep-water fishery for the grenadier which it pioneered. Conducted in the North Atlantic, the catch has been increased from 15,000 metric tons in 1969 to 82,600 metric tons in 1971.

Of the individual Soviet Republics (Table 5), the RSFSR (Russia) which has both the Sevryba and Dal'ryba Territorial Administrations within its borders, provides the greater share of the overall catch (5,078.2 thousand metric tons in 1971).

By far the greater proportion of the Soviet catch is processed for human consumption (Table 6). The propor-

Table 2. Species composition of Soviet catch, 1969-71.

Species	Catch in thousand metric tons per annum 1969	1970	1971
Freshwater fish and shellfish	388.3	410.9	469.0
Diadromous fish	530.5	689.6	706.2
Pelagic marine fish	1,846.1	1,895.3	1,971.4
Demersal marine fish	3,424.5	3,928.6	3,834.3
Marine shellfish	120.4	115.1	120.6
Miscellaneous fish species	188.6	212.7	235.2

Table 3.—Total Soviet catch by sea area, 1967-1971.

Sea Area	Catch in thousand metric tons per annum 1967	1968	1969	1970	1971
Atlantic, NW & Arctic Sea	624.3	801.4	986.2	812.3	1,021.5
Atlantic, NE	1,118.7	1,416.1	1,469.7	1,565.9	1,377.5
Atlantic, West Central	23.9	6.8	4.8	0.0	11.2
Atlantic, East Central	153.5	318.6	569.7	612.5	789.8
Mediterranean & Black Sea	300.6	284.8	138.7	302.5	263.7
Atlantic, SW	677.7	189.8	92.6	420.6	26.2
Atlantic, SE	251.0	484.5	407.2	422.6	438.6
Indian Ocean, West	38.2	10.3	20.8	47.0	239.8
Indian Ocean, East	—	—	—	—	2.6
Pacific, NW	1,204.2	1,302.2	1,394.0	1,447.6	1,562.1
Pacific, NE	569.1	434.3	642.8	747.6	656.0
Pacific, East Central	—	52.8	25.4	20.2	1.9
Pacific, SW	—	—	—	—	10.4

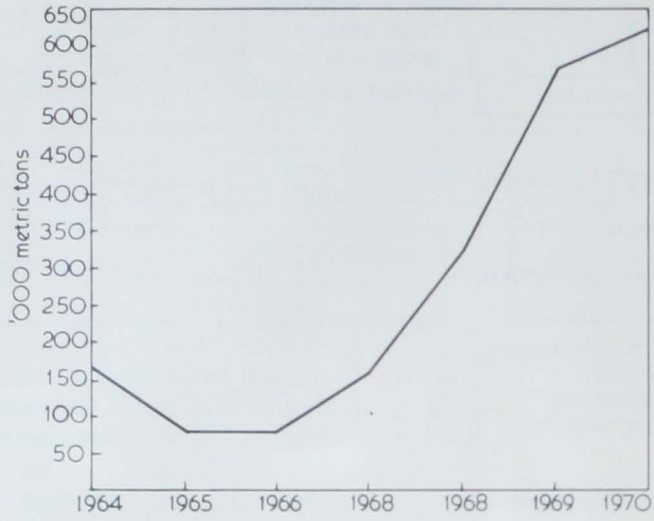

Figure 6.—Soviet catch in the northwest African fishery (in thousands of metric tons), 1964-70.

tion of the catch reduced to fish meal has increased from 237.0 thousand metric tons in 1965 to 427.2 thousand in 1971. Up to 1964 industrial fishing played a minor role and the total amount of industrial fishery products produced in that year was only 43.9 thousand metric tons. At this time, however, many vessels in the fleet were equipped with on-board fish-meal plants to reduce the offal (heads, skins, etc.) from processing operations. As a result, the production of this and associated products increased dramatically. As the size of the fleet and its range of operations increased, greater and greater attention has been paid to the prosecution of an industrial fishery based on underutilized species unsuitable for human consumption. The development of this sector of the industry will be further increased by the recent introduction into the fleet of vessels specifically designed to conduct an industrial fishery.

Table 4.—Total Soviet catch by ocean (in thousand metric tons), 1967-1971.

Year	Atlantic	Pacific	Indian
1967	2,847.9	1,773.3	38.2
1968	3,209.8	1,789.3	10.3
1969	3,526.7	2,062.2	20.8
1970	3,833.1	2,215.4	47.0
1971	3,664.8	2,230.4	242.4

THE FLEET

Today the Soviet fleet comprises a total of 3,741 vessels over 100 grt which constitute more than a quarter of the world's fishing fleet and more than one-half of the total tonnage of this fleet. As Tables 7 and 8 show, the Soviet fleet is made up of 3,247 trawlers and other fishing vessels (around one-fifth of the world total) plus 494 fish carriers and fish factory and mother ships which is more than three-quarters of the total world fleet of such ships.

The fleet as a whole can be subdivided into four basic vessel groups: mother ships; fish processing and carrier ships; factory trawlers; other trawlers and fishing vessel types.

Mother Ships

The first Soviet-built postwar mother ships were the *Andrej Zakharov* class which were built during the seven-year plan 1959-1965. The total series comprised 13 ships, the last of which, the *Aleksandr Kotrysev*, was completed in 1966. The name ship of the series was completed in 1960 and its principal particulars are given in Table 9.

This ship carries 12 motor fishing boats (each weighing from 15 to 30 tons) mounted under davits arranged along both sides. On reaching the grounds these boats are lowered for fishing operations and on completion are carried back to the base port by the mother ship. This class is designed to work not only with its own boats, but also with a flotilla of other fishing vessels, being able to process and store their catch and supply them with provisions, fuel, ice, etc.

The ships' factory plant is designed primarily for canning the catch (princi-

Table 7.—Trawlers and other fishing vessels (number of vessels of gross registered tonnage), 1969-1972.

Tonnage	1969	1970	1971	1972
100-499	1,872	1,850	1,870	1,922
500-599	335	364	644	688
1,000-1,999	15	37	60	63
2,000 and over	322	432	534	574
Total	2,604	2,683	3,108	3,247

Table 8.—Fish carriers and factory ships (number of vessels of gross registered tonnage), 1969-1972.

Tonnage	1969	1970	1971	1972
100-1,999	102	114	135	164
2,000-3,999	56	77	102	106
4,000-5,999	56	69	84	86
6,000-9,999	24	34	38	38
10,000 and over	66	78	96	100
Total	304	372	455	494

Table 5.—Total Soviet marine catch by republics, 1967-71.

Republic	Catch in thousand metric tons per annum				
	1967	1968	1969	1970	1971
Armenia	1.1	1.0	1.1	1.2	0.9
Azerbajyan	65.5	62.2	64.0	73.2	72.6
Byelorossiya	7.3	7.9	6.2	9.0	9.3
Estonia	207.0	262.7	286.3	305.1	337.8
Georgia	61.4	74.2	80.2	85.8	89.1
Kazakh	103.5	102.4	99.1	105.4	100.8
Kirgiz	1.4	1.3	1.3	1.5	1.7
Latvia	358.5	393.7	413.1	441.1	474.4
Lithuania	269.0	288.2	328.1	376.7	378.6
Moldavia	1.8	1.8	2.5	3.2	3.3
Russia	4,199.8	4,335.6	4,635.6	5,147.2	5,078.2
Tadzhik	0.4	0.5	0.6	0.9	1.0
Turkmen	46.7	46.5	50.6	61.7	64.6
Ukraine	441.1	495.5	518.4	629.4	712.6
Uzbek	12.7	8.5	11.3	10.8	11.8

Table 6.—USSR marketed fish production 1966-71.

Product	1966	1967	1968	1969	1970	1971
Fish: fresh, chilled, and frozen	1,766.1	1,878.9	1,951.5	2,307.9	2,557.3	2,449.8
Fish: dried, salted, or smoked	739.5	786.0	797.1	734.8	720.6	658.1
Fish: canned or packaged	485.5	516.6	547.3	617.1	689.9	742.9
Shellfish products	6.3	5.4	5.4	4.8	3.9	3.4
Oil and fats	157.1	175.8	155.7	162.2	167.0	152.1
Meal and animal feedstuffs	264.5	324.8	348.0	374.1	393.1	427.2

Figure 7.—*Pionersk*, a mother ship of the *Korablestroitel Klopotov* type.

pally herring, mackerel, shrimp, and sardine) and for producing fish meal and oil.

The ships are three-decked, single-screw motor ships with the machinery aft and the bridge superstructure forward. The factory, workshops, and accommodation are amidships.

This series provided the basis for a new series named the *Korablestroitel Klopotov* class which started building in 1967. The two classes are outwardly similar and, as can be seen from Table 9, have basically similar principal particulars. The principal improvements in the new class are a 72 percent increase in the production of the canning factory, the ability to produce frozen products, and an increased factory and refrigerated hold volume due to the reduction in the size of the crew. A Polish-built mother ship of this type is shown in Figure 7.

An example of a special purpose mother ship is the *Leninskij Luch*, which is a tuna mother ship built for the Soviet fleet in Japan in 1964. This particular vessel carries six catcher boats and has an endurance of around 126 days. Her principal particulars are:

Length, o.a.	115.0 m	Draft	5.5 m
b.p.	105.0 m	Speed	14 knots
Breadth	17.4 m	Complement	180
Depth	8.8 m		

Her catcher boats have the following particulars:

Length	16.0 m	Draft	1.0 m
Breadth	4.0 m	Displacement	34 tons
Depth	1.6 m	Deadweight	12.6 tons

Soviet fishing operations in the tropical latitudes of the Atlantic, Pacific, and Indian Oceans began in the middle 60's. However, apart from the *Leninskij Luch* none of the existing classes of mother ship were really suitable for tropical operation and a new class was designed specifically for this objective.

The lead ship of the new class, the *Vostok* (Fig. 8) was launched from the Admiralty yard, Leningrad in April 1969 and entered service in 1971. The principal particulars of the vessel are given in Table 9.

The *Vostok* is a four-deck, twin-screw, vessel with its machinery aft and superstructure forward. The ship carries its own fishing fleet of fourteen *Nadezhda* fishing boats (Fig. 16) and the hull incorporates a stern ramp for taking on the catches from the boats. The ship is powered by two geared turbine sets each developing 13,000 hp coupled to fixed-pitch propellers.

In order to make more effective use of the internal volume of the ship, special systems are incorporated for preparing and cleaning empty fuel tanks for the stowage of canned products and fish meal.

The *Vostok* is fitted with a computer for calculating the optimal organization of any particular fishing operation, and an operations/communication center with all-round observation for directing fishing operations. Two helicopters, fitted with fish finding gear, are also carried to aid fish search.

Accommodation and facilities for the crews and factory personnel are of a high standard and include mainly two-berth cabins, a deck sports area, a swimming pool, cinema, library, reading room, classrooms, a club and cultural center, and dining rooms.

During passage to and from the grounds the *Nadezhda* boats are carried seven on each side of the upper deck of the *Vostok* on fixed raised chocks, which stand either side of a pair of rails. The rails are used by self-propelled trolleys (two on each side) which carry keel blocks that can be raised and lowered hydraulically. When the *Nadezhda* boats are to be lowered the trolley runs underneath the boat which is sitting on its chocks in the stowed position. The keel blocks on the trolley are raised under the boat, lifting it free of its towage position. The trolley then transports the

Figure 8.—The mother ship *Vostok*.

Table 9.—Soviet-built factory ships.

Principal Particulars	*Andrey Sakhorov*	*Korablestroitel Klopotov*	*Vostok*	*Brofej Khabaraov*	*Pos'et*
Year of Building	1960	1967	1969	under construction	1972
Length, o.a., m	182.17	—	225	177.6	197.3
Length, b.p., m	150.0	150	—		182.0
Breadth, m	20.0	20	—	24.0	26.4
Depth, m	12.5	12.5	—	14.0	14.5
Draft, m	7.02	7.02	—	8.1	7.7
Displacement, loaded, tons	15,300	15,300	43,400	22,600	28,200
Power, main engine, h.p.	3,800	2×2,000	—	9,000	9,000
Speed, knots	12.5	12.7	19	15	14.5
Capacities, m^3:					
Frozen products	—	1,200	—	4,500	6,000
Preserved products	—	1,430	—	—	—
Canned products	—	1,385	—	—	—
Fish meal	—	400	—	—	—
Overall daily factory throughput:	3,165	4,415	28,000	13,300	15,400
Canning, cans/day	—	288,000	150,000	360,000	—
Preserving, cans/day	—	20,000	—	—	—
Frozen products, tons	—	20	180,000	60	—
Fish meal, tons	—	40	20-25	70	110-120
Deadweight	—	—	21,700	—	—
Endurance, days	—	—	125	75	120
Complement	640	520	600	600	500
Range, n. m.	11,000	—	—	—	—

boat along the deck to a bridge crane (one on each side) which lowers the boat into the water.

The *Nadezhda* boats themselves are stern trawlers with GRP hulls and are able to fish with bottom and mid-water trawls, purse-seines, dip-nets, and electric light. Their principal particulars are:

Length, o.a.	17 m	Power, main engine	600 hp
Beam	5.3 m		
Displacement	69 tons	Crew	5

When fishing is finished the catch is set afloat in either the separable cod-ends, net sacks, or special containers to be picked up by the *Vostok* via its stern ramp.

Another new mother ship design intended for tropical operation is the *Erofej Khabarov* class. This vessel is a single-screw three-deck ship with the machinery aft and superstructure forward. The vessel has a displacement of 22,600 tons dwt, main engine power of 9,000 hp, and a speed of 15 knots. The factory has a daily production capacity of 60 tons of frozen fish, 360,000 × 0.25 kg canned fish products, 22,000 × 5 kg cans and 70 tons of fish meal and oil. Total cargo capacity is 13,500 m^3. The catch from the fishing vessels is taken aboard by both conventional deck handling gear and a fish pump of 50 tons/hr capacity.

Among the most recent introductions into the fleet is the *Pos'et*, a fish-meal mother ship designed for flotilla operation with traditional vessels but particularly with the new all-purpose seiners of the *Rumb* class.

The *Pos'et* is specifically designed to exploit the North Pacific fishery for Alaska pollock which is an ideal raw material for fish meal production. Her principal particulars are as follows:

Length o.a.	197.3 m	Depth	14.5 m
Length b.p.	182.0 m	Draft	7.7 m
Breadth	26.4 m	Speed	14.5 knots

This ship is equipped to take four trawlers alongside at any one time, their catch being taken on board by derricks and fish pumps. The factory is able to receive up to 800 tons of fish daily and to produce 25 tons/day each of frozen fillets, frozen gutted fish, frozen whole fish, edible frozen fish cakes; 5 tons/day each of salted roe and vitamin A (all of these products are packed for marketing); and 12 tons/day of fish oil, in addition to 110-150 tons/day of fish meal.

The factory plant incorporates four fish meal machines with a total capacity of up to 150 tons/day together with cookers and associated fish meal equipment. The fish gutting machine area together with the sorting and processing areas are designed for the complete utilization of up to 600 tons of fish.

The refrigerating plant has a total capacity of 100 tons/day plus a special unit of 4 tons/day capacity for freezing large fish. Accommodation includes a cinema, classrooms, library, and lounge, in addition to cabins.

Fish Carrier/Processing Ships

Table 10 gives the principal particulars of the PTS-type fish carriers which were built in the late 50's and early 60's. These vessels are comparatively small and are used for transporting the catch of vessels operating in near-range grounds.

Other typical short and medium-range fish carriers are the Soviet-built *Petrozavod* and *Zelenodolsk* classes. The *Petrozavod* class are single-screw, single-deck vessels designed for reducing the catch to fish meal and oil and for transporting the same to the base port. All fish handling is mechanized and controlled automatically. The vessels have a displacement of 1,700 tons, main engine power of 1,000 hp, two fish pumps of aggregate capacity 400 m^3/hr, cargo space of 670 m^3, fish oil capacity of 35 m^3, and fish room capacity of 32 m^3. The output of the reducing plant is 60-70 tons/day.

The *Zelenodolsk* class is intended for near-water operation and is designed to freeze and transport the catch taken from fishing vessels. She is, however, capable of conducting a pump-fishery for kilka (sprat). Her principal particulars are:

Displacement	1,150 tons
Main engine, power	800 hp
Freezing rate	15 tons/day
Refrigerated cargo space	360 m^3
Endurance	18 days

Since 1959 the Soviet Union has built five principal classes of long-range refrigerated fish carriers: the *Tavriya* class built from 1959 to 1967, totalling six ships; the *Dalnevostochnij* class built from 1960 to 1963 totalling three ships; the *Sevastopol* class built from 1959 to 1961 totalling six ships; the *Sibir* class built from 1963 to 1967 totalling twenty ships; and the *Yantarnij* class built from 1966.

The principal particulars of these classes are given in Table 11. Of course, in addition to these vessels there are a very large number of fish carriers/processors built outside the USSR, like the *Veter* class (Fig. 9). These particular vessels, of 135 m length o.a. and 4,700 grt, were built in West Germany in 1964.

The *Tavriya* class are refrigerated freezer/fish carriers designed to receive, freeze, and transport processed or whole fish caught by trawlers operating in the northern and southern Atlantic and Pacific oceans. They are single-screw ships with machinery and superstructure aft.

The trawlers' catch is taken aboard by six 3-ton capacity derricks (two

Figure 9.—*Tajfun*, a *Veter* class refrigerated fish carrier.

to each hold) and by one 10-ton capacity heavy lift gear. Each hold is fitted with a fish elevator of up to 40 tons/hr capacity and internal fish conveyors to speed up fish handling.

The main machinery comprises four DC diesel generators each of 760 kW at 470V/740 rpm and a twin-armature electric propulsion motor.

The *Sevastopol* is a larger ship with a deckhouse and machinery aft and a superstructure amidships. The hull is strengthened for operation in ice and the ship is intended for receiving, storing, and transporting whale meat or fish. Cargo space comprises four holds and four 'tween decks arranged forward and aft of the central superstructure.

The main machinery comprises four diesel generators with an output of 1,250 kW at 810 rpm acting on a single shaft. The rated power of the main generators is 1,375 kW at 500V/810 rpm and the rated power of the twin-armature DC electric propulsion motor is 2 × 3,500 hp.

The *Yantarnij* class (Fig. 10) is an improved *Sevastopol* design and the two classes have the same principal particulars. The main improvements are in crew accommodation and cargo-handling, the former by better air-conditioning, and the latter by improved capacity freezers, automation, and so on.

This group of five Soviet-built classes has now been increased by the lead ship of a new class 50 LET SSSR which was built in 1972. This vessel is the largest fish carrier/processor vessel in the world and her principal particulars are as follows:

Length o.a.	172.1 m
Length b.p.	160.0 m
Breadth	23.0 m
Depth	13.7 m
Draft	8.1 m
Displacement:	
Empty	8,300 tons
Loaded	19,630 tons
Deadweight	11,330 tons
Capacity:	
Frozen fish	8,230 tons
Power, max.	11,600 hp
Speed, trials	19 knots
Range	25,000 miles
Capacities:	
Refrigerated holds	16,200 m^3
Fuel	7,100 m^3
Water	900 m^3

Factory Trawlers

Soviet factory trawlers comprise a wide variety of types built in a number of countries, notably Poland, East Germany, Denmark, the Netherlands, and France.

The first factory trawlers in the Soviet fleet were the large stern freezer trawlers (Soviet type designation BMRT). Three classes of this type of factory trawler are in operation in the fleet but only one of them, the *Majakovskij*, was built in the USSR. The other two classes, which are basically similar, were built in Poland and East Germany. The lead ship of the East German class, *Atlantik*, is shown in Figure 11.

The *Majakovskij* class started building in 1957 and the name ship of the series began operation in the summer of 1958. Well over a hundred of these vessels were built during the first ten years of the series' operation. In all, there were 240 *Mayakovskij*-class BMRT's in the fleet in 1972.

The principal particulars of the *Majakovskij* class are:

Length o.a.	84.7 m
Length b.p.	75.0 m
Breadth, mld.	14.0 m
Depth, to main deck	10.0 m
Draft, mean on setting out to the grounds (no catch, full stores and packing materials)	5.54 m
Draft, mean on completion of operations (100% fish products, 25% stores)	5.52 m
Displacement, on setting out to the grounds	3,658 tons
Displacement, on completion of operations	3,638 tons
Deadweight, on setting out to the grounds	1,301 tons
Hold capacities:	
No. 1 (Refrigerated)	290 m^3
No. 2 (Refrigerated)	630 m^3
No. 3 (Refrigerated)	410 m^3
No. 4 (Fish meal)	170 m^3
No. 5 (Canned products)	124 m^3
Tank capacities:	
Fish oil	37 m^3
Diesel fuel	565 m^3
Boiler fuel	263 m^3
Fresh water	285 m^3
Gross tonnage	2,450 reg. tons
Net tonnage	960 reg. tons
Power, main engine	2,000 hp at 250 rpm
Speed (at displacement 3,658 tons)	13 knots
Range	16,000-17,000 nautical miles
Endurance	80 days
Complement	104

The main engine is a 8DR-43/61B1 diesel engine manufactured by

Table 10.—PTS-type fish carriers.

Principal Particulars	PTS-33	PTS-73	PTS-1	PTS-14	PTS-150	PTS-150B	PTS-89
Country of building	USSR	USSR	USSR	USSR	USSR	USSR	USSR
Year of building	1957	1957	1960	1961	1963	1963	1964
Length, o.a., m	26.7	27.10	27.21	27.3	27.10	25.05	27.10
Breadth, extreme, m	5.5	5.5	5.5	5.5	5.65	5.5	5.5
Depth, m	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Draft, m	1.89	1.8	1.8	2.16	1.87	1.87	2.0
Gross tonnage, reg. tons	107	100	107	107	100	100	100
Net tonnage, reg. tons	35	31	40	40	40	40	40
Deadweight, tons	27	42	54	54	59	59	50
No. of non-refrigerated cargo holds	None	2	2	None	None	2	None
Cubic capacity, m^3	—	32;34	21;20	—	—	32;34	—
No. of refrigerated cargo holds	2	None	None	2	2	None	2
Cubic capacity, m^3	32;34	—	—	32;34	—	—	2 × 33
Engine type and number	1 × Diesel	1 × Diesel	1 × Diesel	1 × Diesel	1 × Diesel	1 × Diesel	1 × Diesel
Speed, knots	8	8.9	8.8	8.8	8.9	8.9	8.9
Refrigerant	Freon-12	None	None	Freon-12	Freon-12	None	Freon-12
No. of Compressors	1	—	—	1	1	—	1
Temperature in refrigerated holds, °C	2×(−2°C)	—	—	2×(−2°C)	2×(−2°C)	—	2×(−2°C)

Figure 10.—A *Yantarnij* class fish processing/carrier ship.

Table 11.—Soviet series-built refrigerated fish carriers.

Principal Particulars	*Tavriya*	*Dalnevostochnij*	*Sevastopol*	*Victor Vasnetsov Sibir* Class
Length, o.a., m	99.35	99.35	130.9	130.0
Breadth, extreme m	14.0	14.03	16.5	16.83
Depth, m	7.23	7.23	9.5	9.54
Draft, m	5.65	5.74	6.6	7.22
Gross tonnage, reg. tons	3,230	3,230	5,524	6,133
Net tonnage, reg. tons	1,130	1,130	2,448	2,947
Deadweight, tons	2,544	2,638	4,230	5,285
Hold capacities, m^3				
No. 1	300	890	850	1,752
No. 2	640	1,380	1,460	1,836
No. 3	680	1,000	1,460	1,845
No. 4	NONE	NONE	1,608	1,780
Temp. of above °C	3×(−18°C)	3×(−18°C)	3×(−18°C)	—
Refrigerant	Ammonia	Ammonia	Ammonia	Ammonia
Speed, knots	13.5	13.6	16.6	16.5
Endurance, days	60	—	40	60
Range, n. m.	8,000	—	8,000	10,000
Complement	82	—	—	—

the Russkij Dizel Factory. The electric power plant comprises four three-phase, 230 V, AC Diesel generators each developing 224 kW. The diesels have a rated output of 300 hp at 750 rpm.

The factory area comprises a processing section, an oil production section, a canning section, and a fish meal section. The processing section is fitted with two twin-duct fish freezing rooms of -35°C and a packing room. Two automated gutting lines produce fillets of cod, and a third line produces headed and gutted fish. This section can produce up to 20 tons of frozen fillets and up to 10 tons of frozen, headed fish daily.

The oil production section is fitted with two boilers for rendering down cod livers. The canning section is fitted with two autoclaves and a canning machine. The fish meal production section has two single-drum units which can handle up to 20 tons of fish offal daily.

The trawler is fitted with an ammonia refrigerating plant which provides a temperature of -18°C in the fish rooms.

Another group of factory trawlers is of the Soviet type designation RTM. This group comprises two classes: the *Sever* built in the Soviet Union in 1966, and the *Tropik* built in East Germany from 1962 (Figs. 12 and 13).

The *Sever* is designed as a freezer/wet-fish factory trawler and is designed for operation in the Barents Sea and North Atlantic using bottom trawl nets for catching cod and redfish and midwater trawls for herring. Her principal particulars are:

Length o.a.	71.0 m
Length b.p.	64.0 m
Breadth	13.1 m
Depth, to upper deck	8.2 m
Draft, at design waterline	4.8 m
Displacement, lightweight	1,780 tons
Displacement, loaded	2,540 tons
Gross tonnage	2,025 reg.tons
Net tonnage	758 reg.tons
Cargo Capacities:	
Refrigerated	807 m^3
Non-refrigerated	133 m^3
Overall	940 m^3
Speed	13.3 knots
Range	11,000 nauticalmiles
Complement	51

The hull is all-welded, transversely framed, and the bow is strengthened for operation in ice.

A unified power plant provides all the ship's needs and comprises three automated AC diesel generators each developing 700 kW at 400V/750 rpm. Propulsion is provided by a synchronous electric propulsion motor which drives a ducted c.p. propeller. At anchor, electricity is supplied by a standby diesel generator with a rated output of 100 kW. Steam requirements are met by a 2.5 tons/hr auxiliary watertube boiler and three 250 kg/hr waste-heat boilers.

The ammonia refrigerating plant is able to freeze 20 tons/day of fish to -23°C, produce 5.5 tons/day flake ice and maintain a temperature of

Figure 11.—*Atlantik*, below, an *Atlantik* class BMRT.

Figure 12.—A *Tropik* class RTM transferring its catch to a refrigerated fish carrier.

-25°C in a frozen products hold, a temperature of -2°C to -25°C in the refrigerated hold, and a temperature of -2°C in the canned products hold. Provisions stores are cooled by a Freon plant.

The trawl, which has an overall pull on the warp drums of 12 tons takes in the warps at a speed of 60 m/min. The stern ramp is 3.6 m wide and is closed by a door (hinged at the lower edge) when not in use.

Some other types and classes are:

The *Skryplev* class (Soviet type designation TPR) built in Denmark in the early 60's with a length, o.a., of 102.4 m and of 4,700 grt, intended for operations in the North Atlantic (Fig. 14).

The *Mintaj* class (Soviet type designation BMMRT), building in the USSR and intended for bottom and midwater trawling in the Japan and Okhotsk Seas. This vessel is a twin-deck, single-screw stern trawler and her principal particulars are as follows:

Displacement, loaded	3,660 tons
Power, main engine	2,000 hp
Speed	12.5 knots
Daily output:	
Frozen fish	30 tons
Fish meal and oil	70 tons
Cod-liver oil	9.6 tons
Caviar	560 kg
Cargo space	1,330 m^3
Endurance	60 days

The *Altaj* class (Soviet type designation PR). This vessel is a combination mother ship and factory trawler being designed to receive the catch of accompanying vessels in addition to carrying out trawling via her own stern ramp. The *Altaj* is propelled by a diesel-electric installation and her principal particulars are:

Displacement	5,671 tons
Deadweight	1,520 tons
Power, main engine	5,000 hp
Speed	14 knots
Daily output:	
Frozen fish	50 tons
Fish meal	30-35 tons
Refrigerated cargo space	3,100 m^3
Capacity, fish meal holds	350 m^3
Range	10,000 nautical miles

Figure 13.—*Vololas* (right, middle), a *Tropik* class RTM.

Figure 14.—*Gol'fstrim* (right, bottom), a *Skryplev* class TPR.

Figure 15.—Two BKRT's (large stern canning trawlers).

The *Nataliya Kovshova* class (Soviet type designation BKRT) (Fig. 15). These large stern trawling, canning factory trawlers were built in France in 1966 and have the following principal particulars:

Length o.a.	127.7 m
Length b.p.	115.0 m
Breadth	19.0 m
Depth	12.0 m
Deadweight	4,410
Displacement	9,840
Draft, loaded	6.9 m
Speed	13.7 knots
Endurance	120 days
Complement	238

The *Meridian* class, which has only very recently been completed, is an improved design of the *Majakovskij* BMRT. Its principal particulars are:

Length o.a.	103.1 m
Length b.p.	94.0 m
Breadth	16.0 m
Depth	10.2 m
Draft	5.0 m
Displacement	5,600 tons
Deadweight	1,980 tons
Speed	16 knots

The *Gorizont* is a new design of stern factory/freezer trawler at present under construction in the USSR. Her principal particulars are:

Length o.a.	112.8 m
Length b.p.	100 m
Breadth	17.3 m
Depth	11.0 m
Displacement	7,950 tons
Draft	6.52 m
Deadweight	3,050 tons
Range	4-5,000 nautical miles
Endurance	100 days
Complement	90

Other Vessel Types

Naturally enough, this group comprises the largest and most varied part of the fleet (Fig. 16) and it is perhaps sensible to divide them into two groups: those built prior to the introduction of stern trawlers (the middle 60's) and those built after it.

Vessels Entering The Fleet Prior to 1965

The principal trawler types of the early postwar years were the small and standard type trawlers (Soviet type designations MRT and RT respectively), and, although no longer typical, these vessels are still in use today.

The MRT's (Table 12) are used exclusively for coastal fishing (20-100 miles from the coast). They are single-deck, two-masted drifters and are divided into two groups, the STB-80 (steel hulls) and the TRB MRT (wooden or composite hulls). The improved version of this type is the small refrigerated trawler (Soviet type-designation MRTR), whose principal particulars are also given in Table 12 (Fig. 16).

The RT trawlers are larger side trawlers powered either by steam engines of 650-1,000 hp or diesel engines of 800-1,100 hp. Virtually all of the steam-powered vessels have now been phased out. The RT's are drifter/trawlers able to stow the catch either wet or salted and to produce semiprocessed fish meal and fish oil. Some were also able to can part of the catch. This trawler type can be roughly divided into three main groups: those built from 1947 in Finland, Sweden, and Poland; those built from 1952 in the Soviet Union; those built from 1956 to 1958, the Belgian-built *Kreml* class, and the British-built *Pioneer* class.

The *Pioneer* class RT's (Fig. 17), which were built by Brooke Marine, were a highly successful design which has been extensively used by the Soviet Union for later vessels like, for example, the later Soviet built RTR's (refrigerated standard trawlers) as shown in Figure 18. The principal particulars of a number of RT trawlers are given in Table 13.

Other trawler types built in the late 50's and early 60's were the NIS, RS, and SRS trawlers. The principal particulars of these types are given in Tables 14, 15, and 16.

The first Soviet-built medium trawler (Soviet type-designation SRT) was the *Korablestroitel* built in Murmansk in 1947. This vessel was a side drifter/trawler designed for catching herring and bottom fish using drift and trawl nets. Provision was made for the salt or wet stowage of the catch. Series built SRT's, basically similar to the *Korablestroitel*, were ordered from East Germany in 1949 (Table 17).

The first series of SRT's built in the Soviet Union entered service in 1954. These were the *Gornostaj* class (Table 17) and were single-deck, single-screw side trawlers with all-welded hulls, aft superstructure, and non-refrigerated holds. They fish for herring and bottom fish, storing them either heavily salted or in ice. In 1965 construction was begun on a large series of SRT's, the *Ajdar* class. These vessels are basically the same as the *Gornostag* class, differing only in some items of equipment. None of these vessels is refrigerated and they are all steel-

Table 12.—Type MRT trawlers.

Principal Particulars	MRT-17	MRT-1026	MRTR-12
Country of building	Germany	Sweden	USSR
Year of building	1943	1950	1967
Length, o.a., m	23.0	25.25	31.7
Breadth, extreme m	6.36	6.4	7.2
Depth, m	3.10	3.4	3.5
Draft, m	2.35	1.9	3.1
Gross tonnage, reg. tons	114	113	206
Net tonnage, reg. tons	30	25	63
Deadweight, tons	46	40	75
No. nonrefrigerated cargo holds	1	1	None
Cubic capacity, m^3	48	65	
No. refrigerated cargo holds	None	None	1
Cubic capacity, m^3	"	"	100
Speed, knots	—	8.5	9.2
Engine type	Diesel	Diesel	Diesel
Refrigerant	None	None	Freon-12
Temp. in refrigerated holds°C	"	"	-4°C

Figure 16.—A group of Soviet fishing vessels. On the extreme left is a *Nadeszhda* fishing boat of the type carried by the *Vostok*. The SRTM *Zheleznyakov* is on the extreme right. The vessel in the center *L-20* is probably an MRTR-class.

hulled, two-masted, drifter/trawlers, with their machinery aft.

The first refrigerated medium trawlers in the Soviet Fleet (Soviet type designation SRTR) were the *Bologoe* class built in the Soviet Union in 1957. These side trawlers have basically the same principal particulars as the SRT trawlers (Table 18) but incorporate a Freon cooling plant which provides a fish room temperature of -2°C. The construction of *Bologoe* class trawlers continued up to 1963 and around 200 of them were built. Three ships of this class were the first Soviet trawlers to be fitted with c.p. propellers and the last vessel of the series, the *Progress*, was fitted with the first Soviet-built gas turbine/free piston gas generator propulsion installation. Some of these trawlers have been modernized by fitting equipment for purse-seine fishing and by installing bow thrusters. Another class of SRTR of this period, the *Okean* class, incorporated an ammonia refrigerating plant which provided a fish room temperature of from -2° to -4°C.

However the growing requirement to fish farther and farther away from the Soviet coasts accelerated the development of the medium freezer trawler (Soviet type-designation SRTM). The first two series of this trawler type, the *Mayak* and the *Pioneer* classes, were built in 1963. These new side trawlers were designed to work either independently or as part of a flotilla. They are able to be used for catching a wide variety of bottom and pelagic fish and herring, freezing and packing their catch in standard cardboard boxes, using drift or trawl nets from the starboard side. They are powered by a diesel engine developing 800 hp and driving a c.p. propeller.

These were not, however, the only freezer vessels built around this time. The building of freezer tuna fishing boats was begun, as part of the seven year plan, in 1962. These boats have basically the same principal particulars as the *Pioneer* but are designed to fish for tuna using either a longline or troll gear in the near equatorial regions of the Pacific.

Fishing with the longline is carried out from both sides in the central area of the ship. The troll gear is intended for use during fish search operations. The captured tuna are killed with a humane killer and brought on deck, via a side port, by a boom crane with an electric winch. Here they are gutted and passed through to the freeze room where they are frozen to -18°C in blocks by four box-type blast freezers each with a capacity of 1 ton/day. Almost all the production processes are mechanized.

The processing plant can freeze 4 tons of fish per day. If the catch is greater than this, the excess is stored in flake ice and in a 2-ton capacity bunker. These boats are also able to deep-freeze high-vitamin content shark liver.

The refrigerating plant which supplies the freezing plant, refrigerated holds, ice-generator, and domestic air-conditioning system, consists of two ammonia two-stage compressors. The ship's storeroom is cooled by a Freon refrigeration plant.

The principal particulars of these vessels are:

Length o.a.	54.2 m
Breadth b.a.	9.3 m
Depth, main deck	4.7 m
Displacement, loaded	930 tons
Draft, mean	3.66 m
Deadweight	322.5 tons
Power, main engine	900 hp at 375 rpm
Speed	11 knots
Capacities:	
Fuel	222.0 tons
Lubricating oil	7.5 tons
Fresh water	52.3 t*
Provisions	for 50 days

*Water requirement (calculated at 50-l per man per day) is provided by a desalination plant.

The USSR Register of Ships for 1964-65 lists some 816 SRT's (155

Table 13.—RT-trawlers.

Principal Particulars	RT-56	RT-61	RT-168	RT-180	RT-200	RT-212
Country of building	Finland	Sweden	Sweden	Poland	Gt. Britian	Gt. Britain
Year of building	1951	1952	1956	1954	1955	1957
Length, o.a., m	60.6	63.0	63.0	59.23	57.76	57.76
Breadth, extreme, m	9.02	9.03	9.3	9.0	9.75	9.75
Depth, m	4.85	4.85	4.85	4.9	5.03	5.03
Draft, m	4.19	4.29	4.29	4.33	4.52	4.52
Gross tonnage, reg. tons	645	744	689	658	684	685
Net tonnage, reg. tons	256	263	226	280	226	223
Deadweight, tons	410	415	455	455	335	365
No. of nonrefrigerated cargo holds	2	2	2	None	None	None
Cubic capacity, m^3	267 111	219 141	259 155	—	—	—
No. of refrigerated cargo holds	None	None	None	2	2	2
Cubic capacity, m^3	—	—	—	233 124	200 222	200 222
Type of propulsion	Steam	Steam	Steam	Steam	Steam	Diesel
Speed, knots	11	11	10.5	12	12.8	12.8
Refrigerant	—	—	—	Freon-12	Freon-12	Freon-12
No. of compressors	—	—	—	1	1	1
Temperature in refrigerated holds, °C	—	—	—	2 × (-1°C)	2 × (-1°C)	2 × (-1°C)

Figure 17.—The *Pioneer* RT class.

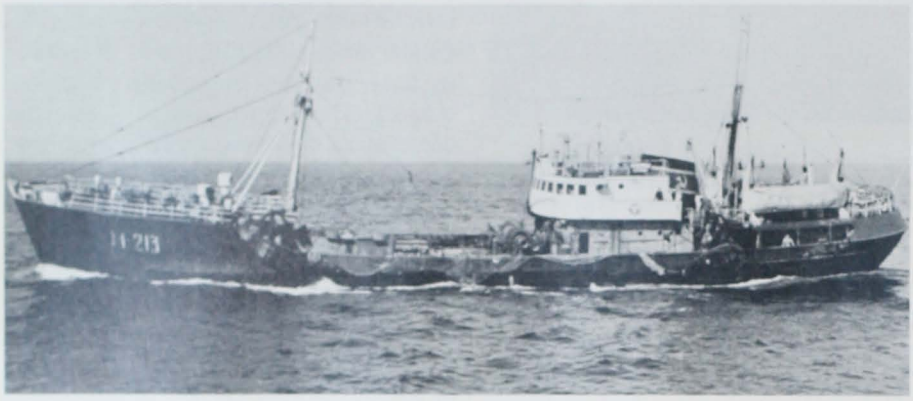

Figure 18.—*Stavrida*, a *Pioneer* class SRTM.

built in the Soviet Union, 660 built in East Germany, and 1 built in West Germany), 23 SRTM's (all built in the USSR), and 169 SRTR's (54 built in the USSR and 117 built in East Germany).

The first new Soviet-built medium trawlers to appear after 1966 were the *Olga* class SRTM (Table 19) and the *Sargassa* class SRTR (Table 18). The principal improvement on these vessels is the incorporation of gear required for fishing with a large purse-seine net (800 × 120 m on the name ship of the series and 1200 × 200 m on the remaining trawlers in the series). The net handling area is also extended. Some of the *Mayak* and *Pioneer* class SRTM's had been converted to purse-seine before this.

Table 14.—Type N1S-trawlers.

Principal Particulars	N1S-5
Country of building	USSR
Year of building	1952
Length, o.a., m	39.49
Breadth, extreme m	7.40
Depth, m	3.60
Draft, m	2.98
Gross tonnage, reg. tons	335
Net tonnage, reg. tons	127
Deadweight, tons	174
No. of nonrefrigerated cargo holds	1
Cubic capacity, m³	103
No. of refrigerated cargo holds	None
Cubic capacity, m³	—
Speed	8.0
Engine type	Diesel
Type of refrigerating plant	None
Refrigerant	—
No. of compressors	—
Temp. in refrigerated holds, °C	—

Vessels Entering The Fleet After 1965

Up to 1967 all Soviet medium trawlers had been side trawlers. The first medium stern trawler in the Soviet fleet was the SRTM *Zheleznyakov* (Table 20; Fig. 16) which was completed in 1967. The service performance of this vessel was carefully studied and a series of medium stern freezer trawlers were designed on the basis of the analysis of the performance and operation of the *Zheleznyakov*.

The first trawler of the new series was the SRTM *Zheleznyj Potok* (Table 20) which was built in 1968. Trawlers of this class are intended for operation in the temperate and tropical zones of the Atlantic, Pacific, and Indian Oceans and are equipped to fish with bottom and midwater trawl nets and purse-seine nets. They are able to operate independently or as part of an expeditionary fleet and to freeze and pack their own catch. They are also capable of operating as freezer/wet fish trawlers by stowing their most recent catch in flake ice.

In trawl fishing the catch is taken from the cod-end and placed in fish boxes arranged along the port side of the fish deck. A conveyor moves the fish to a four-section preparatory cooling bunker where the catch is chilled with flake ice. The fish are then passed automatically to the packing benches in the freeze room where they are packed in batches and moved on to the blast air freezer. The blocks of fish are frozen to a temperature of -18°C, glazed, and packed in cardboard boxes.

In purse-seine fishing the catch is placed in a fish box on the main deck between the superstructure and the trawl winch, from which it can be sent for freezing (in the freeze room) or to the fish-rooms for storage as wet fish.

The propulsion plant, aft, is a 8NVD48 AU diesel driving a c.p. propeller. The vessel's electricity requirement is supplied by four diesel generators with a rated output of 100kW. The steam requirement is met by an automatic auxiliary boiler of 0.5 tons/hr capacity.

The hull is strengthened for operation in ice and all accommodation, consisting of two- and one-berth cabins, is air-conditioned and located in the superstructure.

An improved version of the *Zheleznyj Potok* is now being produced (Table 20), which has increased propulsive power, an improved trawl winch, and is able to fish with a purse-seine net of 1200 × 200 m. The refrigerating and freezing plant capacities are also increased.

In recognition of the growing importance of seine fishing, the building of the name ship of a new series of SRTR's designed specifically as seine-trawlers was begun in 1969. This ship is the *Rumb* and is intended for expeditionary fleet operation. The principal particulars of the *Rumb* are:

Table 15.—RS-type trawlers.

Principal Particulars	RS-1	RS-854	RS-5217	RS-5308
Country of building	USSR	USSR	East Germany	East Germany
Year of building	1964	1958	1953	1958
Length, o.a., m	33.38	33.5	29.35	29.35
Breadth, extreme m	6.69	6.6	6.2	6.2
Depth, m	3.5	3.5	3.0	3.0
Draft, m	2.92	2.5	2.6	2.7
Gross tonnage, reg. tons	158	158	119	119
Net tonnage, reg. tons	39	40	32	32
Deadweight, tons	85	90	68	68
No. of nonrefrigerated cargo holds	2	1	1	1
Cubic capacity, m^3	90.13	90	66	66
No. of refrigerated cargo holds	None	None	None	None
Cubic capacity, m^3	—	—	—	—
Engine type	Diesel	Diesel	Diesel	—
Speed, knots	8.0	9.0	9.0	10
Refrigerant	None	None	None	None
No. of compressors	—	—	—	—
Temp. in refrigerated holds, °C	—	—	—	—

Table 16.—SRS-trawler.

Principal Particulars	SRS-300
Country of building	USSR
Year of building	1962
Length, o.a., m	27.10
Breadth, extreme m	5.5
Depth, m	2.5
Draft, m	1.74
Gross tonnage, reg. tons	100
Net tonnage, reg. tons	31
Deadweight, tons	42
No. of nonrefrigerated cargo holds	1
Cubic capacity, m^3	29
No. of refrigerated cargo holds	None
Cubic capacity, m^3	—
Speed	8.9
Engine type	Diesel
Refrigerant	None
No. of compressors	—
Temp. in refrigerated holds, °C	—

Table 17.—Medium trawlers (Soviet type-designation SRT).

	Ship and place of building				
	East Germany			USSR	
Principal Particulars	SRT-300 without poop	SRT-300	SRT-400	*Korablestroitel*	*Gernostaj* and *Ajdar*
Length, m	38.5	38.5	39.15	38.64	39.15
Breadth, m	7.2	7.3	7.3	7.4	7.3
Depth, to main deck, m	3.5	3.5	3.48	3.85	3.49
Draft, loaded, m	3.57	3.57	3.12	3.15	3.0
Displacement, loaded, tons	436	436	452	467	432
Deadweight, tons	187	140	145	—	141
Propulsion machinery	Diesel with fixed-pitch propeller				
Main engine, hp	300 at 360 rpm	300 at 360 rpm	400 at 275 rpm	400 at 400 rpm	300 at 360 rpm
Supplies,					
fuel, tons	38	46	54	—	54
water, tons	24	31	28	—	28
Speed, knots	9-10	9.5	10.3	9.2	9.6
Endurance, days	25	25	25	25	25
Crew	26	22	25	29	25

Length o.a.	49.2 m
Length b.p.	46.2 m
Breadth	10.5 m
Depth, main deck	6.0 m
Displacement, max	1,130 tons
Draft, at above	4.24 m
Capacity, refrigerated holds	318 m^3
Power, main engine (geared diesel with c.p. propeller)	1,320 hp at 428 rpm
Propeller rpm	250
Power, electric plant;	
Diesel generator	450 kW
Shaft generator	300 kW
Capacity, refrigerating plant	110,000 k cal/hr
Fish room temperature	-5°C
Fishing gear	stern trawl, and purse-seine measuring 1,300 × 300 m
Pull, trawl winch	10.0 tons
Speed, taking in trawl warps	100 m/min
Endurance	35 days
Complement	23
Range	9,000 miles

Later ships in this series will have their speed increased to 19 knots.

Catamaran Trawlers

A unique vessel which does not fit into the vessel type classification used hitherto is the twin-hulled trawler/seiner *Experiment*. This vessel, which was constructed at Kaliningrad in 1968, was a cooperative design venture by the Central Design Bureau of the Ministry in Moscow, the Kaliningrad Technical Institute for Fisheries and Fishing, and the Design Bureau of ATLANTniro. As its name implies, it is an experimental vessel and is the first of a program of three or four twin-hulled vessels being undertaken to evaluate their operational advantages over single-hulled ships.

It was decided, as the optimal solution to the design problem, to use modified conventional SRT 300 hulls (Table 17) and to connect them by a rigid cross-structure. The depth of the cross-structure was selected to reduce wave impacts. The upper edge of the cross-structure is at deck level and it is carried to a depth of 1,200 mm at ship side and 700 mm at the center.

The DTS *Experiment* (Fig. 19) is a twin-hulled, single-deck vessel with a rounded stem and stern ramp in each hull. Each hull is subdivided by six transverse watertight bulkheads. The aft sections of the cross-structure are used as fuel tanks.

All accommodation, service, and public compartments are grouped in the two-tier superstructure above the upper deck. A centralized wheelhouse, giving all-around observation, is located on top of the after part of the superstructure. The accommodation consists entirely of one- and two-berth cabins, each of which is electrically heated and fitted with washbasins and hot and cold water. The galley is all-electric and there are separate messes for officers and crew. Laboratories for strength testing and seakeeping investigations are also incorporated.

The DTS is fitted with two individually controlled streamlined rudders with electrically powered steering gear. The main machinery is automated with controls in the wheelhouse and on the bridge wings. The propulsion machinery consists of two diesel engines (one in each hull) each developing 300 hp at 360 rpm directly coupled to its propeller. The electric power plant consists of two diesel generators, each of 100 kW in the starboard engine room and one diesel generator of 57 kW in the port engineroom all at 220 V DC.

Table 18.—Soviet-built SRTR's.

Principal Particulars	*Bologoe*	*Sargassa*
Length, o.a., m	43.6	54.2
Length, b.p., m	39.6	48.7
Breadth, m	7.6	9.3
Depth, main deck, m	3.8	4.7
Displacement, max. tons	550.0	1,000
Draft at above, m	2.96	3.82
Capacity refrigerated fish rooms, m^3	215.0	420
Type of propulsion	Diesel with fixed or c.p. propeller	Diesel with c.p. propeller
Power main engine, hp	400 hp at 275 rpm	800 hp at 300 rpm
Overall power electric plant, kW	87.0	300
Trawl gear	side trawl and drift nets	Side trawl, purse-seine
Fish room temperature °C	−2	−5
Pull, trawl winch, tons	4.0	6/8
Speed of taking in the trawl warps, m/min	60	60/45
Endurance, days	30	30
Speed, knots	10.4	11.7
Complement	26	29
Range, miles	7,500	9,000
Area of operation	---------- Unlimited ----------	
Capacity, refrigerating plant k cal/hr	—	200,000

Table 19.—Soviet-built SRTM's (side trawling).

Principal Particulars	*Mayak*	*Pioneer*	*Ol'ga*
Length, o.a., m	54.2	54.2	45.2
Length, b.p., m	48.7	48.7	48.7
Breadth, m	9.3	9.3	9.3
Depth, main deck, m	4.7	4.7	4.7
Displacement, max. tons	935	900	975
Draft at above, m	3.69	3.57	3.76
Capacity refrigerated fish room, m^3	350	290	290
Power main engine (Diesel with c.p. propeller) hp	800 to 300 rpm	800 at 300 rpm	800 at 300 rpm
Overall power electric plant, kW	300	264	300
Refrigerating plant capacity kcal/hr	76,000	76,000	76,000
Fish room temperature, °C	−18	−18	−18
Freezing plant capacity, tons/day	6	12	12
Gear	Drift net	tuna, longline purse-seine	
Type of pull of trawl winch, (tons)	—	LETr-3(6/8)	—
Speed of taking in the trawl warps m/min	60/45	60/45	60/45
Endurance, days	30	30	30
Speed	12	12	11.7
Complement	29	29	29
Range, n. miles	9,000	9,000	9,000
Area of operation	---------- Unlimited ----------		

The principal particulars of the *Experiment* are:

Length o.a.	39.7 m
Length waterline	37.4 m
Beam o.a.	19.08 m
one hull	7.3 m
Depth	4.08 m
Draft, load line	3.0 m
Displacement, at above	950 tons (approx)
C_B, one hull	0.56
Power, main engine	2 × 300 hp
Speed, in still water	9.0 knots
Endurance	27 days
Complement	32
Extra accommodation for scientific personnel	6 berths
Capacity, cargo holds	450 m^3 (total)

The vessel's steam requirement is met by an automated boiler with a capacity of 0.5 ton/hr located in the port engine room.

The design provides for fishing by bottom and midwater trawls using a constant trawling system with a time lag of 3 min between hauling in the first trawl and shooting the second, purse-seine (changing from trawling to purse-seining does not take more than one hour). The vessel is fitted with a trawl warp winch, two bridle winches, a special winch for traversing the hanging blocks, and an arrangement of roller fairleads for the warps. The arrangement for purse-seine fishing consists of two power blocks at the crosstrees of the duopod mast.

Model tests were conducted before construction was begun, using a scale 1:15 model in a test tank, and a self-propelled 1:85 scale model (with a man on board) in open water. Rolling and pitching amplitudes and the accelerations and dynamic pressures acting on the cross structure due to wave impacts were measured on the large-scale model.

The main trials of the *Experiment* were conducted in the winter months in the Baltic and North Atlantic. The trial voyage lasted 59 days, of which 26 were spent in storm conditions, and the vessel operated in sea conditions of force 10 or greater on three occasions. Investigations carried out during trials showed that the cross-structure provides sufficient strength to be used in any seas or sea state.

Since trials the *Experiment* has completed two transatlantic fishing expeditions and, despite the fact that it was operating experimentally, its catch significantly exceeded that of neighboring trawlers working in the vicinity. No difficulty was experienced in mooring alongside factory/depot ships at sea.

From experience gained in the operation of the *Experiment*, the catamaran hull-form is found to be particularly suitable for a number of different types of fishing vessels and fishing methods. Its principal advantages are a high degree of stability under way, low rolling amplitudes, minimal deck wetness, high maneuverability, increased working deck space (Table 21), improved accommodation and working conditions, and an ability to fish from more than one stern ramp.

Table 20.—Soviet-built SRTM's (stern trawling).

Principal Particulars	*Zhelezhyakov*	*Zheleznij Potok*	Improved Design of *Zheleznij Potok*
Length, o.a., m	54.8	54.8	54.8
Length, b.p., m	49.4	49.4	49.4
Breadth, m	9.8	9.8	9.8
Depth, main deck, m	5.0	5.0	5.0
Displacement, max. tons	1,080	1,130	1,150
Capacity refrigerated fish rooms, m^3	383	400	414
Power main engine (Diesel with c.p. propeller) hp/rpm	800 at 300 rpm	1,000 at 375 rpm	1,318 at 428 rpm
Overall power electric plant, kW	300	400	500
Capacity refrigerating plant at an evaporation temperature of 40°C, k cal/hr	76,000	114,000	150,000
Fish room temperature, °C	−6; −18	−6; −18	−6; −24
Freezing plant capacity, tons/day	12	12	20
Trawl gear	Purse-seine 640 × 120 m		Purse-seine 1200 × 200 m
Remote-controlled trawl winch, type	LETr-3	LETr-3	LTE-6.3
Pull of trawl winch, tons	6/8	6/8	6.3/8
Speed of taking in the trawl warps, m/min	60/45	60/45	90/70
Endurance, days	30	30	30
Speed, knots	11.7	12.0	13.0
Complement	29	29	29
Area of operation	---------- Unlimited ----------		

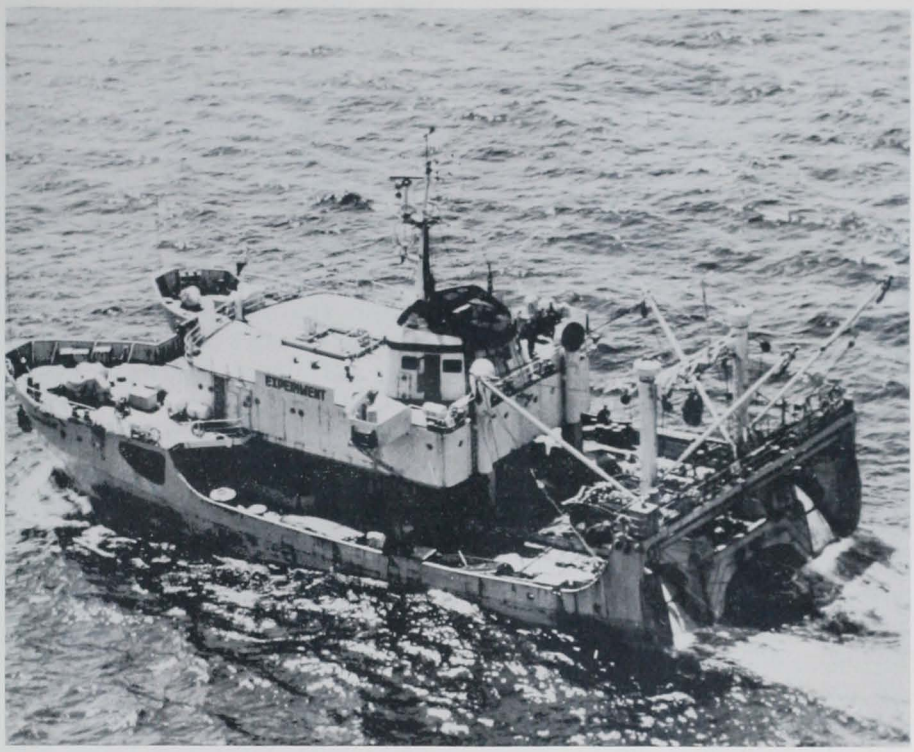

Figure 19.—The experimental twin-hulled trawler/seiner *Experiment*.

FOREIGN RELATIONS

The worldwide operation and domestic importance of the Soviet fishing industry have made it an important part of Soviet foreign policy in general and of its aid program to developing countries in particular.

The USSR takes an active role in all international bodies for the regulation, control, or conservation of fisheries. In addition the Soviet Union has conducted a policy of negotiating directly with individual coastal states for fishing/landing rights in particular ocean areas and a multitude of such agreements now exist between the USSR and the United States, Canada, Japan, and other countries.

In the case of developing nations, the fishing industry has played a vital role in the USSR's assistance program and generous help has been given to develop local fishing industries in return for particular offshore fishing/landing rights. An example of this mutual help policy is the northwest African fishery where generous help from the USSR encouraged the rapid development of the domestic fishing industries in Ghana and Senegal. As a result these two countries produce the largest catches in West Africa. Of the 42 countries (including Japan) fishing in this ocean area, the largest catch is taken by the USSR with Senegal and Ghana taking second and third place respectively.

The dramatic increase in the USSR's catch in the Indian Ocean has also been in parallel with Soviet-aided fishery development projects in India and Ceylon.

Another aspect of the Soviet aid program is the export of fish products. Although by far the greater part of the Soviet catch is intended for domestic consumption, a small proportion is exported (Table 22) and almost all of this is delivered to other socialist states. Some, however is exported to developing nations like Egypt and Ghana where it can make some contribution towards meeting the shortfall in the receiving nations' animal protein requirement.

Other aid programs have been the building of shore facilities, for example of a shipyard in Egypt and the construction of a fishing port, fish dock, and other facilities in Cuba.

Through this aid program to help developing nations to meet the basic and fundamental task of feeding their populations, the Soviet fishing industry has become a powerful and effective instrument for increasing and extending Soviet influence and interests throughout the world.

Table 21.—Comparison of working deck area and displacement of different types of trawlers.

Trawler type	Working deck area, m^3	Displacement, tons
SRTR *Bologoe*	125	457
SRTM *Mayak*	200	950
RTM *Tropik*	230	2,800
BMRT *Mayakovskij*	300	3,600
DTS *Experiment*	440	950

FUTURE DEVELOPMENT

The present five-year plan for the industry has set a catch target of 10.0 million metric tons by 1975. This means that in the years 1971 to 1975 the USSR must increase its catch from all sources by an average of 665.5 thousand metric tons per annum, whereas the average annual increase from 1965 to 1970 was only 430.46 thousand metric tons. The increase over the 1970 catch in 1971 was only 84.5 thousand metric tons and the maximum annual increase over the period under discussion was 753.8 thousand metric tons in 1970. Overall the fish and shellfish catch actually attained in 1970 fell short of the target set in 1965 by about 500 thousand metric tons.

In the broader context, the rate of increase in the world catch appears to be slowing down despite estimates of a possible world catch of around 100 million metric tons. The year 1969 saw the first drop in the world catch (from 63.9 million metric tons in 1968 to 62.6) since the end of World War II. This figure was further reduced to 62.4 million metric tons in 1971.

Over this period the USSR has managed to maintain its catch at a fairly consistent 11 percent of the world total. However it has not succeeded in closing the gap between its own catch and that of its closest competitor, Japan, a gap which has increased from 2 million metric tons in 1967 to 2.5 million metric tons in 1971. In this latter year the Japanese fleet comprised 2,578 vessels of all kinds over 100 grt compared with the USSR's 3,563.

In common with all the other fishing nations of the world the USSR is, therefore, suffering from increased international competition and effort in both traditional and newly-established fishing grounds. In addition the current international trend of coastal states to extend, unilaterally, their fishing limits from the internationally accepted 12 miles to up

Table 22.—USSR exports and imports of fish and fish products, 1968-71.

Product	Imports				Exports			
	1968	1969	1970	1971	1968	1969	1970	1971
Fish: fresh, chilled, or frozen	26.1	29.1	38.2	22.2	183.7	165.9	222.2	261.1
Fish: dried, salted, or smoked	7.6	3.2	0.1	—	24.2	23.0	21.4	16.1
Fish: canned or packaged	1.4	1.7	1.5	1.4	20.1	22.1	22.4	22.1
Shellfish products	—	—	—	—	4.7	3.4	3.8	3.5
Oil and fats	0.3	0.0	0.1	0.0	59.4	64.0	34.5	14.6
Meal and animal feedstuffs	53.	0.6	—	—	28.0	26.5	12.1	10.4
Total	40.7	34.6	39.9	23.8	320.1	304.9	316.4	327.8

to 200 miles and more is forcing foreign fleets off the continental shelf from which the overwhelming majority of the world's catch is taken. In view of this it seems increasingly unlikely that the industry will achieve its target by 1975.

Since 1946, the USSR has adopted a policy of continued expansion of its fleet and area of operation. This is a process which cannot be continued indefinitely, not only because there are a finite number of fish in the sea, but also because the increased competition in the available grounds will make the large fleets used at present counterproductive. In addition, labor productivity is significantly less in the Soviet fleet than in its nearest competitors (as is shown by the comparison between the Japanese and Soviet catches and fleet sizes made above), and it is obviously essential, in view of the current situation in world fisheries, to increase fishing effort by greater efficiency rather than solely by greater investment in catching units. If the Soviet fleet is in fact able to increase the productivity of its industry to a level comparable with its competitors, this will, in itself, tend to reduce the number of units operated. As far as present commercially exploited stocks are concerned it is highly probable that the optimal catch in terms of resource viability and economic fishing effort will be attained within the very near future. This means that other fish species, hitherto considered unsuitable or uneconomic to fish, will have to be exploited, which in turn requires the design and development of new vessels, gear, and food products.

Such species fall into two main groups: pelagic species inhabiting the deep oceans and demersal fish at depths in excess of 1,000 m, and it is to exploit these new species efficiently that the Soviet R and D organization is now directed. In terms of objectives the Soviet industry must seek to:

1) Increase the catch of pelagic fish from the deep-water areas of the world's oceans by improving fish-finding and herding techniques and equipment, improving the design of vessels for autonomous operation, improving net-gears like seines and midwater trawls, and developing new non-net catching methods involving the use of electricity, pumps, underwater light, noises, etc, either singly or in combination.

2) Increase the fleet's deep-water trawling capability to 2,000 m and more by developing new fish-finding equipment, winches, warps, trawls and other gear.

3) Increase the production of fish meal and associated products by exploiting underutilized species in traditional and new fishing grounds and to develop new food products which can make former "industrial" fish more attractive to the human consumer.

4) Increase fish-farm production in both fresh and seawater.

Significant developments have and are being made in all these areas as the introduction of self-contained special purpose fish/fish meal factory trawlers like *Pos'et*, *Altaj* and *Gorizont*, and self-contained mother ships like *Vostok*, and the introduction of new net and non-net methods of deep-water and midwater fishing show.

So, although it does seem inevitable that the proportion of the total protein requirements of the USSR provided by the industry will fall, the industry will continue to be a vital part of the country's food production industry through its ability to exploit new fish resources and to increase fish production through cultivation.

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